

Notice of Market Rules Modification

Paper No.:	EMC/RCP/99/2017/346
Rule Reference:	Chapter 3, Sec 3.3; Chapter 6, Sec 10.2.10; App 6M
Proposer:	EMC, Market Admin
Date Received by EMC:	12 September 2017
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Effective Date:	1 September 2018

This paper assesses the proposal to compensate generators which are adversely affected by price revision. As the market rules already provide for compensation under Type 3 price revision cases, the discussion in this paper will apply only to price revision of Types 1, 2, 4 and 5.

A marginal uniform pricing regime is intended to incentivise generators to offer close to their marginal costs, as a generator's marginal price would generally be at least equal to the offer price(s) of a scheduled offer. Yet, when circumstances warrant an ex-post revision of prices, some generators could receive a revised market energy price (MEP) which is lower than the offer price(s) of energy they generated, thereby incurring out-of-pocket costs or losses. Currently, the market rules do not provide compensation for such generators.

EMC assesses that it is unfair and undesirable for generators to be negatively impacted financially from following an erroneous ex-ante price signal. Hence, EMC proposes to compensate generators based on the difference between their offer prices and revised MEP, for quantities generated in adherence to dispatch instructions.

At the 98th RCP meeting, the Panel by majority vote supported (i) the proposed compensation methodology and (ii) for such compensation to be MP-initiated, and tasked EMC to draft the relevant rule modifications.

The proposed rule modifications to give effect to the RCP's decision were presented at the 99th RCP meeting. The RCP by majority vote recommends that the EMC Board **adopt** the proposed rule modifications as set out in **Annex 2**.

Date considered by Rules Change Panel:	14 November 2017
Date considered by EMC Board:	17 January 2018
Date considered by Energy Market Authority:	08 February 2018

Proposed rule modification:

See attached paper.

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

PAPER NO. : **EMC/BD/01/2018/05(a)**

RCP PAPER NO. : **EMC/RCP/99/2017/346**

SUBJECT : **COMPENSATION FOR GENERATORS ADVERSELY AFFECTED BY PRICE REVISION**

FOR : **DECISION**

PREPARED BY : **LOH LUCIA
SENIOR ECONOMIST**

REVIEWED BY : **WANG JING
AVP, MARKET ADMINISTRATION**

DATE OF MEETING : **17 JANUARY 2018**

Executive Summary

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1. Introduction

This paper assesses the proposal to compensate generators which are adversely affected by price revision.

2. Background

2.1 Price revision

The Singapore Wholesale Electricity Market (SWEM) adopts ex-ante pricing where buyers and sellers, under most circumstances, settle based on spot prices for energy, reserve and regulation that are determined by the market clearing engine (MCE) just prior to the start of each dispatch period.

Notwithstanding the adoption of ex-ante pricing, prices could be revised ex-post under specific circumstances. The circumstances which necessitate price revision are summarised in Table 1 below.

Table 1: Types of Price Revision

Type of Price Revision	Circumstance(s) under which a MCE rerun would be carried out
1	The MCE has failed to produce a real-time schedule (RTS) in time ¹
2	The MCE has used the wrong input data in producing the RTS
3	The MCE has used the adjusted nodal load forecasts which reflect the energy shortfall specified by the PSO
4	The MCE has incurred constraint violation penalty for line constraint, and the PSO has confirmed that there is no load shed in real-time
5	The MCE has produced prices not reflective of their respective locational system marginal prices

The reasons underpinning the decision to allow price revision in SWEM are:

- **Economic efficiency** – ensure prices used for settlement reflect prevailing market fundamentals and act as correct market signals, so as to improve investors' confidence and aid in their decision-making.
- **Equity and fairness** – allow consumers and generators to settle based on correct prices, since neither party caused the erroneous prices.

Revised prices are obtained by re-running the MCE with all input data that should have been supplied to it at the time the RTS would normally have run. However, if a rerun is not possible, then the revised price would be based on the average settlement price for the dispatch period in the last 30 days.

Current compensation arrangements pertaining to price revision

Chapter 6 section 10.2.9 of the current market rules provides for compensation for generators which were affected by ex-ante load forecast adjustments intended to reflect energy shortfalls (as specified by the PSO under section 9.1.2 of Chapter 6), an event which also triggers Type 3 price revision. Other than this, there are currently no other compensation arrangements for generators affected by price revision.

¹ Refers to failure to release the RTS in accordance with the timeline specified in the market operations timetable, which is 30 seconds before the start of the dispatch period

2.2 Prevalence of price revision, by type (1 Jan 2012 – 30 Jun 2017)

Table 2 overleaf tabulates the frequency of price revision and the magnitude of changes in USEP and Market Energy Price (MEP) for the past 5.5 years.

Table 2: Frequency of price revision and magnitude of price changes, by type and year

Frequency of reruns (number of periods, by year)	Total number of rerun periods	Maximum increase (\$/MWh)		Maximum decrease (\$/MWh)		Average change (Rerun price – Original price)								
		MEP	USEP	MEP	USEP	MEP (across all MEPs of GRFs and GSFs)	USEP							
<table border="1"> <tr> <td>■ Type 1</td> <td>1</td> <td>6</td> <td>1</td> <td>9</td> <td>2</td> <td>1</td> </tr> </table>	■ Type 1	1	6	1	9	2	1	20	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
■ Type 1	1	6	1	9	2	1								
<table border="1"> <tr> <td>■ Type 2</td> <td>4</td> <td>9</td> <td>79</td> <td>69</td> <td>15</td> <td>5</td> </tr> </table>	■ Type 2	4	9	79	69	15	5	181	4541.85	39.09	4444.17	1148.47	-27.55	-41.45
■ Type 2	4	9	79	69	15	5								
■ Type 3: 0	0	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.							
<table border="1"> <tr> <td>■ Type 4</td> <td>4</td> <td>31</td> <td>2</td> <td>0</td> <td>1</td> <td>0</td> </tr> </table>	■ Type 4	4	31	2	0	1	0	38	2533.94	569.93	4299.23	777.67	1.17	-157.51
■ Type 4	4	31	2	0	1	0								

Frequency of reruns (number of periods, by year)	Total number of rerun periods	Maximum increase (\$/MWh)		Maximum decrease (\$/MWh)		Average change (Rerun price – Original price)								
		MEP	USEP	MEP	USEP	MEP (across all MEPs of GRFs and GSFs)	USEP							
<table border="1"> <tr> <td>■ Type 5</td> <td>2</td> <td>61</td> <td>100</td> <td>0</td> <td>0</td> <td>29</td> </tr> </table>	■ Type 5	2	61	100	0	0	29	192	1946.44	6.87	4385.40	315.76	-39.66	-4.15
■ Type 5	2	61	100	0	0	29								

Note:

Maximum increase refers to dispatch periods where the Revised Price is higher than Original Price.

Maximum decrease refers to dispatch periods where the Revised Price is lower than Original Price.

2.3 Proposal received

A proposal received during the Rules Change Work Plan 2017/18 suggests introducing compensation for generators adversely affected by Type 2 price revision. For comprehensiveness, this paper will assess compensation generally across all types of price revision, except for Type 3 where provisions are already in place, since price revision could impact generators' MEP and there is no reason to limit the review only to Type 2 price revisions.

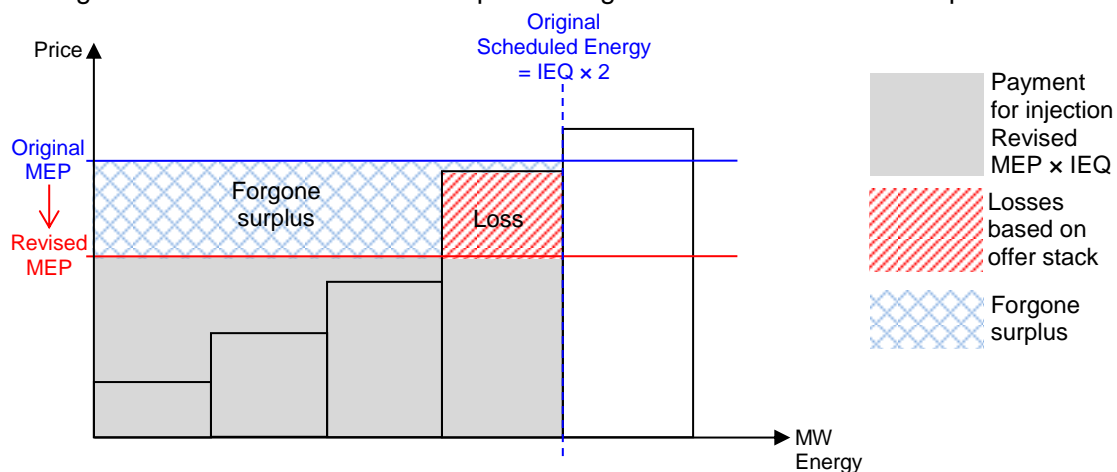
3. Analysis

The RCP had, in two previous rules change papers, examined the issue of compensation for generators adversely affected by price revision but the discussions then did not lead to the introduction of a compensation arrangement². We re-examine the issue in this section.

3.1 The need for compensation arising from downward price revision

While price revision is considered advantageous in terms of enhancing economic efficiency (as explained in section 2.1 of this paper), it could have an adverse financial impact on generators which had physically responded to the higher original price, but received a revised price which is lower than their offer prices. An example of such a scenario is illustrated in Figure 1:

Figure 1: Illustration of financial impact on a generator due to downward price revision



As seen from Figure 1, without/before price revision, a generator would receive the Original MEP multiplied by its actual generation i.e. Injection Energy Quantity (IEQ, which is assumed to correspond exactly to its Scheduled Energy). When prices are revised downwards to Revised MEP, the generator's revenue is reduced by the aggregate area indicating (i) Surplus Forgone (blue shaded area) and (ii) Loss (red shaded area).

A generator's offer price indicates the minimum price it must receive in order to produce the corresponding offered quantity. A uniform marginal pricing regime (like that in SWEM) encourages generators to offer close to their true marginal costs, since they will be paid at their offer prices or more. It is therefore unfair for a generator to incur losses or out-of-pocket costs (relative to its offer price which approximates its marginal costs) for responding to an erroneous high price signal.

² Refer to Annex 1 for a summary of the discussions and outcomes for these two rules change papers.

If generators are not compensated for such losses, it could lead to the following two undesirable outcomes:

- Industry players' confidence in market prices is undermined
- Increase in uncertainty for genscos. They could in turn factor this risk into their offer prices, or by reducing the quantity of higher-cost capacity that is offered into the market.

As such, an appropriate compensation arrangement for generators affected by downward price revision is required.

3.2 Proposed Compensation Methodology

This section sets out the proposed compensation methodology for Generation Registered Facilities (GRFs) which are adversely affected by price revision.

A) Use of Offers

As established in section 3.1, offers are the best proxy of GRFs' marginal costs. Furthermore, the need for compensation when prices are revised downwards stems from the inability of generators to recover their marginal costs (as proxied by their offer prices) for higher-priced offer tranches that, with hindsight, would not have been scheduled or generated. Hence, compensation for GRFs adversely affected by price revision is proposed to be based on offers.

B) Quantity Eligible for Compensation

Generators which had adhered to their dispatch instructions should not be made to incur losses or out-of-pocket costs. In line with this rationale, the quantity to be compared against a GRF's offer stack would be dependent on whether the GRF is on automatic generator control (AGC).

A GRF which is on AGC would have its output controlled by the PSO and is considered to be adhering to its dispatch instructions. Hence, such GRF's entire IEQ would be eligible for compensation as long as the offer prices, for offered quantities corresponding up to its IEQ, is higher than its revised MEP (for example, see red shaded area in Case A of Table 3 overleaf).

On the contrary, the output of GRFs which are not on AGC are controlled by the respective dispatch coordinators. Such GRFs would be eligible for compensation based on their IEQ, but capped at their dispatch instructions for the dispatch period³ (as illustrated in Cases B and C of Table 3, with the accompanying rationale for exclusions shaded in blue). Such dispatch instructions would be either the energy schedule level in the original RTS (if not overridden by the PSO), or the level as may be instructed by the PSO.

³ Note that the lower of IEQ and dispatch level would have to be further compared against a GRF's offer stack, and the compensation quantum is only for offer stacks where **revised MEP is less than offer price**. For clarity, refer to red shaded areas marked as "Compensation" in Table 3.

Table 3: Illustration of Quantity Eligible for Compensation

GRF's status	Quantity Eligible for Compensation (to be compared against GRF's offer stack)	Illustration
GRF is on AGC	IEQ	<p>Case A (GRF on AGC)</p> <p>Price</p> <p>Revised MEP</p> <p>Compensation</p> <p>IEQ x 2</p> <p>MW Energy</p> <p>Payment for injection Revised MEP x IEQ</p>
GRF is NOT on AGC	IEQ, capped at dispatch instruction	<p>Case B (GRF not on AGC, Generate > Schedule)</p> <p>Price</p> <p>Revised MEP</p> <p>Compensation</p> <p>Dispatch instruction</p> <p>IEQ x 2</p> <p>MW Energy</p> <p>Payment for injection Revised MEP x IEQ</p> <p>No compensation</p> <ul style="list-style-type: none"> • Under-recovery of marginal costs for energy quantities generated beyond scheduled amount is due to GRF's actions, not directly caused by downward price revision <p>Case C (GRF not on AGC, Generate < Schedule)</p> <p>Price</p> <p>Revised MEP</p> <p>Compensation</p> <p>Dispatch instruction</p> <p>IEQ x 2</p> <p>MW Energy</p> <p>Payment for injection Revised MEP x IEQ</p> <p>No compensation</p> <ul style="list-style-type: none"> • Marginal costs (and thus losses) not incurred for quantities which are not generated

3.3 Other Considerations

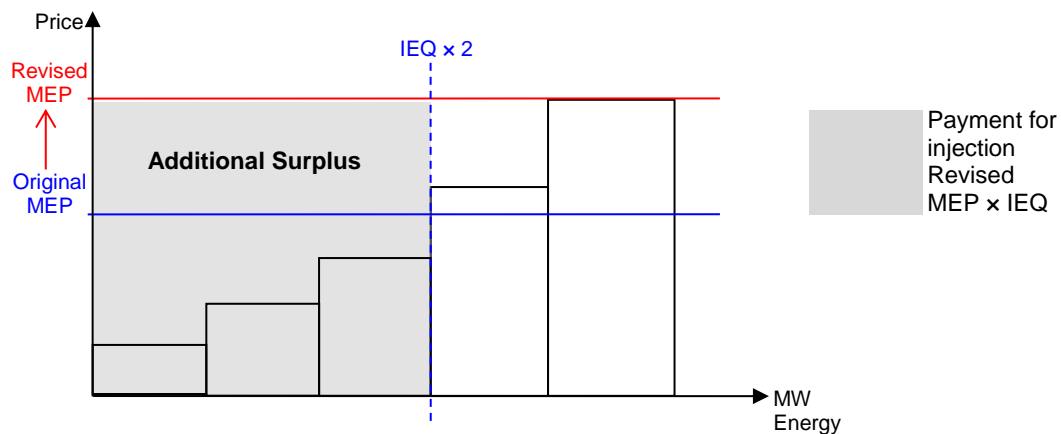
(i) Costs of compensation are borne by loads

Given that the causers of price revision may not always be identifiable, in SWEM, the costs of compensation are recovered from loads (specifically via the monthly energy uplift charge, MEUC). Since the need for price revision is also not caused by loads, a balance should be struck to ensure that the compensation amount is moderated and not overly burden loads.

(ii) No compensation when revised prices are higher

Price revision could sometimes lead to higher prices, where generators receive additional surpluses (area marked with “Additional Surplus” as shown in Figure 2 below). Consistent with the rationale for conducting price revision, which is so that incorrect prices are not allowed to persist, the market should be settled based on correct, albeit higher, revised prices under such scenarios with no compensation for any party.

Figure 2: Illustration of financial impact on a generator due to upward price revision



(iii) No compensation for reserve and regulation

The above discussion on compensation pertains only to energy. While reserve and regulation should in principle be taken into account, they form a substantially smaller part of the market. Moreover, reserve and regulation providers are currently paid based on revised prices and revised scheduled quantities⁴, which complicates the compensation calculations if added into consideration. Hence, in keeping with the principle of having an administratively simple and cost-effective compensation arrangement, we do not propose compensation for reserve and regulation providers affected by price revision.

3.4 Applicability of compensation for each type of price revision

Table 4 below assesses whether the issue of compensation is applicable across each price revision type.

⁴ It is recognised that paying providers based on revised scheduled quantities is inappropriate.

Table 4: Assessment of the applicability of compensation

Type of Price Revision	Circumstance(s) under which a MCE rerun would be carried out	Should there be compensation for Generation Registered Facilities?
1	MCE failed to produce a RTS	Yes, if revised MEP is lower than GRF's energy offer price(s) for quantities it was instructed to generate in accordance with Table 3 above.
2	MCE used wrong input data in RTS	Yes, if revised MEP is lower.
3	MCE used adjusted nodal load forecasts which reflect the energy shortfall specified by the PSO	Yes, but as mentioned above, compensation provisions already separately provided for in the market rules. The current market rules ⁵ sets out the compensation methodology for market participants (MPs) whose GRFs were scheduled less energy in the RTS (using load forecast adjusted for energy shortfall specified by the PSO) than in the revised RTS (using unadjusted load forecast). <u>Hence, the proposed compensation methodology discussed in this paper excludes Type 3 cases.</u>
4	MCE has incurred CVP for line constraint, and there is no load shed in real-time	Yes, if revised MEP is lower.
5	MCE has produced prices not reflective of their respective locational system marginal prices	Yes, if revised MEP is lower.

3.5 Proposed compensation procedures

There are currently two ways of administrating compensation under the market rules:

- a) *EMC-initiated* – EMC initiates and calculates the compensation amount for MPs under two specific cases, described in Table 5.

Table 5: Current EMC-initiated compensation provisions

No.	Compensation for:	Market Rules	Calculation of compensation
1	Generators which were scheduled at levels lower than they should have, due to load forecast adjustment (to reflect load	Appendix 6I	Calculated by EMC, since MPs do not know the level which they would have been scheduled had the load forecast

⁵ Appendix 6I of the Market Rules

No.	Compensation for:	Market Rules	Calculation of compensation
	shedding)		adjustment not been made.
2	Generators which were scheduled out-of-merit order at their minimum stable load (MSL)	Appendix 6K	Automatically calculated by EMC.

- b) *MP-initiated* – All other compensation claims allowed under the current market rules are initiated by the market participant (MP), with claims submitted by the MP to the relevant party (e.g. PSO).

Some considerations in deciding on the party who should initiate and calculate the compensation discussed in this paper include:

- Frequency of Price Revision

Based on data from 01 Jan 2012 – 30 June 2017, prices for 0.41% of dispatch periods were revised.

- Number of GRFs adversely affected per rerun period

Based on data from 01 Jan 2012 – 30 June 2017, excluding Type 1 cases where the “Original MEP” is not known, the average number of GRFs with Revised MEP lower than their Original MEP is 2.38 GRFs per rerun period. This assumes the worst case scenario whereby all such GRFs are also scheduled to generate.

- Availability of Data to Calculate Compensation

The party initiating compensation should have all data and information required to calculate the compensation amount.

The information/data required to calculate the compensation amount for a GRF per dispatch period are listed in Table 6 below, together with an indication of whether such information/data are currently available to MPs and EMC.

Table 6: Data required for compensation calculation

Information/data	Currently available to MPs?	Currently available to EMC?
(i) GRF's offer stacks (quantity and price)	Yes	Yes
(ii) Revised MEP	Yes	Yes
(iii) GRF's AGC status	Yes	No
(iv) GRF's dispatch instruction issued by the PSO	Yes	No
(v) GRF's IEQ	Yes	Yes

- Implementation costs

The estimated implementation time and costs for the above compensation to be EMC-initiated (i.e. automatic calculation) are shown in Table 7 below:

Table 7: Estimated implementation time and costs (EMC-initiated Automatic Calculation)

<u>Time Estimates</u>	<u>Effort Estimates (Man weeks)</u>	<u>Lapse Time (Calendar weeks)</u>
1. Change Requirement Scoping and Analysis	9	5
2. System Development/Testing	50	25
3. User Acceptance Testing (UAT)	7	7
4. Audit	4	5
Total Effort Required	70	42
Cost		
1. Internal EMC Manpower	\$90,800 (Within EMC's budget)	
2. External resource to support (Vendor)	\$220,000	
3. Audit	\$25,000	
Total Additional Cost Required (Commence implementation from January 2019)	\$245,000	
Total Additional Cost Required (Commence implementation upon approval of rules)	\$245,000 + <u>\$160,000</u> = \$405,000	

Note that the above estimates assume the following:

- (i) additional data inputs currently unavailable to EMC (such as GRF's AGC status and whether a GRF's dispatch instruction was overridden) are provided by the PSO through electronic upload, similar to the Automatic Penalty Scheme (APS) file; and
- (ii) compensation procedures will follow that for MSL (i.e. No. 2 of Table 5), including the issuance of preliminary and final compensation statements and invoice, allowance for MPs to file notice of dissent, recovery via MEUC, etc.

In addition, as there will be a code freeze period from March 2018 to January 2019 for EMC's server technology refresh, implementation of Items 2 – 4 (namely, System Development/Testing, UAT and Audit) is preferred to only begin **from February 2019**. This implies that implementation of all steps would begin from January 2019. Otherwise, additional costs estimated at \$160,000 to merge the code would be incurred.

4. Conclusion

The adoption of uniform marginal pricing in SWEM is intended to incentivise generators to offer close to their marginal costs. Yet, when circumstances warrant an ex-post revision of prices, generators are not guaranteed of receiving at least their offer prices. It is unfair and undesirable for generators to incur out-of-pocket costs from following an erroneous ex-ante price signal. This paper thus proposes compensation for generators adversely affected by downward price revision due to price revision of Types 1, 2, 4 and 5.

5. Consultation

The concept paper was published for consultation on 28 July 2017. As part of consultation, EMC also sought the views of MPs on the preferred compensation procedures referred to in section 3.5. Comments were received from Pacifielight Power (PLP), Tuaspring, Senoko Energy and the PSO, as follows:

Comments from PLP

PLP is supportive of the proposed changes, which we believe are equitable to all parties and provide fair compensation to those generators affected by a price revision.

EMC's response

PLP's support of the proposal is noted.

Comments from Tuaspring

Tuaspring supports the review, specifically for EMC-initiated compensation calculations with the feature of allowing MPs to review and dispute the calculations through a similar portal and workflow as the Automatic Penalty Scheme (APS).

EMC's response

We note Tuaspring's preference for EMC to initiate and calculate compensation, which would require EMC to make the system changes for automatic calculation.

Comments from Senoko Energy

Senoko is supportive of establishing an EMC-initiated procedure to compensate generators that are adversely affected by downward price revisions.

EMC's response

We note Senoko Energy's preference for EMC to initiate and calculate compensation, which would require EMC to make the system changes for automatic calculation.

Comments from the PSO

Over the years, significant effort was made to reduce the total number of re-runs. Hence it is more important to proactively establish the cause of the price rerun and see how we can resolve it either through operational effort like the daily price check process or modelling enhancements.

EMC's response

While we agree that instances of price revision should be minimised, as long as price revision provisions remain in the market rules, there is still reason for GRFs that are adversely affected by price revision to receive compensation for any out-of-pocket costs or losses arising from a price revision.

6. Decisions at 98th RCP Meeting

At the 98th RCP meeting, the RCP by majority vote **supported** (i) the proposed compensation methodology described in section 3.2 of the paper, and (ii) the adoption of MP-initiated compensation procedure, and tasked EMC to draft the relevant rule modifications.

The details of the two decisions are as follows:

(i) Proposed Compensation Methodology

The following Panel members voted in support of the proposed compensation methodology:

- Mr Henry Gan (Representative of the EMC)
- Mr Lim Han Kwang (Representative of Transmission Licensee)
- Mr Marcus Tan (Representatives of Generation Licensee)
- Ms Priscilla Chua (Representative of Generation Licensee)
- Mr Sean Chan (Representative of Retail Electricity Licensee)
- Mr Daniel Lee (Representative of Retail Electricity Licensee)
- Mr Luke Peacocke (Representative of Retail Electricity Licensee)
- Dr. Toh Mun Heng (Representative of Consumer of Electricity in Singapore)
- Mr Phillip Tan (Person experienced in Financial Matters in Singapore)

- Ms Grace Chiam (Representatives of Generation Licensee)

The following Panel member voted not to support the proposed compensation methodology:

- Mr Soh Yap Choon (Representative of the PSO)

The following Panel member abstained:

- Mr Lawrence Lee (Representative of the market support services licensee)

(ii) Compensation Procedure to be Adopted

The following Panel members voted in support of MP-initiated compensation:

- Mr Lim Han Kwang (Representative of Transmission Licensee)
- Ms Priscilla Chua (Representative of Generation Licensee)
- Mr Sean Chan (Representative of Retail Electricity Licensee)
- Mr Daniel Lee (Representative of Retail Electricity Licensee)
- Mr Luke Peacocke (Representative of Retail Electricity Licensee)
- Dr. Toh Mun Heng (Representative of Consumer of Electricity in Singapore)
- Mr Phillip Tan (Person experienced in Financial Matters in Singapore)

The following Panel members voted in support of EMC-initiated compensation:

- Mr Henry Gan (Representative of the EMC)
- Mr Marcus Tan (Representatives of Generation Licensee)
- Ms Grace Chiam (Representatives of Generation Licensee)

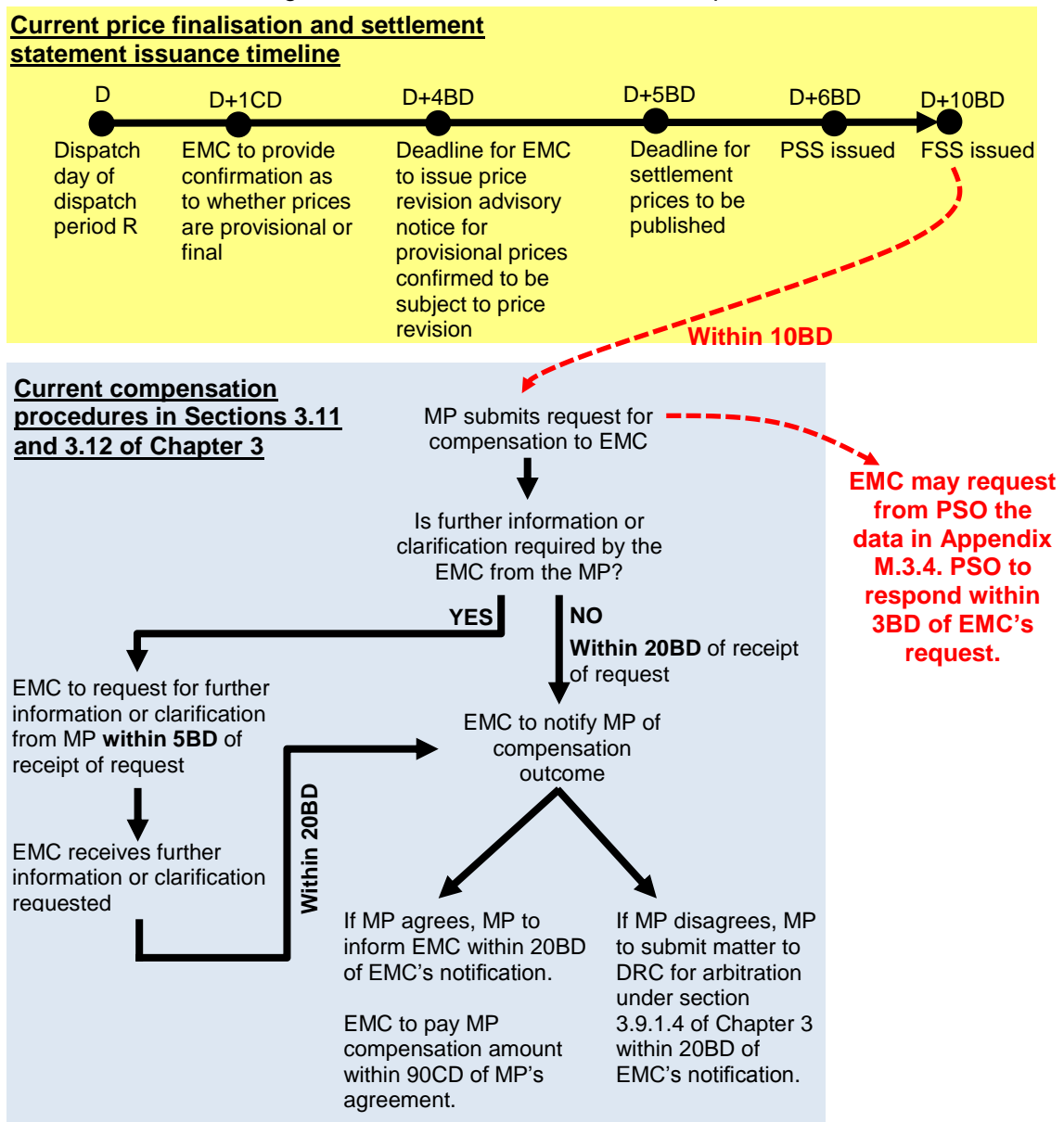
The following Panel members abstained from voting:

- Mr Soh Yap Choon (Representative of the PSO)
- Mr Lawrence Lee (Representative of the market support services licensee)

7. Timeline and implementation lead time and cost for MP-initiated Compensation

Figure 3 overleaf illustrates the current process for MP-initiated compensation (based on section 3.11 and 3.12 of Chapter 3), which would similarly apply to the compensation examined in this paper arising from the RCP's decision described in section 6 of this paper.

Figure 3: Timeline for MP-initiated Compensation



Note: Arrows in red are new provisions specific to the compensation discussed in this paper.

In addition, EMC Market Operations has provided two implementation approaches (Option 1 and Option 2) for MP-initiated compensation.

Under both approaches, MPs will submit their claims using an excel template provided by EMC. The implementation approaches differ in terms of how EMC will process claims received.

- **Option 1:** EMC will use internal Excel tool to validate and facilitate the claim process
- **Option 2:** EMC will develop an internal system platform to validate and semi-automate the claim process.

The implementation lead time and costs for each implementation approach are as follows:

Option 1 (EMC uses Internal Excel Tool)

<u>Time Estimates</u>	Effort Estimates (Man weeks)	Lapse Time (Calendar weeks)
1. Change Requirement Scoping and Analysis	4	2
2. System Development/Testing/Project Management	15.2	15
3. User Acceptance Testing (UAT)	5	7
4. Audit	4	5
Total Effort Required	28.2	29
<u>Cost</u>		
1. Internal EMC Manpower	\$47,200 (Within EMC budget)	
2. External resource to support (Vendor)	\$59,405	
3. Audit	\$25,000	
Total Additional Implementation Cost Required	\$84,405	
4. Operational Cost Per Claim ⁶	2 man-days	
5. Operational Cost Per Year for Documentation Housekeeping and Audit Support	3 man-days	

Option 2 (EMC uses Internal System Platform)

<u>Time Estimates</u>	Effort Estimates (Man weeks)	Lapse Time (Calendar weeks)
1. Change Requirement Scoping and Analysis	9	5
2. System Development/Testing/Project Management	54.8	25
3. User Acceptance Testing (UAT)	7	8
4. Audit	4	5
Total Effort Required	74.8	43
<u>Cost</u>		
1. Internal EMC Manpower	\$100,000 (Within EMC budget)	
2. External resource to support (Vendor)	\$219,003	
3. Audit	\$25,000	
Total Additional Implementation Cost Required	\$244,003	
4. Operational Cost Per Claim	0.5 man-days	
5. Operational Cost Per Year for Documentation Housekeeping and Audit Support	3 man-days	

Note: If Option 2 is to be implemented during EMC's server technology refresh, it will potentially incur additional cost of \$159,552.

Option 1 has lower one-off implementation cost but higher operational cost per claim, while the reverse is true for Option 2.

In view of the implementation costs, EMC recommends implementation approach **Option 1**. If the frequency of claims subsequently increases such that it is more cost efficient to implement either Option 2 or EMC-initiated compensation, stakeholders can raise the issue for review again.

⁶ Per claim refers to per period per facility basis.

8. Summary of Proposed Modifications

Arising from the RCP's decision at its 98th meeting, EMC drafted the proposed modifications to the market rules as set out in Annex 2. Table 8 below summarises these changes.

Table 8: Summary of Proposed Rule Modifications

Chapter/Section	Proposed changes	Reasons for change
Chapter 3 section 3.3.1.3	Italicised "EMC's".	To italicise a defined term.
Chapter 3 section 3.3.1.5	Added "section 10.2.10 of Chapter 6".	To include the new compensation request provisions under section 10.2.10 of Chapter 6 within the scope of disputes.
Chapter 6 section 10.2.10 (new section)	Added provisions for MPs to request for compensation if settlement prices have been revised under section 10.2 (except under sections 10.2.7 and 10.2.8), and specified the procedures and requirements that such requests should adhere to.	<p>To give effect to the proposed compensation for generators adversely affected by price revision (except for price revision of Type 3 i.e. under sections 10.2.7 and 10.2.8).</p> <p>To require that such compensation requests be made in accordance with section 3.11 of Chapter 3 and submitted in such form as may be prescribed by the EMC, and that the compensation amount shall be calculated in accordance with Appendix 6M.</p> <p>To stipulate that the 10BD timeline in section 3.11.2 of Chapter 3 will begin from the date of issuance of the final settlement statement.</p>
Appendix 6M (new)	Added new appendix setting out the criteria and calculations for compensation under section 10.2.10 of Chapter 6.	<p>To specify, for compensation to GRFs under section 10.2.10 of Chapter 6, the criteria and calculations for compensation.</p> <p>To include provisions for EMC to request, and PSO to respond to EMC's request, data pertaining to a GRF.</p>

9. Legal Sign-Off

Text of the rule modifications in Annex 2 has been vetted by EMC's internal legal counsel whose opinion is that the modifications reflect the intent of the rule modification proposal as expressed in the analysis section of this paper.

10. Consultation (Proposed Rule Modifications)

The proposed rule modifications were published for consultation on 16 October 2017 and no comments were received.

Pursuant to section 5.3.6 of Chapter 3 of the market rules, EMC has also consulted the Dispute Resolution Counsellor (DRC) on the proposed rule modifications. The DRC responded that he has no comments.

11. Deliberations and Decisions at the 99th RCP meeting

The RCP considered the proposed rule modifications at its 99th meeting. At the 99th RCP meeting, the Panel **unanimously supported implementation approach Option 1** (as described in section 7).

Drafting of Section M.3.4 of Appendix 6M

Section M.3.4 of Appendix 6M of the proposed rule modifications was originally drafted as set out in Box 1 below (with emphasis added). Given that it is a request for data from the PSO, a Panel member suggested replacing both instances of the use of the word “submit” in Section M.3.4 of Appendix 6M with “furnish” in the first instance and “provide” in the second instance.

Box 1: Original Draft of Section M.3.4 of Appendix 6M (“original proposed rule modifications”)

M.3.4 For each request for compensation under section 10.2.10 of Chapter 6 that is received by the *EMC*, the *EMC* may request for the *PSO* to **submit** 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 whether the *generation registered facility* was at all relevant times operating under *AGC*; and

M.3.4.2 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 **submit** the aforementioned data within 3 *business days* of the *EMC*'s request.

Since the PSO is providing data to assist the EMC in assessing and validating a compensation request, EMC agrees with replacing both instances of the use of “submit” with “provide”. The proposed rule modifications in Annex 2 have been amended to reflect this (“revised proposed rule modifications”).

Post meeting, the RCP **by majority vote supported the revised proposed rule modifications** as set out in **Annex 2**.

The details of the voting outcomes are:

Those who voted in support of the revised proposed rule modifications (as set out in Annex 2):

- | | |
|-----------------------|---|
| 1. Mr. Henry Gan | Representative of EMC |
| 2. Ms. Priscilla Chua | Representative of Generation Licensee |
| 3. Ms. Grace Chiam | Representative of Generation Licensee |
| 4. Ms. Carol Tan | Representative of Transmission Licensee |
| 5. Mr. Sean Chan | Representative of Retail Electricity Licensee |
| 6. Mr. Daniel Lee | Representative of Retail Electricity Licensee |
| 7. Mr. Luke Peacocke | Representative of Retail Electricity Licensee |
| 8. Mr. Phillip Tan | Person experienced in Financial Matters in Singapore |
| 9. Dr. Toh Mun Heng | Representative of Consumers of Electricity in Singapore |

Those who voted in support of the original proposed rule modifications:

1. Mr. Dallon Kay Representative of Wholesale Electricity Trader

12. Recommendations

The RCP **by majority vote** recommends that the EMC Board:

- (a) **adopt** the proposed rule modifications as set out in **Annex 2**;
- (b) **seek** the EMA's approval of the proposed modifications to the proposed rule modifications as set out in **Annex 2**; and
- (c) **recommend** that the proposed rule modifications as set out in **Annex 2** come into force **29 weeks** after the date on which the approval of the Authority is published by the EMC.

Annex 1: Papers and decision on this issue at the RCP's previous reviews

The RCP had discussed the issue of compensation arising from price revision twice.

RCP meeting that issue was considered	Issue and EMC's Proposal	RCP's Discussion and Outcome
<p>25th (14 Mar 2006), 26th (11 May 2006), 27th (4 July 2006)</p>	<p>RC253: Compensation Arising From Market Energy Price Revisions</p> <p>EMC proposed compensation for generators based on difference between revised MEP and the respective offer price of cleared tranches, <u>for affected quantities</u> (i.e. only offer tranches with offer price > revised MEP, up to IEQ).</p>	<p>At its 26th meeting, the RCP by majority vote supported compensation based on difference between revised MEP and the highest cleared offer price, multiplied <u>by the generator's entire injection energy quantity</u>.</p> <p>At its 27th meeting, the RCP re-considered the proposal which was referred back by the EMC Board. The RCP by majority vote maintained its 26th RCP decision.</p> <p>The EMC Board did not adopt the rule change.</p>
<p>33rd (3 Jul 2007), 36th (11 Mar 2008), 37th (13 May 2008), 38th (1 Jul 2008)</p>	<p>RC272: Changes Arising From the Review of Price Revision in the SWEM</p> <p>EMC proposed for (i) the removal of Type 4 Price Revision and (ii) compensation for generators based on EMC's proposal in RC253.</p>	<p>At its 38th meeting, the RCP supported the removal of Type 4 price revision (item i). As there was a split vote on the issue of compensation (item ii), no decision was taken.</p> <p>The EMA did not approve the rule change to remove Type 4 price revision (item i).</p>

Annex 2: Proposed Rule Modifications

Existing Market Rules (1 July 2017)			Proposed Rule Changes (Deletions represented by strikethrough text and additions represented by double-underlined text)			Reasons for Modification																								
Chapter 3			Chapter 3																											
3 DISPUTE RESOLUTION AND COMPENSATION			3 DISPUTE RESOLUTION AND COMPENSATION																											
<p>3.3 <u>SCOPE</u></p> <p>3.3.1 Disputes that shall be resolved by the dispute resolution process in section 3 are shown in the table below:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;"></th> <th style="width: 35%;">Disputes between</th> <th style="width: 50%;">Dispute in respect of</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">...</td> <td style="text-align: center;">...</td> <td style="text-align: center;">...</td> </tr> <tr> <td>3.3.1.3A</td> <td>- <i>EMC and a participation applicant</i></td> <td>- EMC's denial of a request to transfer the registration of a <i>registered facility</i> to the <i>participation applicant</i></td> </tr> </tbody> </table>				Disputes between	Dispute in respect of	3.3.1.3A	- <i>EMC and a participation applicant</i>	- EMC's denial of a request to transfer the registration of a <i>registered facility</i> to the <i>participation applicant</i>	<p>3.3 <u>SCOPE</u></p> <p>3.3.1 Disputes that shall be resolved by the dispute resolution process in section 3 are shown in the table below:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;"></th> <th style="width: 35%;">Disputes between</th> <th style="width: 50%;">Dispute in respect of</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">...</td> <td style="text-align: center;">...</td> <td style="text-align: center;">...</td> </tr> <tr> <td>3.3.1.3 A</td> <td>- <i>EMC and a participation applicant</i></td> <td>- EMC's<u>EMC's</u> denial of a request to transfer the registration of a <i>registered facility</i> to the <i>participation applicant</i></td> </tr> <tr> <td style="text-align: center;">...</td> <td style="text-align: center;">...</td> <td style="text-align: center;">...</td> </tr> <tr> <td>3.3.1.5</td> <td>- <i>EMC and a market participant</i> - <i>EMC and</i></td> <td>- request for compensation made under any of the following: - section 4.7.3 of</td> </tr> </tbody> </table>				Disputes between	Dispute in respect of	3.3.1.3 A	- <i>EMC and a participation applicant</i>	- EMC's <u>EMC's</u> denial of a request to transfer the registration of a <i>registered facility</i> to the <i>participation applicant</i>	3.3.1.5	- <i>EMC and a market participant</i> - <i>EMC and</i>	- request for compensation made under any of the following: - section 4.7.3 of	<p>To italicise a defined term.</p>
	Disputes between	Dispute in respect of																												
...																												
3.3.1.3A	- <i>EMC and a participation applicant</i>	- EMC's denial of a request to transfer the registration of a <i>registered facility</i> to the <i>participation applicant</i>																												
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Existing Market Rules (1 July 2017)				Proposed Rule Changes (Deletions represented by strikethrough text and additions represented by double-underlined text)			Reasons for Modification
...				
3.3.1.5	<ul style="list-style-type: none"> - <i>EMC and a market participant</i> - <i>EMC and a market support services licensee</i> - <i>PSO and a market participant</i> - <i>PSO and a market support services licensee</i> 	<ul style="list-style-type: none"> - request for compensation made under any of the following: <ul style="list-style-type: none"> - 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 	<ul style="list-style-type: none"> - <i>PSO and a market participant</i> - <i>PSO and a market support services licensee</i> 	<ul style="list-style-type: none"> - 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 9.7.3 of Chapter 5 - section 10.4.1 of Chapter 5 - <u>section 10.2.10 of Chapter 6</u> 	<p>To include the newly added request for compensation in section 10.2.10 of Chapter 6 within the scope of disputes.</p>		

Existing Market Rules (1 July 2017)				Proposed Rule Changes (Deletions represented by strikethrough text and additions represented by double-underlined text)		Reasons for Modification
			<ul style="list-style-type: none"> - section 8.6.2 of Chapter 5 - section 9.1.7 of Chapter 5 - section 9.7.3 of Chapter 5 - section 10.4.1 of Chapter 5 			
Chapter 6				Chapter 6		
10	EMC RESPONSIBILITIES AFTER EACH DISPATCH PERIOD			10	EMC RESPONSIBILITIES AFTER EACH DISPATCH PERIOD	

Existing Market Rules (1 July 2017)	Proposed Rule Changes (Deletions represented by strikethrough text and additions represented by double-underlined text)	Reasons for Modification
[New section]	<p><u>10.2.10</u> Where the <i>EMC</i> has determined revised values for the <i>settlement</i> data pursuant to the provisions under section 10.2 (other than pursuant to sections 10.2.7 and 10.2.8), a <i>market participant</i> with one or more <i>generation registered facilities</i> may make a request to the <i>EMC</i> for compensation in accordance with section 3.11 of Chapter 3, if its <i>generation registered facility</i> satisfies the criteria for compensation set out in section M.2 of Appendix 6M. Such request shall be submitted in such form as may be prescribed by the <i>EMC</i> and the compensation amount shall be calculated in accordance with Appendix 6M. 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 <i>final settlement statement</i> for the <i>trading day</i> which the compensation request relates is issued.</p>	<p>To include provisions for compensation for dispatch periods where prices have been revised.</p> <p>To require compensation requests to be submitted by MPs in accordance with the existing provisions in section 3.11 of Chapter 3.</p> <p>To require that the compensation request be submitted in such form as may be prescribed by the EMC, and the compensation amount be calculated in accordance with</p>

Existing Market Rules (1 July 2017)	Proposed Rule Changes (Deletions represented by strikethrough text and additions represented by double-underlined text)	Reasons for Modification
		<p>the new Appendix 6M.</p> <p>To stipulate that, for compensation requests under section 10.2.10 of Chapter 6, the 10BD timeline in section 3.11.2 of Chapter 3 will commence from the date of issuance of the final settlement statement pertaining to the dispatch period which the request relates to.</p>
[New Appendix]	<p><u>APPENDIX 6M – COMPENSATION ARISING FROM MARKET ENERGY PRICE REVISION</u></p>	
	<p><u>M.1 PURPOSE AND DEFINITIONS</u></p> <p><u>M.1.1 This Appendix sets forth the criteria and calculations for compensation referred to in section 10.2.10 of Chapter 6. Unless otherwise indicated, the criteria and calculations</u></p>	<p>To set out the purpose of this new appendix.</p>

Existing Market Rules (1 July 2017)	Proposed Rule Changes (Deletions represented by strikethrough text and additions represented by double-underlined text)	Reasons for Modification
	<p><u>described in this Appendix shall be applied for each dispatch period and to each generation registered facility.</u></p> <p>M.1.2 In this Appendix, the following definitions apply:</p> <p><u>RMEP^m</u> ≡ <u>revised market energy price (in \$/MWh) at MNN m for the relevant dispatch period, determined in accordance with section 10 of Chapter 6</u></p> <p><u>IEQ^m</u> ≡ <u>injection energy quantity (in MWh) for GRF m for the settlement interval corresponding to the relevant dispatch period, based on the metering data submitted by the market support services licensee for the purposes of the final settlement statement in accordance with section B.3.1 of Appendix 7B</u></p> <p><u>OQ^m</u> ≡ <u>GRF m's scheduled energy output (in MW) for the relevant dispatch period, being:</u></p> <p><u>its scheduled energy output in the real-time dispatch schedule that is</u></p>	<p>To set out the definitions which would be used in this appendix.</p>

Existing Market Rules (1 July 2017)	Proposed Rule Changes (Deletions represented by strikethrough text and additions represented by double-underlined text)	Reasons for Modification
	<p><u>deemed to be <i>dispatch instructions</i> issued by the <i>PSO</i> for the relevant <i>dispatch period</i>, or</u></p> <p><u>if the <i>PSO</i> did not use the <i>real-time dispatch schedule</i> as the <i>dispatch instructions</i> or if the <i>real-time dispatch schedule</i> was not available, the highest <i>energy</i> output level that <i>GRF m</i> was instructed for the relevant <i>dispatch period</i></u></p> <p><u>spq \equiv index of a specific <i>price-quantity pair</i> in an <i>energy offer</i></u></p> <p><u>pq \equiv index of a <i>price-quantity pair</i> in an <i>energy offer</i>, ordered in ascending order of price</u></p> <p><u>$Q^{\text{m,pq}}$ \equiv quantity of a <i>price-quantity pair</i> pq of the <i>energy offer</i> of <i>GRF m</i> for the relevant <i>dispatch period</i></u></p> <p><u>$P^{\text{m,pq}}$ \equiv price of a <i>price-quantity pair</i> pq for the <i>energy offer</i> of <i>GRF m</i> for the relevant <i>dispatch period</i></u></p>	

Existing Market Rules (1 July 2017)	Proposed Rule Changes (Deletions represented by strikethrough text and additions represented by double-underlined text)	Reasons for Modification
	$\sum_{pq=1}^{spq-1} Q^{m,pq} \equiv \underline{\underline{0, \text{ for } spq = 1}}$ $\underline{\underline{COMP^{m,pq}}} \equiv \underline{\underline{\text{compensation payable in relation to a price-quantity pair } pq \text{ of the energy offer of GRF } m \text{ for the relevant dispatch period}}}$ $\underline{\underline{COMP^m}} \equiv \underline{\underline{\text{compensation payable to GRF } m \text{ for the relevant dispatch period}}}$	
	<p><u>M.2 CRITERIA FOR COMPENSATION</u></p> <p><u>M.2.1 A generation registered facility 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:</u></p> <p><u>M.2.1.1 is lower than that in the real-time price schedule; or</u></p> <p><u>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:</u></p> <p><u>a. $\sum_{pq=1}^{spq-1} Q^{m,pq} < OQ^m$; and</u></p>	<p>To set out the criteria for a GRF to be considered eligible for compensation, i.e. when the revised MEP is lower than that in the real-time price schedule (if available), or the offer prices that are cleared based on the dispatch instructions issued by the</p>

Existing Market Rules (1 July 2017)	Proposed Rule Changes (Deletions represented by strikethrough text and additions represented by double-underlined text)	Reasons for Modification
	$\underline{\underline{b. \sum_{pq=1}^{spq} Q^{m,pq} \geq OQ^m}}$	PSO.
	<p><u>M.3 CALCULATION OF COMPENSATION AMOUNT</u></p> <p><u>M.3.1 The reference quantity, RQ^m, for a given <i>dispatch period</i> in respect of a <i>generation registered facility</i>:</u></p> <p><u>M.3.1.1 which was at all relevant times operating under AGC, would be $(IEQ^m \times 2)$; and</u></p> <p><u>M.3.1.2 in all other cases, would be the minimum of $(IEQ^m \times 2)$ and OQ^m.</u></p> <p><u>M.3.2 For each <i>generation registered facility</i> which meets the criteria in section M.2.1, the compensation amount as described in section 10.2.10 of Chapter 6 for that <i>dispatch period</i> shall be calculated as follows:</u></p> $\underline{\underline{COMP^m = \sum_{pq=1}^{10} COMP^{m,pq}}}$ <p><u>M.3.3 For the purposes of section M.3.2, the compensation amount for each <i>price-quantity pair spq</i> of the <i>energy offer</i> of a <i>generation registered facility</i> shall be calculated as follows:</u></p>	<p>To specify that the quantity to be used to compare against a GRF's offer stack (i.e. RQ^m) is dependent on its AGC status for that dispatch period.</p> <p>To set out the calculations for compensation.</p>

Existing Market Rules (1 July 2017)	Proposed Rule Changes (Deletions represented by strikethrough text and additions represented by double-underlined text)	Reasons for Modification
	<p><u>M.3.3.1</u> If $\sum_{pq=1}^{spq-1} Q^{m,pq} \geq RQ^m$, then <u>$COMP^{m,spq} = 0$</u></p> <p><u>M.3.3.2</u> Otherwise,</p> <p><u>$COMP^{m,spq} = \max[(P^{m,spq} - RMEP^m), 0] \times [\min(\sum_{pq=1}^{spq} Q^{m,pq}$</u></p> <p><u>$, RQ^m) - \sum_{pq=1}^{spq-1} Q^{m,pq}] \times 0.5$</u></p>	
	<p><u>Explanatory Note:</u> <u>The following example illustrates the compensation calculation, assuming GRF m meets the criteria under section M.2.1.</u></p>	<p>To include an explanatory note to illustrate the compensation calculations.</p>

Existing Market Rules (1 July 2017)	Proposed Rule Changes (Deletions represented by strikethrough text and additions represented by double-underlined text)	Reasons for Modification
	<p><u>$COMP^{m,1} = 0$ (Based on section M.3.3.2, since $P^{m,1} < RMEP^m$)</u></p> <p><u>$COMP^{m,2} = 0$ (Based on section M.3.3.2, since $P^{m,2} < RMEP^m$)</u></p> <p><u>$COMP^{m,3} = \max[(120 - 100), 0] \times [\min(30, 35) - 20] \times 0.5$ $= 20 \times 10 \times 0.5 = \\100 (Based on section M.3.3.2)</u></p> <p><u>$COMP^{m,4} = \max[(130 - 100), 0] \times [\min(40, 35) - 30] \times 0.5$ $= 30 \times 5 \times 0.5 = \\75 (Based on section M.3.3.2)</u></p> <p><u>$COMP^{m,5} = 0$ (Based on section M.3.3.1, since</u> $\sum_{pq=1}^{5-1} Q^{m,pq} = 40$<u>, which is more than RQ^m)</u></p> <p><u>Hence, total compensation payable to GRF m is:</u> <u>$COMP^m = COMP^{m,1} + COMP^{m,2} + COMP^{m,3} + COMP^{m,4} +$ $COMP^{m,5}$</u> <u>$= \\$0 + \\$0 + \\$100 + \\$75 + \\$0$</u> <u>$= \\175</u></p>	
	<p><u>M.3.4 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</u></p>	<p>To require that the PSO provide within 3BD from the EMC's</p>

<p>Existing Market Rules (1 July 2017)</p>	<p>Proposed Rule Changes (Deletions represented by strikethrough text and additions represented by double-underlined text)</p>	<p>Reasons for Modification</p>
	<p><u>the <i>dispatch period</i> that the compensation request relates:</u></p> <p><u>M.3.4.1</u> whether the <u><i>generation registered facility</i></u> <u>was at all relevant times operating under <i>AGC</i>; and</u></p> <p><u>M.3.4.2</u> if the <u><i>generation registered facility</i></u> <u>was not at all relevant times operating under <i>AGC</i>, provide the <i>dispatch instruction</i> relating to the highest <i>energy</i> output level (in MW) that is issued by the <i>PSO</i> to the <i>generation registered facility</i>.</u></p> <p><u>The <i>PSO</i> shall provide the aforementioned data within 3 <i>business days</i> of the <i>EMC</i>'s request.</u></p>	<p>request, data on (i) the GRF's AGC status and (ii) the dispatch instructions relating to energy for the GRF if the GRF was not operating on AGC.</p>