RCP PAPER NO.	:	**EMC/RCP/106/2019/CP75**
SUBJECT	:	**REVIEW OF GATE CLOSURE RULES**
FOR	:	**DECISION**
PREPARED BY	:	**JO ONG ZU ER** **SENIOR ECONOMIST**
REVIEWED BY	:	**VERONICA RODRIGUEZ** **SVP, MARKET ADMINISTRATION**
DATE OF MEETING	:	**17 JANUARY 2019**

Executive Summary

This paper reviews the current gate closure rules in Chapter 6 Section 10.4 of the Singapore Electricity Market Rules. This review addresses the following two proposals:

(i) To reduce the current 65-minute gate closure ("reduction of the gate closure period"); and
(ii) To expand the current gate closure exemptions ("expansion of the gate closure exemptions"), specifically to allow a specific generation registered facility (GRF) to re-offer into the market after gate closure when that given GRF recovers from a forced outage, as well as to include other exemptions proposed by the industry.

In view of the moderately concentrated market, the lead time required by the PSO for security assessment and the GRFs for unit commitment, EMC **does not recommend** reducing the current gate closure period.

As for the expansion of the gate closure exemptions, EMC **does not recommend** allowing a specific GRF to reoffer after gate closure when that given GRF recovers from a forced outage. This is because if the forced outage indeed creates a shortfall situation severe enough for the relevant advisory notices to be issued, the existing exemptions already allow all facilities to change their offers and bids after gate closure to improve the situation. Instead, EMC **recommends** that the existing gate closure exemption - for a GRF that has experienced a forced outage to reflect its revised capability after gate closure - allow the GRF to reflect its reduced capability after gate closure for only the first 3 periods following the forced outage. This is because currently, a forced outage generator can revise its offer quantities downwards after gate closure until it recovers from its forced outage, and this encourages irresponsible reoffering prior to its forced outage recovery.

Lastly, EMC **recommends** expanding the gate closure exemptions to include two other proposed exemptions, namely:

- To reflect a GRF's revised capability when it fails to synchronise
- To increase energy, reserve or regulation supply if it improves a shortfall situation, for which a High-Risk Operating State (HOS) system status advisory notice is in effect.

At the 106th RCP meeting, the RCP:

(a) **by majority vote supported** maintaining the **status quo** for the gate closure period;
(b) **by majority vote supported** that the existing gate closure exemption - for a GRF that has experienced a forced outage to reflect its revised capability after gate closure - allow the GRF to reflect its reduced capability after gate closure for only the first 3 periods following the forced outage;
(c) **unanimously supported** including two other proposed gate closure exemptions – to reflect a GRF's revised capability when it fails to synchronise, and to increase energy, reserve or regulation supply if it improves a shortfall situation, for which a HOS system status advisory notice is in effect; and
(d) **tasked** EMC to draft the relevant rule modifications.

1. Introduction

This paper reviews the current gate closure rules in Chapter 6 Section 10.4 of the Singapore Electricity Market Rules.

2. Background

In the Singapore Wholesale Electricity Market (SWEM), generation registered facilities (GRFs) are required to submit offers to supply energy, reserve and/or regulation, while load registered facilities (LRFs) are required to submit reserve offers (as interruptible loads) and/or energy bids (as dispatchable loads) for each half-hourly period. Offers and bids are made up of price-quantity pairs.

2.1 Why Gate Closure?

Ideally, there should be no gate closure and changes to offers and bids should be allowed up to the period. This will enhance economic efficiency by enabling offering and bidding in response to the most recent information available. However, this is only true if:

- a market is competitive and efficient enough such that there is no market power concern and consequently limited strategic reoffering opportunities; and
- changes to offers and bids up to the period does not compromise dispatch certainty and threaten unit commitment and system security.

Hence, gate closures are imposed in most electricity markets to disallow offer or bid changes too close to the period unless such changes are due to specific reasons that are allowed for by the market rules. The market rules would allow for reasons (for offer or bid changes after gate closure) when the benefits to the market and/or system exceed the associated costs.

2.2 Current Gate Closure Period in the SWEM

The gate closure period in the SWEM is currently 65 minutes.

GRFs and LRFs can continually change their offers and/or bids for a period up to 5 minutes before the period, when the real-time dispatch schedule (RTDS) is run. However, all such changes made after gate closure, i.e. within the 65-minute period before the period, will be reported to the Market Surveillance and Compliance Panel (MSCP) ex-post for investigation[1].

2.3 Current Gate Closure Exemptions in the SWEM

Chapter 6 Sections 10.4.1 and 10.4.2 of the Market Rules provide for offer or bid changes to be submitted after gate closure for a period under any of the following conditions:

[1] Specifically, EMC will first report all offer and bid changes made after gate closure to the Market Assessment Unit (MAU). MPs that are dispatch coordinators of the relevant GRFs or LRFs are then required to submit a report explaining their reasons for the offer and bid changes made after gate closure. Based on the report and additional information (if any), the MAU will provide its analyses and recommendations for all gate closure violations to the MSCP for the MSCP's determination.

For offer changes,

(a) To reflect a GRF's expected ramp profiles during periods following synchronisation or preceding de-synchronisation
(b) To reflect a GRF's revised capability during a forced outage
(c) To decrease energy supply in an energy surplus situation, for which a market advisory notice has been issued
(d) To increase energy, reserve or regulation supply if it improves a shortfall situation, (i) for which a market advisory notice has been issued or (ii) for which an Emergency Operating State (EOS) system status advisory notice is in effect (i.e. has been issued and not yet withdrawn)

For bid changes,

(e) To reflect a LRF's revised capability during a forced outage or following a decrease in energy withdrawal from reserve activation
(f) To increase quantities in its energy bids if it improves an energy shortfall situation, for which a market advisory notice has been issued or for which an EOS system status advisory notice is in effect.

And subject to the following condition:

(g) The price so offered or bidden, other than for additional quantities, is the same as that previously offered or bidden for that period

2.4 Proposals Received

This review addresses the following two proposals:

(i) To reduce the current 65-minute gate closure ("reduction of gate closure period"); and
(ii) To expand the current gate closure exemptions ("expansion of gate closure exemption"), specifically to allow a specific GRF to re-offer into the market after gate closure when that given GRF recovers from its forced outage, as well as to include other exemptions proposed by the industry.

3. Analysis

Practices in Other Jurisdictions

EMC surveyed the gate closure practices in other electricity markets (see **Annex 1**).

All the electricity markets surveyed, except for the Australian National Electricity Market (NEM), impose gate closures. Notably, the lack of a gate closure in the NEM has been highlighted to be a problem in recent reports[2] as it has encouraged inefficient late rebidding, causing artificial price spikes.

Given that most of the electricity markets surveyed, with the exception of the NEM and the New Zealand Electricity Market (NZEM), have a day-ahead market where bulk of the trading takes place (leaving very few offers and bids to be submitted in the real-time balancing market), their

[2]Refer to the Grattan Institute Report: https://grattan.edu.au/wp-content/uploads/2018/06/905-Mostly-working.pdf, and the Finkel review: https://www.energy.gov.au/sites/g/files/net3411/f/independent-review-future-nem-blueprint-for-the-future-2017.pdf

considerations concerning gate closures for real-time markets may not be applicable to the SWEM's context.

Like the SWEM, the NZEM is a real-time energy-only market with a dispatch interval of 30 minutes. The NZEM's gate closure period was reduced from 2 hours to its current 1 hour in November 2015, and among other exemptions, it currently allows generators to change their offers within gate closure when (a) the revision is necessary due to a bona fide physical reason (including forced outage) and (b) this bona fide reason ceases to exist within 24 hours and the upward revision of the offer quantity cannot be more than the original downward revision.

Nonetheless, arising from the differences across the markets (e.g. presence of day-ahead market, dispatch interval, generation technology mix, etc.), it is not meaningful to over-rely on the gate closure rules in these markets as a reference for the SWEM's in isolation of other factors.

Responses to Questionnaire

EMC had consulted market participants (MPs) and the PSO via a questionnaire (see **Annex 2**) on the proposals mentioned in section 2.4. Eight respondents (ExxonMobil Asia Pacific, PacificLight Power, Sembcorp Cogen, Senoko Energy, Senoko Waste-To-Energy, Tuas Power Generation, Tuaspring and PSO) completed the questionnaire. Their responses to each proposal are shown in the following section relevant to the proposal.

3.1 Issue 1: Reduction of Gate Closure Period

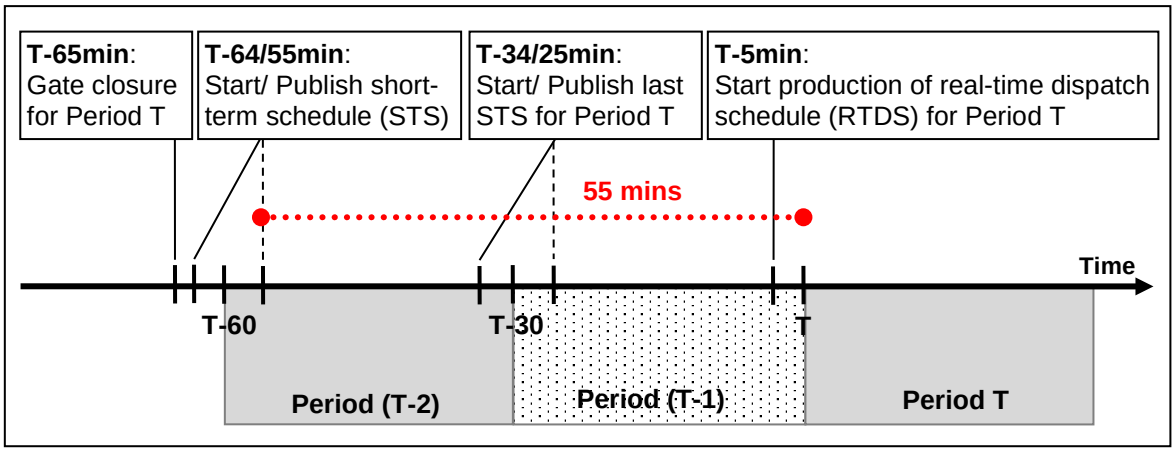
3.1.1 Why 65 Minutes?

The gate closure period was last reduced to 65 minutes to improve economic efficiency arising from more responsive offering (or bidding). It was not proposed for the gate closure period to be further reduced to below 65 minutes so that the PSO and MPs can have dispatch certainty, as well as at least 55 minutes to react to any change in information for Period T.

To illustrate, Figure 1 overleaf shows the timeline in relation to Period T, with the following key events occurring:

- **T-65min**: Gate closure for Period T begins, no offer changes allowed except where provided for under the Market Rules.
- **T-64/55min**: The short-term schedule (STS) for Period T is run at T-64min, and published by T-55min.
- **T-34/25min**: Another STS for Period T is run at T-34min, and published by T-25min. This is the last STS to be published for Period T.
- **T-5min**: The real-time dispatch schedule (RTDS) for Period T is run at T-5min, and published before T-30s.

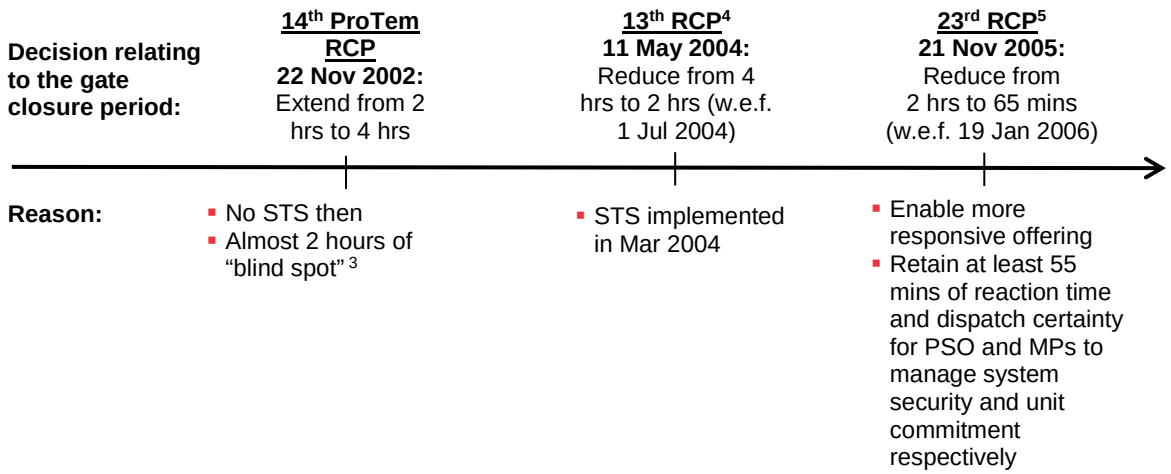
Figure 1: Timeline of Computation and Publication of Schedules



With the current gate closure period of 65 minutes, any change in offer or bid changes for Period T made by MPs before T-65 mins will be reflected in the immediate half-hourly STS which is computed at T-64min and published by T-55min. Once the PSO and MPs receive this STS, they will have at least 55 minutes to manage system security and unit commitment respectively.

The gate closure period in the SWEM has evolved significantly since before market start. Figure 2 below shows the evolution of the gate closure period in the SWEM.

Figure 2: Timeline of Evolution of Gate Closure Period in the SWEM



[3] "Blind spot" refers to the length of time within which offer and bid changes submitted in respect of a dispatch period will not be captured in any forecast schedule. See **Annex 3** for more details.
[4] RC233: Gate Closure Reduction https://www.emcsg.com/f310,9103/EMC_233_wg_-_EMA.pdf
[5] RC246: Gate Closure Reduction https://www.emcsg.com/f311,9288/EMC_246-EMA-wg_revised.pdf

3.1.2 Industry's Views

Through the questionnaire, we consulted the industry on their views on reducing the gate closure period to:

- **35 minutes**, to allow offer changes for Period T to be reflected in the STS next computed at T-34 mins and published by T-25 mins, so that the market has at least 25 mins of reaction time; or
- **6 minutes**, as this is the minimum gate closure period given that the RTS is computed at T-5 mins.

Half of the respondents supported remaining status quo, while the other half supported reducing the 65-minute gate closure period to 35 minutes or 6 minutes. Their responses are summarised in Table 1.

Table 1: Summary of Responses on Reduction of Gate Closure Period

Gate Closure Period	No. of Respondents	Reasons Given by Respondents
65 mins	4	Do **not** support reducing the gate closure period as it could: ▪ Reduce reaction time and dispatch certainty, which are necessary for PSO and MPs to manage system security and unit commitment respectively ▪ Be misaligned with Gas Network Code's (GNC) gate closure[6] ▪ Increase opportunities for unwanted market play or price gaming by reoffering resulting in market volatility and system instability
35 mins	2	**Support** reducing the gate closure period to 35 minutes to allow MPs to be more responsive to changes in the market conditions. Do **not** support reducing the gate closure period further to 6 minutes as it could: ▪ Reduce reaction time of MPs to unanticipated dispatch outcomes ▪ Immensely raise the possibility of market manipulation that results in detrimental outcomes for other MPs
6 mins	2	**Support** reducing the gate closure to 6 minutes as it could: ▪ Provide the traders with more flexibility to respond to changes such as system demand, bidding behaviours of other MPs or to reflect the actual operating conditions of the GRFs ▪ Improve the market's responsiveness to demand/supply changes and respective price signals

3.1.3 Benefits & Costs

Benefits

A shorter gate closure period would allow MPs to vary their offers and bids closer to the real-time period. The key benefit is improved trading (offering and bidding) responsiveness to changing market or system conditions, as well as plant conditions, in turn enhancing efficiency.

To illustrate this benefit, the following are examples provided by MPs for RC246 Gate Closure Reduction in 2005 which remains valid for the discussion in this paper:

[6] Section C.1.1.2 of GNC states that for the purposes of the Code, "Gate Closure" means, in relation to a Balancing Period, the last **hour** bar falling prior to the hour bar on which the Balancing Period commences.

- **Example 1 (address market imbalances)**
  With a shorter gate closure period, online generators can more quickly offer spare capacity in response to high forecasted prices potentially caused by higher load forecasts or forced outages, thereby more quickly restoring market imbalances. For instance, if at 2:35pm there is a high forecasted price for periods commencing from 3:00pm onwards, the earliest period a generator can offer its spare capacity is currently the one commencing at 4:00pm. If the gate closure period were to be reduced to 35 minutes, the generator can change its offer for the period commencing 3:30pm (instead of 4:00pm).

- **Example 2 (address commercial considerations)**
  MPs with multiple generators can quickly offer capacity from their other units when one unit suffers from a forced outage, reducing their spot price risk arising from being in out-of-balance contractual positions. This is especially for MPs who wish to generate a certain amount of energy to fulfill its contractual obligations (e.g. with their customers for gentailers) for a period. A sudden unit outage after gate closure could cause them to be exposed to high spot prices for the period as they will need to purchase their generation deficit from the spot market. If the gate closure were to be reduced, the MPs can change the offers for their other online units to reduce their exposure to spot prices.

Lastly, while not a reason to support reduction in the gate closure period, MPs who vary offer and bids between T-65 mins to T-35 mins do not need to justify their changes to the MSCP, reducing administrative costs.

Costs

Strategic Reoffering

Having a shorter gate closure period in a relatively concentrated market raises the possibility of strategic reoffering by generators. Strategic reoffering refers to the situation where a generator changes its offer quite close to the beginning of the relevant trading period to influence final prices. For example, if a generator withdraws generation (by reducing offered quantities or moving existing quantities to a higher price band) just before the period, this could result in higher prices which are reflected only in the final schedules.

Strategic reoffering would be easiest where a generator is confident of the effect its reoffering will have on price. The presence of gate closure limits generators' ability to engage in strategic reoffering by effectively requiring any strategic reoffering to be completed before gate closure. As there is a significant amount of uncertainty on the final schedule (such as changes in demand, transmission constraints, etc.) prior to gate closure, a generator would be less certain about the effect its actions could have on price.

If reducing the gate closure period encourages or facilitates strategic reoffering by generators, then it would be to the detriment of the market.

Unit Commitment & System Security

Having a shorter gate closure would mean fewer or no reliable forecast schedules i.e. STSs for MPs and the PSO to use to address unit commitment and system security concerns. Gate closures have the effect of encouraging MPs to provide accurate information in pre-final offers and bids. These pre-final offers and bids ought to serve as final offers and bids (i.e. be relatively firm), unless allowed changes are made. The forecast schedules, specifically the STSs in the SWEM, produced using these firm offers and bids are reliable as they will only differ from the final

dispatch schedule, specifically the RTS in the SWEM, by virtue of changes to other inputs (such as load forecasts, transmission constraints, etc.).

In a self-commitment market where MPs are responsible for preparing their facilities to perform in accordance with dispatch instructions, it is important that these facilities have some degree of certainty of their real-time dispatch based one or more reliable forecast schedules. For example, some generators need the lead time to "warm up" and be synchronised to the grid. A shorter gate closure could then increase the likelihood of a generator being not able to run-up in real time when dispatched (or not being able to shut-down in real time when not dispatched). Reducing the gate closure hence risks compromising not only unit commitment but also system security.

A shorter gate closure could also adversely affect system security by reducing the ability of the PSO to assess whether there is sufficient generation capacity available for real-time dispatch to meet projected load. The PSO typically needs the lead time and reliable forecast schedule(s) to, amongst other things:

- Carry out an informed system security assessment and planning
- Declare a grid emergency and call for generators to provide more capacity (if there is not enough capacity)
- Assess potential transmission constraints, and take action to manage a constraint if necessary.

Lastly, greater uncertainty to both the PSO and the MPs could lead to higher costs to mitigate risks arising from such uncertainty, where such costs would eventually be borne by consumers. For instance, the market may need to procure more ancillary services to cater for dispatch volatility. Another instance could be that as GRFs are not paid separately for their start-up and shut-down costs in this self-commitment market, they may factor the dispatch uncertainty into their offers, leading to higher cleared prices for the market in general.

3.1.4 EMC's Assessment

Firstly, although the SWEM's market concentration has improved over the past few years as measured by both the Herfindahl Hirschman Index (HHI) and Pivotal Supplier Test (PST), it remains moderately concentrated[7]. Therefore, reducing the gate closure period further could expose the market to significant opportunities for strategic reoffering.

Secondly, a combined cycle gas turbine (CCGT) plant that makes up 77.78% of GRFs' capacity in the SWEM takes about 90 minutes from notification to ramp up to its minimum stable load (MSL). The time taken by different types of plants are shown in Table 2 overleaf.

[7] In Section 3.2.1 of CP58: Publication of Offer Data (https://www.emcsg.com/f309,128968/CP58_-_Publication_of_Offer_Data_12032018_-_For_Consultation.pdf), the degree of competitiveness of the SWEM was assessed using:

- HHI: The HHI in the SWEM has fallen from 2,521 in Nov 2012 to 1,681 in Nov 2017, indicating that the electricity market in Singapore has improved from highly concentrated to moderately concentrated.
- PST: The number of periods with pivotal supplier for energy and regulation in 2017 has decreased significantly from 2012. Overall, the results suggest that both the markets for Energy and Regulation have become more competitive.

Table 2: Time Taken by Different Types of GRFs

Type	Notification to Sync	Sync to Minimum Stable Load (MSL)	MSL to Full Load	% of GRFs' capacity
Open Cycle Gas Turbine (OCGT)	20 mins			1.34
Combined Cycle Gas Turbine (CCGT)	90 mins		NA	77.78
Steam Turbine (ST)	24-48 hours		NA	20.88

Hence, a CCGT plant needs to be notified for synchronisation about 60 minutes before the start of a period in order to reach its MSL at the end of the period[8]. Reducing the gate closure period further could thus compromise on unit commitment.

Thirdly, for the SWEM, EMC has consulted the PSO and the PSO's view is that the gate closure period cannot be reduced to less than the current 65 minutes because the PSO needs time to perform security assessment based on the RTDS and STSs from after gate closure to before the start of the period. Due to the complexity of the transmission network, the PSO needs to carry out system studies to ensure that the dispatch schedules do not cause the power system to enter into high risk or emergency operating states. While the system studies have already been automated, the PSO needs to analyse the results for decision-making. If the results indicate that there is risk to the power system, the PSO has to decide whether to reconfigure the transmission network or to impose security constraints. Transmission network reconfiguration, if required, would involve coordination with the SP PowerGrid's site officers. The time required depends on the situation, varying based on its complexity, the risks involved and the mitigating measures to be taken.

On balance, EMC **does not recommend** reducing the gate closure period as the status quo of 65 minutes allows for the mitigation of opportunities for strategic reoffering, as well as provides sufficient time between the first reliable STS and the RTDS for the MPs and the PSO to manage unit commitment and system security. For dire market or system circumstances, as well as unforeseen issues of the plants, that require more responsive offering or bidding from the MPs for the sake of system security, there will still be gate closure exemptions to cater to them, as explained in the next section.

3.2 Issue 2: Expansion of Gate Closure Exemptions

Why do we need gate closure exemptions?

In the SWEM, the exemptions fall into two categories:

- exemptions that relates to a specific GRF or LRF better reflecting its physical capability (conditions (a), (b) and (e) in section 2.3); and
- exemptions that relates to situations whereby the overall system is under stress and all units (rather than a specific GRF or LRF) are encouraged to reduce or increase their offers or bids in a way that contributes positively to resolving the system situation (conditions (c), (d) and (f) in section 2.3).

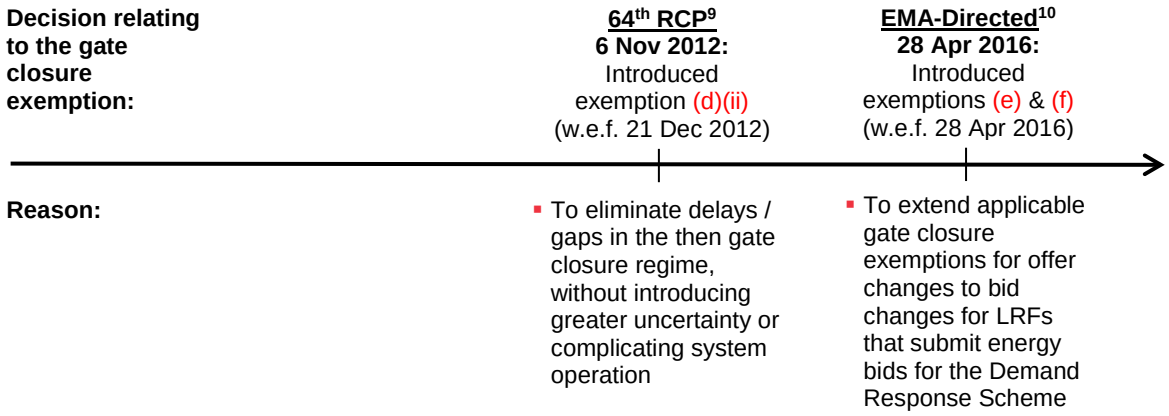
[8] We recognise that, in reality, the GRFs can submit offered quantities of up to their MSL at negative or zero prices during start-up. By securing dispatch with negative or zero-priced offers, the GRFs may not rely on the first reliable STS for notification to synchronise and start up.

These two types of gate closure exemptions exist for the primary reason of system security. While the contribution of the second type of gate closure exemptions to system security is obvious, the contribution of the first type of gate closure exemptions to system security lies in that individual units can take immediate action to reflect unforeseen changes in their physical capability in their offers. Without doing so, such last-minute changes in their physical capability, whether due to changes in machine characteristics or forced outages, could cause the units to fall short of their cleared offers (while insufficient generation is cleared from other physically available units), compromising system security.

Hence, in assessing the expansion of gate closure exemptions, system security considerations take priority.

The gate closure exemptions in the SWEM have been expanded twice since market start. Figure 3 below shows the evolution of the gate closure exemptions in the SWEM.

Figure 3: Timeline of Evolution of Gate Closure Exemptions in the SWEM



3.2.1 GRFs that have recovered from forced outages

This section assesses the proposal to allow a specific GRF to re-offer into the market after gate closure when that given GRF recovers from its forced outage.

3.2.1.1 Background

When a GRF experiences a forced outage, the current Market Rules require its dispatch coordinator to promptly revise its offers to "reflect its revised capability during a forced outage" for the upcoming periods[11], even if these offer revisions are to take place after gate closure[12].

[9] RC314: Exceptions to Gate Closure During an Emergency Operating State https://www.emcsg.com/f1027,77844/EMC314-EMA-LL.pdf

[10] Rules Modification for EMA's "Implementing Demand Response in the National Electricity Market of Singapore" https://www.emcsg.com/f127,112211/335-ImplementingDR_Publication_-_Market_Rules.pdf

[11] This is in spite of a GRF that experienced a forced outage that caused it to automatically disconnect from the transmission system being currently exempted from automatic financial penalties for deviating from its energy schedule for two dispatch periods (i.e. the period that the forced outage occurs and the period after).

[12] According to Section 3.1.3 of RC298: Review of Economic Incentives for Generator Reliability (https://www.emcsg.com/f770,56189/EMC298-EMA-NT.pdf), Chapter 6, Section 10.4.1 of the Market Rules on gate closure takes precedence over Chapter 6, Sections 5.1.5 to 5.1.7 of the Market Rules on re-declaration obligations, which require a dispatch coordinator to re-declare the availability of its facility immediately upon a reasonable expectation of shortfall in its availability from its offered quantity. Hence, if this expectation is formed after gate closure, the dispatch coordinator should re-declare only if it is provided for under one of the exemptions in 10.4.1.

In 2004, when the gate closure period was 4 hours, the MSCP proposed to replace "during" with "following"[13] to:

- Reflect the fact that GRFs revise their capabilities after the occurrence of a forced outage
- Take into account GRFs re-offering into the market when their units recover from the outage

EMC's analysis of the proposal then concluded that the use of "during" was still most accurate as it "describes the period between the beginning and the end of a forced outage, which is exactly the window that violation of gate closure can reasonably be allowed". EMC then found that the use of "following" implies there is no end to the window period, meaning that the unit can continue to make offer changes after gate closure even after the unit has recovered from the outage.

Currently, with the gate closure period at 65 minutes, the MSCP enforces the forced outage gate closure exemption by allowing downward offer quantity revisions after gate closure from the unit during forced outage but not upward offer quantity revisions. By proposing to allow a specific GRF to re-offer into the market after gate closure when that given GRF recovers from a forced outage, the proposal is suggesting that the MSCP allow for upward offer quantity revisions from the GRF after gate closure near the end of the forced outage.

3.2.1.2 Industry's Views

From the questionnaire, half of the respondents supported allowing a specific generator to re-offer into the market after gate closure when that given generator recovers from its forced outage, while the other half did not. Table 3 overleaf summarises their responses.

Table 3: Summary of Responses on Expansion of Gate Closure Exemption

Support?	No. of Respondents	Reasons Given by Respondents
Yes	4	▪ Improves grid stability. ▪ Contributes positively to the market situation (shortfalls, state of emergencies, etc.) arising from the outage. ▪ Electricity supply can be resumed earlier, particularly during periods of emergencies. ▪ Unit able to resume capability in generating electricity earlier. ▪ Allows GRFs to reflect their true generation capacity promptly, given that there is a robust mechanism to ensure that the revised capacity is accurate.
No	4	▪ For system security and reliability, it is critical that the tripped generator be given sufficient time to assess the cause of tripping and resolve the problem before it can resynchronise again. ▪ It does not mean that market clearing would face a system stress situation without these re-offers. ▪ If any offers were cleared on forced outage units that they did not deliver during real time, a rerun should be done ex-post to correct the prices without these offers. ▪ It is not equitable to all MPs, if only the GRFs that are recovering from forced outages can reoffer into the market after gate closure. Instead, would prefer gate closure period to be reduced to 35 minutes or 6 minutes for all MPs.

3.2.1.3 EMC's Assessment

If the forced outage indeed poses a problem to system security, the issuance of market advisories indicating shortfall or system advisory notices indicating EOS would have already allowed all units

[13] RC221: Offers Exceeding Offer Change Limits https://www.emcsg.com/f310,9071/EMC_221-ts_EMA_.pdf

to reoffer after gate closure. On the other hand, if the forced outage does not pose a problem to system security, there is no reason for allowing only that specific unit that has recovered from forced outage to reoffer after gate closure.

In conclusion, EMC **does <u>not</u> recommend** allowing a specific GRF to re-offer after gate closure when that given GRF recovers from a forced outage.

EMC's Counter-Proposal

Currently, during forced outage, unlimited downward offer revisions after gate closure are allowed. It was thus observed that GRFs that have experienced forced outages and are eager to reoffer could exhibit the following currently allowable offer revision behaviour:

Behaviour 1 – withdraw offers for many periods after forced outage, then reoffer before gate closure only to withdraw offers after gate closure when they realise they are unable to recover from the forced outage in time.

Behaviour 2 – withdraw offers for only a few periods after forced outage, then gradually withdraw offers (when they are still unable to recover from the forced outage) or reduce offered quantity (when they are able to recover from the forced outage respectively) after gate closure for subsequent periods.

To illustrate the different offer revision behaviour, we use an example where a forced outage occurred to a generator at 12:28 (P25), and the time and total quantities of offer submissions are shown in Table 4 below. Cells are shaded orange to reflect revisions to the total offer quantities that occurred <u>after gate closure</u>.

Table 4: Time and Total Quantities of Offer Submissions

	Time	**13:00 – 13:30**	**13:30 – 14:00**	**14:00 – 14:30**	**14:30 – 15:00**	**15:00 – 15:30**	**15:30 – 16:00**
	Period	**P27**	**P28**	**P29**	**P30**	**P31**	**P32**
	GC	**11:55**	**12:25**	**12:55**	**13:25**	**13:55**	**14:25**
Received at		**Total Offer Quantities**					
	08:00	300	300	300	300	300	300
Behaviour 1	12:35	0	0	0	0	0	0
	12:54	-	-	150	300	300	300
	13:45			0	150	-	-
Behaviour 2	12:35	0	0	-	-	-	-
	13:25		-	150	-	-	-
	13:45			0	150	-	-
Desired Behaviour	12:35	0	0	0	0	0	0
	13:45			-	-	150	300

Behaviour 1 and 2 give both the power system and the market a false sense of security in forecast schedules and should be avoided. Such behaviour is a result of the unlimited downward offer revisions after gate closure currently allowed during forced outage which encourages irresponsible offering.

The Desired Behaviour of a GRF during a forced outage is the withdrawal of its offers for many periods after the forced outage, followed by the submission of its reoffer before gate closure for the period in which it is certain of a recovery from the forced outage and ready to resynchronise and generate. In this way, the GRF can prioritise the assessment and resolution of forced outage after the withdrawal of its offers upon forced outage, instead of rushing to reoffer in an uncertain manner.

By allowing downward offer quantity revisions after gate closure only for the first few periods immediately following the occurrence of each forced outage in the first place, we can encourage the Desired Behaviour. Any downward offer quantity revisions after the first few periods need to be done before gate closure. It is reasonable to assume that beyond these initial periods, the GRF would already be able to foresee its physical capability for the upcoming periods and change its offers accordingly before gate closure, unless circumstances that are already or will be provided for in the existing or recommended exemptions (see next section) for offer changes after gate closure arise.

For example, if a repeat forced outage occurs to the same unit (or the unit fails to synchronise), downward offer quantity revisions after gate closure will then be allowed by virtue of these other existing (or recommended) gate closure exemptions. Apart from these gate closure exemptions, other circumstances do not warrant a breach of gate closure by the unit to change its offer quantities downwards.

Therefore, EMC **recommends** that the existing gate closure exemption clause relating to GRFs during a forced outage to allow a GRF to reflect its reduced capability i.e. change its offer quantities downwards after gate closure for only the first 3[14] periods following the forced outage.

[14] This is to cater for the scenario where the forced outage occurs late in period T e.g. 12:28 such that the offers can only be changed after the RTDS is run for the upcoming period T+1 e.g. 12:40. The MP may need to revise its offer quantities downwards after gate closure for the upcoming periods T+2 (starting at 13:00) and T+3 (starting at 13:30), and will be allowed to do so.

3.2.2 *Other proposed exemptions*

The industry has also proposed other gate closure exemptions through their responses to the questionnaire. The proposals and EMC's assessment are as follows:

S/N	Proposed Exemption & Reason(s) (if any)	EMC's Assessment	Recommend?
1	For a GRF to reflect its expected ramp-up profile following a forced outage	This is already provided for in the existing exemption for offer changes after gate closure to reflect changes in a GRF's ramp profile following synchronisation as following a forced outage, the GRF would have synchronised to the grid to ramp up.	NA
2	For a GRF to reflect its revised capability when it fails to synchronise Reasons: ▪ There could be some unforeseen issues that occur prior to synchronising and discovered only 1 or 2 periods before the dispatch period ▪ As the entire synchronisation process may take a few periods in various loading levels, it is important that the generator immediately changes its offers for the upcoming periods if it cannot synchronise and generate according to the schedules	Synchronisation to the grid is an essential first step for a GRF to subsequently be able to generate in adherence to its schedule in the following periods. Hence, a GRF's failure to synchronise poses the same risk as a forced outage, in which the unforeseen reduction in the physical capability of the unit ought to be reflected after gate closure in offers so that system security risks can be circumvented by the scheduling of other facilities to cover the shortfall. The MSCP, in its investigation of gate closure violations arising from the GRFs' failure to synchronise, can verify with the PSO on this as the GRFs' dispatch coordinators are required to have sought the PSO's approval for synchronisation.	Yes[15]
3	For a GRF to reflect its revised capability due to operational, technical or machine issues that require the GRF to immediately shut-down or de-rate	This proposed exemption overlaps with the existing exemption for offer changes after gate closure to reflect a GRF's revised capability during forced outage, as the definition of a forced outage in the Market Rules is "an unanticipated intentional or automatic removal from service of equipment or the temporary de-rating of, restriction of use or reduction in performance of equipment". The dispatch coordinators have to prove to the MSCP their gate closure violations fall within the existing exemption, and the MSCP should practise due diligence in verifying so.	NA

[15] Similarly, a GRF that fails to synchronise should be allowed to reflect its reduced capability in its offers after gate closure for only the first 3 periods following its failure to synchronise.

S/N	Proposed Exemption & Reason(s) (if any)	EMC's Assessment	Recommend?
4	To increase energy, reserve or regulation supply if it improves a shortfall situation for which a High-risk Operating State (HOS) system status advisory notice is in effect (i.e. has been issued and not yet withdrawn)	The existing exemption that allows facilities to vary offers or bids after gate closure to contribute positively to the resolution of energy, reserve or regulation shortfalls in an emergency operating state (EOS) was introduced in 2012 by RC314: Exceptions to Gate Closure During an EOS. RC314 concluded that the exemption has merit (a) if it does not aggravate system operation while eliminating the delays/gaps in the gate closure regime[16], and (b) if the exemption is implemented, the system advisory notices can state the product responsible. With PSO's confirmation on the 2 items above, the existing exemption was introduced. For the same reason, we recommend for this exemption to extend to include HOS, subject to the PSO's confirmation on the 2 items for HOS.	Yes, subject to the PSO's confirmation
5	To reflect a facility's revised capability during commissioning, re-commissioning and performance tests	Circumstances leading to any unexpected changes in the physical capability of a facility (e.g. forced outage) should already be provided for in the existing and recommended exemptions. Undergoing commissioning, recommissioning of performance tests per se does not justify offer changes after gate closure.	No
6	To reflect a GRF's *revised* cost and capacity when it is required to change over to diesel in the event of an unplanned gas supply disruption	This deviates from the ultimate condition for offer and bid changes after gate closure, that is to not involve price changes, meant to mitigate opportunities for strategic reoffering. Moreover, in the event of an unplanned gas supply disruption, the system would have already been under stress, and a fall in supply (whether due to a reduction in offer quantities or an increase in offer prices) could exacerbate the system or market situation. In fact, if the unplanned gas supply disruption does pose a shortfall situation for which a market advisory notice or an EOS system status advisory notice is in effect, all facilities will be allowed to change their offers and bids to improve the situation.	No
7	To correct an inaccurate offer or bid	It is challenging to determine whether an offer or bid revision is indeed meant to correct an inadvertent mistake or to perform strategic reoffering (to influence market price). Further, MPs will lose the incentive to ensure accurate submission prior to gate closure.	No

[16] System status advisories (EOS and HOS) can be issued any time, unlike market advisories that are issued at fixed intervals aligned with the dispatch or forecast runs. Hence, allowing facilities to vary offers or bids after gate closure to contribute positively to the resolution of shortfalls for which system status advisories are in effect allows the system to benefit from greater responsiveness.

4. Implementation Time & Cost Estimates

For the proposed revisions to the gate closure exemptions, no changes to the market systems is required as currently, all changes to offers and bids made after gate closure are already required to be reported to the MAU, and the MSCP will then make the determination whether the reasons for such changes fall within the premises of the revised gate closure exemptions.

5. Consultation

We published the concept paper for consultation on 16 October 2018, and also specifically sought the PSO's views on:

a) whether offer and bid changes during a High-risk Operating State, as envisioned in the proposed exemption, would aggravate system operation; and if it does not,
b) whether the PSO could specify the area of shortfall responsible for the system status advisory, to guide MPs in providing additional offers and bids.

Comments were received from 5 stakeholders, namely PSO, PacificLight Power, Senoko Energy, Tuas Power, and Keppel. Their comments and EMC's responses are set out in Table 5 (for the proposed reduction of gate closure period), Table 6 (for the proposal to allow a specific GRF to re-offer into the market after gate closure when that given GRF recovers from a forced outage) and Table 7 (for the other proposed gate closure exemptions).

Table 5: Comments on proposed reduction of gate closure period

Comments from	Comments	EMC's Response
PacificLight Power	PLP would advocate the reduction of gate closure from current 65 minutes to 35 minutes. The shorter gate closure would provide more flexibility to respond to the changes in the market conditions such as system demand. Moreover, it would allow MPs to reflect the actual status of generation facility more promptly. As a result, the balance between demand and supply could be maintained. Compared to 6 minutes, a 35-minute gate closure would mitigate the risk of PSO not having sufficient time to perform security assessment and taking action according to the transmission network. Strategic reoffering should not be created by shortening closure period from 65 to 35 minutes as another short-term schedule (STS) is run before the real-time dispatch schedule period.	EMC agrees with PacificLight on the benefit of a shorter gate closure. However, PSO has confirmed that they need the 65-min gate closure for their security assessment and follow-up actions, and hence, EMC is concerned that the costs outweigh the benefits of a shorter gate closure.
Senoko Energy	We do not agree with EMC's assessment to maintain the status quo on the gate closure period as we believe that the benefits of reducing the gate closure period outweigh the costs stated. On the benefits, 1. With the increased integration of intermittent generation embedded in loads, it will allow companies more time to react to the changes both their generation portfolio (conventional + intermittent) and their contracted load positions (net consumption).	EMC appreciates Senoko's elaboration on the benefits of a shorter gate closure. EMC recognises the benefit of a shorter gate closure in addressing market imbalances and commercial considerations, in particular those arising from load fluctuations due to the greater penetration of intermittent generation sources. However, EMC is concerned that the costs outweigh the benefits of a shorter gate closure.

Comments from	Comments	EMC's Response
	2. The advancement in metering infrastructure will allow increased real-time monitoring of load consumption, which generation assets will need to be able to react faster to meet their contractual obligations.	
	On the costs, 1. We would like to see more conclusive evidence that strategic reoffering is detrimental to the market, which would have hedged their electricity consumption price via term contracts or electricity futures, while anti-competitive behaviour is closely monitored and regulated by the EMA.	The hedging of price via term contracts or futures does not diminish the detriment of strategic reoffering.
	2. Arising from the differences across markets, it is not meaningful to over-rely on the HHI methodology in US FERC as a reference for SWEM, while the methodology used by EMA has not been referenced in this. On top of HHI, the Lerner index for SWEM based on Vesting LRMC should also be included as a measurement of market power.	The impact of calculating HHI using capacity (US FERC) vs output (EMA), as well as the limitations of HHI have been earlier addressed by EMC under Matters Arising at the 103rd RCP meeting in the context of Concept Paper CP58. Please see Annex 4 for the excerpt from Matters Arising at the 103rd RCP meeting on the use of HHI to determine market competitiveness. The HHI has been interpreted with the PST to conclude that the SWEM is still moderately concentrated. While more metrics could be used to measure the degree of competitiveness of the SWEM, this paper adopts a more conservative stance on the SWEM's market concentration and hence the gate closure period. Further, the Lerner Index has its limitations as well. It may not provide a meaningful measure of market power in a dynamic market like the SWEM. This is because it applies only to an instant of time, while the impact of market power applies to some interval of time[17].
	3. It is agreed that market concentration has dropped drastically since the current gate closure period was set in 2006, while technological improvements would allow system operators to manage power imbalances in real time. It will be useful for PSO to share the frequency of instances where there is insufficient generation to meet projected load, and the average lead time taken to carry out the follow up actions	EMC has consulted the PSO, and the PSO shared that: ▪ For system security, the 65-min gate closure provides reaction/ response time to cater for the possibility of transmission network reconfiguration and ensure that the inputs given to the MCE for the RTDS are accurate. ▪ The frequency of past instances should not be used to determine the gate closure period, as system conditions are dynamic and will change from time to time. ▪ The proposed change could encourage a party to change offers

[17] The Measurement of Monopoly Power in Dynamic Markets, by Robert S. Pindyck, 1984

Comments from	Comments	EMC's Response
		frequently with consequential impact on system security and market volatility.
	4. For example, if a unit is halfway through its run up profile and it is able to synchronise earlier, then a longer gate closure would impede this unit and cause an inefficient outcome for the unit operator.	EMC agrees with Senoko that a benefit of a shorter gate closure period is improved trading (offering and bidding) responsiveness to changing plant conditions (e.g. readiness to move up start-up profile), in turn enhancing efficiency. However, the PSO commented that since the start-up profile of a unit needs to adhere to the Original Equipment Manufacturer's recommended start-up profile, shortening the unit run-up time could result in tripping of the unit. Hence, the benefit of a shorter gate closure in Senoko's example could be limited.

Table 6: Comments on the proposal to allow a specific GRF to re-offer into the market after gate closure when that given GRF recovers from a forced outage

Comments from	Comments	EMC's Response
PacificLight Power	We maintain that GRFs should be allowed to revise their offer upwards after gate closure when that given GRF recovers from a forced outage. This would help them to reflect their most updated unit capability and improve market responsiveness thereby alleviating the mismatch between supply and demand.	As established in the paper, system security considerations take priority in assessing proposed gate closure exemptions. Hence, upward revision of offers by GRFs that have recovered from a forced outage should only be allowed if their failure to do so would pose as a system security problem. If the forced outage indeed poses a problem to system security without the reoffers, the issuance of market advisories indicating shortfall or system advisory notices indicating EOS would have already allowed all units to reoffer after gate closure. GRFs should submit their reoffer before gate closure for the period in which it is certain of a recovery from the forced outage and ready to resynchronise and generate. If the lack of their reoffers poses a problem to system security, the gate closure would have opened up for reoffers from all units.
	PLP would express our concern on the amendments to the existing gate closure exemption. This limitation might force GRFs which experience forced outage to rigidly commit with offer submitted before gate closure, even if technical constraints have already been resolved. This is inconsistent with the objective of alleviating the mismatch between demand and supply.	EMC's recommendation serves to make clear that such a GRF should withdraw its offers for many periods after the forced outage (after gate closure for first 3 periods and before gate closure for subsequent periods), followed by the submission of its reoffer before gate closure for the period in which it is certain of a recovery from the forced outage and ready to resynchronise and generate.
Tuas Power	While Tuas Power has, in principle, no objection to EMC's recommendation to restrict the GRF to change its offer quantities downwards after gate closure for only the first 3 periods following a forced outage, we	

Comments from	Comments	EMC's Response
	understand that the PSO has recently introduced a new process and regulatory framework for GRFs with forced outages, i.e. the tripped unit is not allowed to resume operation until the EMA investigation team, which will be dispatched to site, is (1) convinced of the cause of the trip; and (2) satisfied with the mitigation measures put in place and assurance by Genco that there will not be recurrence due to similar fault. Until there is clarity on this new implementation, we do not think that it would be fruitful to make changes to the gate closure rules for GRFs recovering from forced outages.	This does not conflict with the PSO's new process and regulatory framework for GRFs that experience forced outages.

Table 7: Comments on other proposed gate closure exemptions

S/N	Comments from	Comments	EMC's Response
2	Keppel	We agree that gate closure exemptions should be expanded to allow a GRF to reflect its revised capability when it fails to synchronise.	EMC notes Keppel's support.
4	PSO	a) PSO has no objection for offer and bid changes during a HOS (as they do not aggravate system operation) b) PSO can state the product that is causing the HOS in the advisory notices.	EMC notes PSO's comments.
	Tuas Power	With regards to EMC's recommendation to extend the gate closure exemption to HOS, Tuas Power would like to provide our views that extension to gate closure exemption to include HOS may not be necessary as there are already many measures in place to help to restore system security and stability during contingency events, i.e. (1) Chapter 11, section 11.4.3 of the System Operation Manual has provided the PSO the right to declare an EOS should the power system remained in the HOS for more than 30 minutes, and EOS would allow the Market Participants to submit their offer variations after gate closure as per Chapter 6, section 10.4.1.1e of the Market Rules; and (2) Chapter 5, section 9.1.3 of the Market Rules also allowed PSO to issue dispatch instructions to the GRFs during HOS or EOS.	Tuas Power has correctly pointed out some of the existing measures in place to restore the PSO controlled system to normal operating state. Nevertheless, the issue of central control and coordination by the PSO (i.e. issuing dispatch instructions to GRFs) versus market-driven alleviation through additional offers (and bids) was discussed in RC314 (see Section 4.2 of paper), and the conclusion was that with PSO's confirmation on (1) offer and bid changes during EOS will not aggravate system operation and (2) PSO is able to state the product shortfall responsible for the EOS, the proposal is of merit. Since PSO has confirmed the same for offer and bid changes during HOS, EMC recommends for extending the gate closure exemption to HOS as it further eliminates the delays/gaps in the gate closure regime.
	Keppel	We agree that gate closure exemptions should be expanded to allow GRFs to increase energy, reserve or regulation supply if it improves a shortfall situation for which a HOS system status advisory notice is in effect.	EMC notes Keppel's support.

6. Conclusion

This paper reviews the gate closure rules, with respect to the gate closure period, as well as the gate closure exemptions. Upon examining the benefits, costs and rationale for existing arrangements, and taking into account the stakeholders' views, EMC's assessment of each proposal is summarised in the table below.

Table 8: EMC's Assessment of each Proposal

Proposal	EMC's Assessment
Shortening Gate Closure Period	Do not support
Allowing a GRF to reoffer within gate closure upon recovery from forced outage	Do not support. Instead, support allowing GRF to reflect its reduced capability within gate closure for only the first 3 periods following forced outage.
Expanding gate closure exemptions	Support gate closure exemptions to: ▪ Reflect GRF's revised capability when it fails to synchronise ▪ Increase energy, reserve or regulation supply if it improves a shortfall situation for which a HOS system status advisory notice is in effect

7. Decision at the 106th RCP Meeting

The concept paper was presented at the 106th RCP meeting held on 17 January 2019. The RCP:

(a) **by majority vote supported** maintaining the **status quo** for the gate closure period;
(b) **by majority vote supported** that the existing gate closure exemption - for a GRF that has experienced a forced outage to reflect its revised capability after gate closure - allow the GRF to reflect its reduced capability after gate closure for only the first 3 periods following the forced outage;
(c) **unanimously supported** including two other proposed gate closure exemptions – (1) to reflect a GRF's revised capability when it fails to synchronise, and (2) to increase energy, reserve or regulation supply if it improves a shortfall situation, for which a HOS system status advisory notice is in effect; and
(d) **tasked** EMC to draft the relevant rule modifications.

The details of the voting outcomes are shown in Table 9 below.

Table 9: Summary of Voting Outcomes at the 106th RCP Meeting

RCP Member		(a) To maintain the status quo for the gate closure period	(b) For a GRF to reflect its reduced capability after gate closure for 1st 3 periods only	(c) To include 2 other gate closure exemptions
Representative of EMC	Mr. Henry Gan	Support	Support	Support
Representative of PSO	Mr. Soh Yap Choon	Support	Support	Support
Representative of Generation Licensee	Mr. Tan Jun Jie	Do not support	Support	Support
	Mr. Tony Tan	Do not support	Do not support	Support
	Mr. Teo Chin Hau	Do not support	Do not support	Support
Representative of Retail Electricity Licensee	Mr. Sean Chan	Support	Support	Support
	Mr. Vijay Sirse	Support	Support	Support
	Mr. Daniel Au	Do not support	Do not support	Support

RCP Member		(a) To maintain the status quo for the gate closure period	(b) For a GRF to reflect its reduced capability after gate closure for 1st 3 periods only	(c) To include 2 other gate closure exemptions
Representative of Wholesale Electricity Trader	Mr. Matthew Yeo	Support	Support	Support
Representative of market support services licensee	Ms. Ho Yin Shan	Support	Support	Support
Representative of transmission licensee	Ms. Carol Tan	Support	Support	Support
Person experienced in Financial Matters in Singapore	Mr. Tan Chian Khong	Abstain	Abstain	Support
Representative of Consumers of Electricity in Singapore	Dr. Toh Mun Heng	Absent	Absent	Absent
	Mr. YK Fong	Support	Abstain	Support
Decision		**By majority vote support**	**By majority vote support**	**Unanimously support**

ANNEX 1: Practices in Other Jurisdictions

Market	Day-ahead Market?	Real-time Dispatch Interval	Real-time Market's Gate Closure Period
PJM Interconnection (PJM)	Yes	5 mins	65 mins
ISO New England (ISONE)	Yes	5 mins	30 mins (w.e.f. Dec 2014)
New York Independent System Operator (NYISO)	Yes	60 mins	75 mins (reduced from 90 mins w.e.f. 2015)
California Independent System Operator (CAISO)	Yes	15 mins or 5 mins (1 min under certain grid conditions)	75 mins
Midwest Independent System Operator (MISO)	Yes	5 mins	30 mins
Australian National Electricity Market (NEM)	No	5 mins	0 mins (i.e. no gate closure)
Wholesale Electricity Market (WEM) (Western Australia)	Yes	30 mins	2 hrs (in discussions to reduce to 30 mins)
New Zealand Electricity Market (NZEM)	No	30 mins	1 hr (reduced from 2 hrs w.e.f. Nov 2015)

ANNEX 2: Questionnaire to the Industry

QUESTIONNAIRE ON REDUCTION OF GATE CLOSURE

INTRODUCTION

During the Prioritisation Exercise for the Rules Change Work Plan 17/18, the industry prioritised a proposal by PacificLight Power to review the 65-mins gate closure period, specifically to allow generators to re-offer into the market after gate closure when they have recovered from their forced outages.

In Jan 2005, the gate closure period was reduced to 65 mins to allow offer variations for Period T to be reflected in the half-hourly Short-Term Schedule (STS) computed at T-64 mins and published at T-55 mins, so that the market has at least 55 mins of reaction time. In view that it has been almost 12 years since then, it is timely for EMC to review whether the current circumstances warrant a further reduction in the gate closure period to:

- **35 mins**, to allow offer variations for Period T to be reflected in the STS next computed at T-34 mins and published at T-25 mins, so that the market has 25 mins of reaction time; or

- **5 mins**, as this is the minimum gate closure period given that the Real-Time Schedule (RTS) is computed at T-5 mins.

As changing the gate closure period (and the permissible exceptions) has industry-wide impact, EMC would like to first consult stakeholders. Hence, we have prepared a simple questionnaire for you to complete. We would appreciate if you could return the completed questionnaire to us by **COB 9 March 2018 (2 weeks' time)**, via email to Jo.Ong@emcsg.com.

Please be assured that your response will be treated with **strict confidence** by EMC. Thank you.

Reply to:

Ms Jo Ong (EMC Market Administration)

Email: **Jo.Ong@emcsg.com**

Tel.: **6871 1877**

Deadline: 9 March 2018

QUESTIONNAIRE

Please indicate whether you support reducing the current gate closure period of 65 mins, along with reasons for your view. Where possible, please substantiate with specific examples.

☐ **YES**, we support reducing the gate closure period to **35 mins**.

☐ **YES**, we support reducing the gate closure period to **5 mins**.

☐ **NO**, we do not support reducing the gate closure period.

Reasons:

Please indicate whether you support allowing generators to re-offer into the market after gate closure when they have recovered from their forced outages, along with reasons for your view. Where possible, please substantiate with specific examples.

☐ **YES**, we support.

☐ **NO**, we do not support.

Reasons:

Apart from the condition stated in Q2, please indicate whether you feel that there is/are any condition(s) (other than the existing conditions outlined in Chapter 6, Section 10.4.1) under which offer variations should be allowed to be submitted after gate closure?

☐ **YES**, the condition(s) and reason(s) are indicated overleaf.

☐ **NO**, the existing conditions are comprehensive enough.

Condition(s) & Reason(s):

Are there any other relevant issues/concerns which you want to bring to EMC's attention in relation to the gate closure period and the permissible exceptions? Please give the details below.

Please furnish us with your particulars so that EMC can contact you if we have any queries to your response.

Name of Respondent: _____

Designation: _____

Company: _____

Contact No.: _____

E-mail: _____

Signature: _____

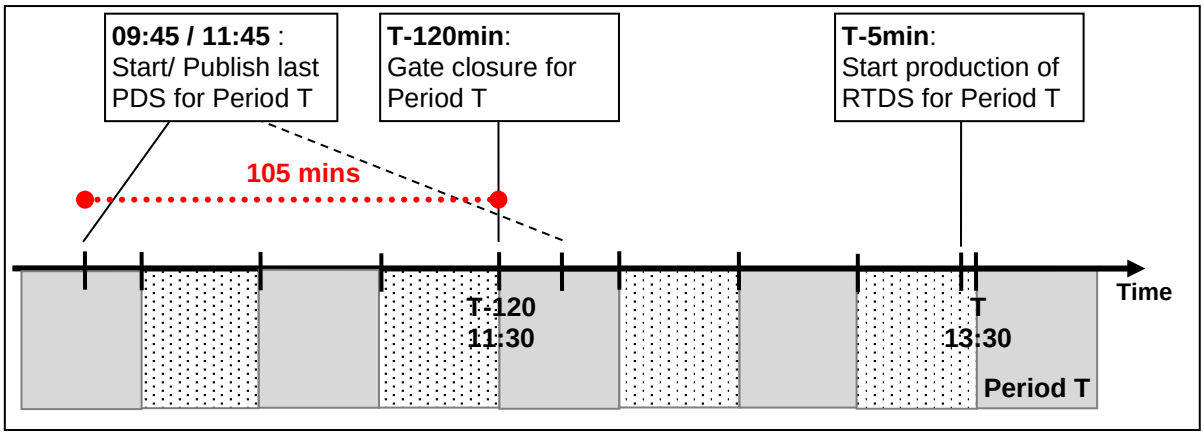
END OF QUESTIONNAIRE

Thank you for taking the time to complete this questionnaire. Your views are important to us. EMC will take into consideration all stakeholders' views/concerns when it submits its recommendations to the RCP for consideration.

ANNEX 3: “Blind spot” without STS

In 2002, the gate closure period was extended from 2 hours to 4 hours due to the absence of the STS and the resulting “blind spot”. As the PDS is computed and published every 2 hours, the worst-case “blind spot”, i.e. length of time in which offer and bid changes submitted in respect of a dispatch period are not captured by any forecast schedule, was almost 2 hours (105 minutes). This worst-case scenario is illustrated in the figure below showing the timeline in relation to Period T starting at 13:30 with the following key events occurring:

- **09:45**: The PDS for Period T is run with offers submitted before 09:45.
- **11:30**: Gate closure for Period T begins at T-120min, no offer changes allowed except where provided for under the Market Rules.
- **11:45**: The PDS for Period T is published. This is the last PDS to be published for Period T.
- **13:25**: The RTDS for Period T is run at T-5min (and published before T-30s).



Offer changes submitted between 09:45 and 11:30 in respect of Period T starting at 13:30 are not captured in any forecast schedules, resulting in the worst-case “blind spot” of 105 minutes.

ANNEX 4: Excerpt from Matters Arising at the 103rd RCP Meeting - Use of HHI to determine market competitiveness

Calculation basis for HHI

The Herfindahl-Hirschman index (HHI) is one of the structural indicators of the competitiveness of a market and provides an indication of the ability of firms to exercise market power.

EMC has surveyed the calculation basis for HHI in other jurisdictions, with the results tabulated in Table 1 below.

Table 1: Survey of the HHI Calculation Basis in Different Jurisdictions

No.	Market	Context within which HHI was used	HHI Calculation Basis	Source
1	Australia National Electricity Market	One of the structural indicators of competitiveness	Capacity	Australia Energy Regulator, State of the Energy Market - May 2017 (Figure 1.21, page 48) https://www.aer.gov.au/system/files/AER%20State%20of%20the%20energy%20market%202017%20-%20A4.pdf
2A	Singapore	As a part of the analysis of the impact of using a concentration cap under the "improved vesting regime" option	Capacity	Frontier Economics, Review of Vesting Contract Regime - August 2016 (Figure 26, page 151) https://www.ema.gov.sg/cmsmedia/Consultations/Electricity/review%20of%20vesting%20contract%20regime%20(2016)/Frontier%20Economics%20-%20Review%20of%20Vesting%20Contract%20Regime%20-%20Revised%20Report%20-%20STC.pdf
2B	Singapore	Provide an overview of the wholesale electricity market	Scheduled Generation	EMA, Developing Efficient and Competitive Energy Markets in Singapore 2017 (Slide 3) https://www.emcsg.com/f1671,123943/1_-_Ng_Wai_Choong_Energy_Market_Authority.pdf
3	Alberta	As a simple market concentration metric	Capacity	Market Surveillance Administrator, Measuring Generator Market Power October 31, 2012 (Section 3.3.3) https://albertamsa.ca/uploads/pdf/Archive/2012/SOTM%20Market%20Power%20103112.pdf
4	Midwest ISO	Part of structural market power analyses for competitive assessment	Capacity	Potomac Economics, 2017 State of the Market Report for the MISO Electricity Market – Analytic Appendix (Figure A142, Page 141) https://www.potomaceconomics.com/wp-content/uploads/2018/07/2017-SOM-Appendix_Final_7-6.pdf
5	ISO New England	As one of the structural market power indicators	Capacity[18]	Potomac Economics, 2017 Assessment of the ISO New England electricity markets (Figure 1 page 3) https://www.potomaceconomics.com/wp-content/uploads/2018/06/ISO-NE-2017-EMM-SOM-Report_6-17-2018_Final.pdf

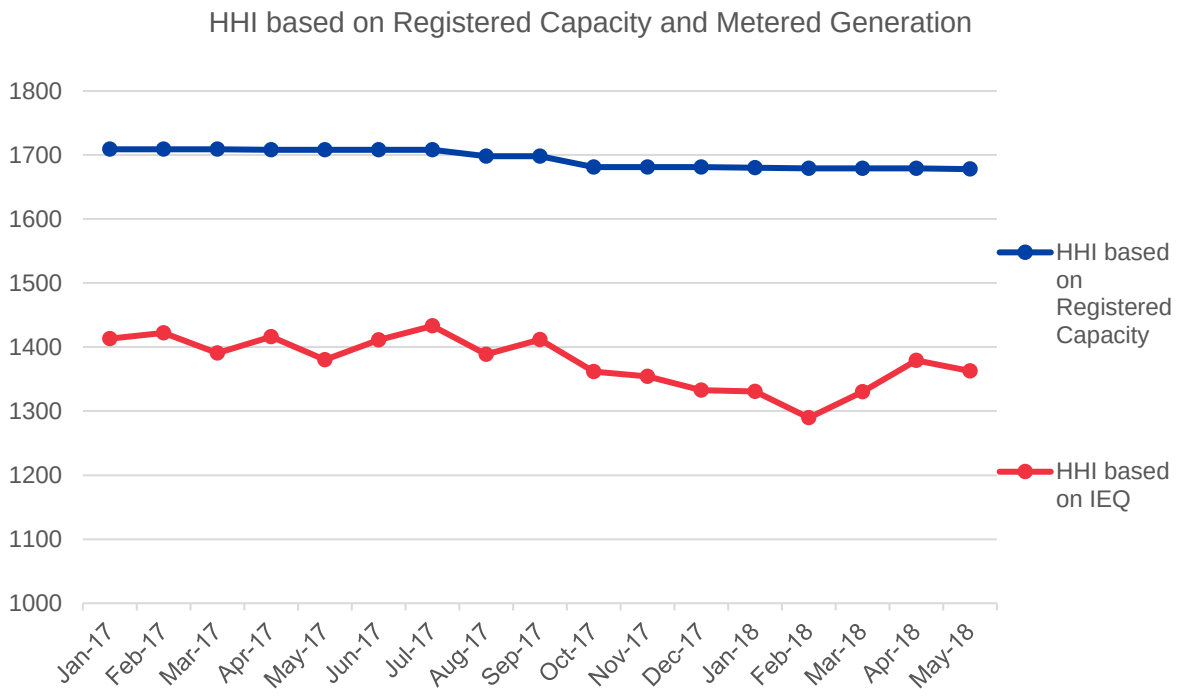
[18] Uses Seasonal Claimed Capability - a generator asset's capability to perform under specified summer and/or winter conditions for a specified duration

No.	Market	Context within which HHI was used	HHI Calculation Basis	Source
6	Great Britain	As an indication of market concentration	Metered volumes	Ofgem, State of the energy market 2017 report (Page 46 - 47) https://www.ofgem.gov.uk/system/files/docs/2017/10/state_of_the_market_report_2017_web_1.pdf
7	PJM	To evaluate the competitiveness of the market structure	Energy output (Hourly Energy Market HHI)	Monitoring Analytics, Quarterly State of the Market Report for PJM: January through September 2017, section 3 (Page 101) http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2017/2017q3-som-pjm-sec3.pdf
8	New Zealand	Illustration of the generation market concentration trend	Actual Generation	Electricity Authority, 2016/17 Annual Report, (Figure 9, Page 94) https://www.ea.govt.nz/dmsdocument/22577

In summary, Table 1 shows that the markets surveyed generally use market shares based on either **capacity** or **output** to calculate the HHI.

HHI in SWEM, calculated based on both registered capacities and metered generation (i.e. injection energy quantities), is provided below for the Panel's information.

HHI in SWEM (January 2017 to May 2018)



Impact of calculating HHI using capacity vs output

While HHI can be calculated using market share based on either capacity or output, our view is that if the intent is to demonstrate the structural composition of firms within the market and their ex-ante ability to exercise market power (as is the intent in Concept Paper CP58), then using HHI based on capacity is more appropriate.

Box 1 below uses a simplified case to illustrate the impact of calculating HHI using different measures.

Box 1: Illustration of HHI Calculations

Take the simplified case whereby there exists five firms, Firms A to E, with the capacities and outputs as summarised in the table below.

Firms A to E are arranged in ascending order of marginal costs. Assuming the absence of any transmission constraints, Firm C is a pivotal supplier as long as market demand is higher than 8,000 MW (as its output is necessary to satisfy any demand higher than 8,000 MW).

Cases 1 and 2 illustrate possible scheduling outcomes when market demand is 9,000MW/ For simplicity, assume each firm's output corresponds with their schedules.

Capacity and scheduling outcomes when market demand is 9,000 MW

Firm		Capacity (MW)	Case 1 Schedule (MW)	Case 2 Schedule (MW)
Increasing marginal costs ↓	A	2,000	2,000	2,000
	B	2,000	2,000	2,000
	C	4,000	4,000	2,000
	D	2,000	1,000	2,000
	E	2,000	0	1,000
HHI		**2,222**	**3,086**	**2,098**

Case 1 illustrates the outcome under a scenario where all firms offered at their marginal costs. Since demand is 9,000 MW, the least-cost generators are scheduled.

However, as Firm C is a pivotal supplier, if Firm C attempts to withhold capacity to raise prices, it may result in the outcomes in Case 2.

Comparing Case 1 and Case 2, even though Case 1 reflects a more economically efficient outcome (where the least-cost generators are scheduled), the HHI based on output market share is higher than that in Case 2 where a pivotal supplier was withholding capacity.

Output market shares may already have incorporated the impact of withholding actions by firms, and therefore may not fully reflect the market's competitiveness or the ability of firms to exercise market power.

Limitations of HHI

Notwithstanding the use of HHI in our analysis, it is important to also note that the HHI has limitations. For example:

(i) The HHI does not consider the demand in the market. The market power of sellers will increase as demand rise since the supply cushion would be tighter. For example, in the extreme case where all (or most) generation capacity is required to meet demand, even the smallest of generators possess the ability to exercise market power.

(ii) The HHI also ignores the fact that firms may not have the incentive to exercise market power, even if they possess the ability to do so, which would be the case if generators are over-contracted or if demand is low relative to total supply.

Hence, while the HHI is commonly used, it is not a definitive measure of a market's competitiveness. The HHI should be interpreted together with other metrics (such as number of pivotal suppliers, price-cost mark-up) in order to provide a fuller picture of the state of the market.