**Executive Summary**

In the Rules Change Panel Work Plan 2020/21, a proposal to provide real-time estimates of the Reserve Responsibility Share (RRS) for each Generation Registered Facility (GRF) was prioritized for review by the Rules Change Panel (RCP).

This proposal was first made by Senoko Energy. It proposed to establish a methodology to calculate an estimated RRS for each GRF in real time and publish the estimated RRS for each dispatch period of the market outlook scenario (MOS), pre-dispatch schedule (PDS), short-term schedule (STS) and real-time schedule (RTS).

The proposer explained that this new information would further improve the pre-dispatch transparency of the reserve share (and associated reserve costs) arising from the scheduled generation of each GRF.

**EMC is of the view that making forecasted RRS available to MPs enhances market transparency.**

We recommend that the RCP:

1. Support the proposal for EMC to:
   a. use the existing RRS calculation methodology to calculate forecasted RRS
   b. calculate forecasted RRS for RTS, STS and PDS
   c. provide forecasted RRS to the relevant owner-MPs only; and

2. task EMC to draft the required market rules for the provision of forecasted RRS

At the 118th RCP meeting held on 8 Sep 2020, the RCP by majority vote supported EMC’s recommendations.
1. Introduction

This paper discusses a proposal for the EMC to establish a methodology to calculate an estimated Reserve Responsibility Share (RRS) for each Generation Registered Facility (GRF) in real time and to publish the estimated RRS for each dispatch period of the market outlook scenario (MOS), pre-dispatch schedule (PDS), short-term schedule (STS) and real-time schedule (RTS). The proposer sought to improve transparency on the reserve shares (and associated reserve costs) arising from the scheduled generation of GRFs.

2. Background

2.1 What is a Reserve Responsibility Share (RRS)?

The RRS is a parameter calculated using a Modified Runway Model to allocate reserve costs\(^1\). This parameter is calculated from 2 inputs: 1) a GRF’s energy dispatch schedule and 2) a GRF’s standing probability of failure\(^2\) (SPF). In general, a GRF that has a higher scheduled energy quantity and a higher SPF will have a higher RRS and thereby allocated higher reserve costs.

2.2 Schedules Published by EMC

EMC produces the following dispatch and price schedules in accordance with the Market Rules. Please refer to Table 1 below.

<table>
<thead>
<tr>
<th>Type of Schedule</th>
<th>Real Time Schedule (RTS)</th>
<th>Short Term Schedule (STS)</th>
<th>Pre-Dispatch Schedule (PDS)</th>
<th>Market Outlook Scenario (MOS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Also known as</td>
<td>Dispatch Run (DPR)</td>
<td>Look Ahead Run (LAR)</td>
<td>Day Ahead Run (DAR)</td>
<td>Week Ahead Run (WAR)</td>
</tr>
<tr>
<td>Frequency of publication</td>
<td>Every Period</td>
<td>Every Period</td>
<td>Every 2 hours</td>
<td>Every Day</td>
</tr>
<tr>
<td>Published by</td>
<td>T-30 seconds</td>
<td>T+5 Mins</td>
<td>15 Mins before each 2-hour block, starting from 0000 hrs</td>
<td>9am of each day</td>
</tr>
<tr>
<td>Coverage</td>
<td>Upcoming period T</td>
<td>Upcoming periods from T+1 to T+12 excluding upcoming period T which is covered under RTS</td>
<td>Covers at least 24 periods and not more than 72 periods</td>
<td>All periods from the start of the next day for 6 consecutive days</td>
</tr>
<tr>
<td>Comments</td>
<td>Binding dispatch schedule</td>
<td>Forecast Schedule</td>
<td>Forecast Schedule</td>
<td>Forecast Schedule</td>
</tr>
</tbody>
</table>

\(^1\) Only applicable to GRFs that are scheduled for more than 10MW of energy.

\(^2\) Standing Probability of Failure (SPF) is a measurement of a GRF’s reliability. In general, the higher the SPF, the less reliable the GRF as the probability of the GRF experiencing a forced outage is higher. Under the market rules, EMC is tasked to maintain a register of SPF for all GRFs and provide this information to all MPs and the Market Support Services Licensee (MSSL), Market Rules, Appendix 7A, A.7.
2.3 Current Market Rule Obligations for Publishing of RRS

Under the current Market Rules\(^3\), EMC is obliged to calculate the RRS based on an approved methodology\(^4\) after each dispatch period. This calculated RRS will then be used in the allocation of reserves costs for settlement\(^5\). Currently, this RRS is only made available to the Market Participant (MP) that owns the GRF (owner-MPs).

EMC is currently not required to calculate forecasted RRS. Hence, this paper will examine the costs and benefits associated with providing forecasted RRS, the methodology for calculating forecasted RRS and the appropriate recipients of forecasted RRS.

3. Analysis

In the following sections, we analyse the costs and benefits of calculating/publishing forecasted RRS in the various dispatch schedules.

3.1 Benefits of Information Disclosure

In standard economic literature, it is generally accepted that availability of information is vital for the efficient operation of markets. For a general discussion written previously on the benefits of information disclosure and transparency, please refer to RC355: Publication of Offer Data\(^6\).

In this paper, we concentrate on the potential benefits to MPs and the industry of making forecasted RRS available. In general, publishing forecasted RRS can yield the following benefits:

**At the Individual MP Level**

Forecasted RRS can give a MP an indication on how much reserve costs will be allocated to its GRF or a portfolio of GRFs based on their SPF and forecast schedule. This information will allow MPs to optimize their offers between energy and reserve products so that they are able to act to maximize net revenue from the market and minimize the risks associated with their bidding strategies.

For example, if the RRS for an upcoming dispatch period indicates that a GRF will be allocated a large share of the reserve costs, the GRF can reduce its energy offer (either physically removing the offers or economically removing it by pricing offers higher) to reduce its scheduled quantity, thereby reducing reserve costs. Alternatively, the GRF can offer more into the reserve product to increase its overall net revenue for the period.

**At the Industry Level**

Information asymmetry can create competitive disadvantage to smaller MPs. Large MPs with significant share of supply have a natural information advantage over smaller MPs. This is simply by virtue of knowing their own production and costs, which form a large proportion of the market. Disclosure of Forecasted RRS can reduce this information asymmetry.

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\(^3\) Market Rules, Chapter 7, Section 2.2.4: “The EMC shall, following each dispatch period, determine the reserve responsibility share (RRS) for each GRF for the settlement interval corresponding to that dispatch period.”

\(^4\) Market Rules, Appendix 7A: Calculation of Reserve Responsibility Shares

\(^5\) RRS was originally allocated based on metered IEQ. This may partially explain why the RRS information is found under Market Rules, Chapter 7: Settlement. Please refer to RC244: Allocation of Reserve Costs in 2005 for more information.

\(^6\) Please refer to RC355: Publication of Offer Data for a summary of the benefits and costs to in general.
For example, smaller MPs can use the forecasted RRS information of the bigger MPs to enhance their own bidding strategies because the bigger MPs’ energy dispatch levels can be inferred from their RRS.

Similarly, bigger MPs can use the forecasted RRS of smaller MPs in the same way. And by being bigger and usually controlling more units, bigger MPs have more options in their bidding strategies. So, it can be a double-edged sword. The unintended consequence may be that of enhancing structural advantages that bigger MPs already have over the smaller MPs, more so if the industry structure is not competitive.

Therefore, the benefits at the industry level is dependent on the competitiveness of the market structure at a given point in time. The more competitive the market structure, the stronger the benefits. In a non-competitive setting, there is risk of enhancing the structural advantages of larger MPs.

3.2 Costs of Information Disclosure

The disclosure of market-relevant information normally improves market outcomes. In some cases, it may instead facilitate and/or encourage anti-competitive behaviour. Anti-competitive behaviours such as unilateral exercise of market power or collusion between MPs can result in a variety of harms, such as high prices to consumers, productive inefficiency and dynamic inefficiency.

In the Singapore Wholesale Electricity Market (SWEM), factors such as high seller concentration, product homogeneity, inelastic demand and stability of costs can increase the propensity for anti-competitive behaviour. It is therefore important to assess the structural competitiveness of the SWEM. This can be done by looking at a variety of indices. The indices most used by market monitors and authorities around the world are the Herfindahl-Hirschman Index (HHI) and the Residual Supplier Index (RSI). In this paper, we use both the HHI and the RSI as measurements of the competitiveness of the SWEM. Please refer to Annex A for details on index methodologies and the resultant analysis.

The HHI is typically used to measure the competitiveness of a market structure in the long run. Based on HHI analysis, the SWEM is deemed to be more competitive today compared to Jan 2013. From a ‘highly concentrated market’, the SWEM has become ‘moderately concentrated market’ since Jan 2017.

The RSI is typically used to measure the periodic competitiveness of a market. Our RSI analysis suggests that ‘transient’ market power remain in the SWEM. Based on recent data covering 01 Jan 2019 to 31 May 2020, pivotal suppliers were present in 33% of dispatch periods, although the distribution of pivotal periods in the 2 years are slightly different. Please refer to Annex A for detailed analysis.

We assess that the ability to exercise of pricing power by pivotal MPs has still been possible at certain times. Hence, further disclosure of information that can enhance the abilities of pivotal MPs to exercise market power should be considered carefully.

7 For a description of the various indices, please refer to the following paper, Discussion Paper No. 14-048: Screening Instruments for Monitoring Market Power in Wholesale Electricity Markets – Lessons from Applications in Germany by the Centre for European Economic Research, July 2014. Link
8 'Transient’ market power is a term used by Frontier Economics in Review of Vesting Contract Regime for EMA in August 2016. It refers to one of the Australian Energy Market Commission (AEMC) final determination on market power. AEMC makes a temporal distinction between generators having transient pricing power/market power, ability to increase prices for short periods of time and substantial market power, ability to sustained pricing above the level that would prevail in a workably competitive market. Please refer to AEMC, Final Rule Determination, Potential Generator Market Power in the NEM, 26 April 2013, p.19. Link
4. Practical considerations and recommendations for publishing forecasted RRS

The potential benefits of improved information transparency should also be weighed against financial and other costs associated with the following:

- Choice of methodology for calculating forecasted RRS
- Range of dispatch schedules to provide forecasted RRS for
- Provision of all forecasted RRS to all MPs or only to the owner-MPs

4.1 Methodology to Calculate Forecasted RRS

As the methodology for calculating RRS is well documented in the Market Rules, we assess that there is no need to create another methodology to forecast RRS.

Hence EMC recommends using the existing methodology in the Market Rules to calculate forecasted RRS, using the SPF and various dispatch schedules.

4.2 Range of Dispatch Schedules to Calculate Forecasted RRS for Implementation and Recurring Costs

If the forecasted RRS is to be calculated/published for the full range of dispatch schedules, i.e. RTS, STS, PDS and MOS, implementation and recurring costs would be the highest. Itemised cost estimates were provided jointly by EMC Technology Team and Market Operations Team in Table 2 below.

<table>
<thead>
<tr>
<th>Table 2: Estimated Implementation Costs and Time for Various Schedules</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost Estimates</strong></td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>1. Analysis and Requirement Gathering/Sharing</td>
</tr>
<tr>
<td>2. Development / Testing / Deployment Documentation /</td>
</tr>
<tr>
<td>3. Project Management</td>
</tr>
<tr>
<td>4. CII</td>
</tr>
<tr>
<td>5. Pentest</td>
</tr>
<tr>
<td><strong>Total Costs (Vendor)</strong></td>
</tr>
<tr>
<td><strong>Additional Costs</strong></td>
</tr>
<tr>
<td>1. Internal EMC Manpower</td>
</tr>
<tr>
<td>2. Additional costs for code merge and testing if it happens before NEMSCAP Refresh Go-live, expected Oct 2021</td>
</tr>
<tr>
<td><strong>Total Additional Implementation Cost</strong></td>
</tr>
<tr>
<td><strong>Total Cost (Assuming project Go-live before Oct 2021)</strong></td>
</tr>
</tbody>
</table>
## Time Estimates

<table>
<thead>
<tr>
<th></th>
<th>(1) RTS + STS</th>
<th>(2) PDS + Option (1)</th>
<th>(3) MOS + Option (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0. Vendor Selection/Preparation</td>
<td>8 Calendar Weeks</td>
<td>8 Calendar Weeks</td>
<td>8 Calendar Weeks</td>
</tr>
<tr>
<td>1. Change Requirement Scoping and Analysis</td>
<td>3 Calendar Weeks</td>
<td>3 Calendar Weeks</td>
<td>3 Calendar Weeks</td>
</tr>
<tr>
<td>2. System Development/Testing/Project Management</td>
<td>10 Calendar Weeks</td>
<td>11 Calendar Weeks</td>
<td>12 Calendar Weeks</td>
</tr>
<tr>
<td>3. User Acceptance Testing (UAT)</td>
<td>5 Calendar Weeks</td>
<td>5 Calendar Weeks</td>
<td>5 Calendar Weeks</td>
</tr>
<tr>
<td><strong>Total Elapse Time in Calendar Weeks</strong></td>
<td>26 Calendar Weeks</td>
<td>27 Calendar Weeks</td>
<td>28 Calendar Weeks</td>
</tr>
</tbody>
</table>

### Usefulness of Information

We expect different MPs would find forecasted RRS for the various schedules useful. But generally, the usefulness of these forecasts increases the closer to real-time they are generated.

### Table 3: Costs and Benefits of Publishing for All Schedules or Limited Set of Schedules

<table>
<thead>
<tr>
<th></th>
<th>All Schedules</th>
<th>Limited Set of Schedules</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Costs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher implementation and recurring costs</td>
<td></td>
<td>Lower information transparency</td>
</tr>
<tr>
<td>Potentially higher cost to MPs to manage larger volume of data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dispatch schedules which are further from the real-time dispatch is less useful than those that are nearer to the real-time dispatch</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Benefits</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher information transparency</td>
<td></td>
<td>Lower cost to MPs to manage the data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lower implementation and recurring costs</td>
</tr>
</tbody>
</table>

By studying Table 3, **EMC recommends that forecasted RRS be provided for a limited set of schedules only (Option 1 in Table 2).**

### 4.3 Provision of Forecasted RRS to All MPs or Owner-MPs only

As discussed in Section 3.1, there are benefits to be gained from market information transparency in general. However, most of the benefits listed in Section 3.1 can be gained by providing forecasted RRS to the respective owner-MPs. This is in line with the current practice for RRS.

Publishing forecasted RRS to all MPs can facilitate anti-competitive behaviour. MPs gain the opportunity to monitor the behaviour of one another and can engage in collusion. Section 3.2 has shown that pockets of periods exist in recent times in which pivotal MPs can exercise market power. Also, bigger MPs would benefit more as discussed in Section 3.1. Competition can be further undermined by enhancing the bigger MPs' ability to exercise market power, to the detriment of consumers. Hence, **EMC recommends providing forecasted RRS only to the relevant owner-MPs.**
5. Conclusion

This paper discussed a proposal for the EMC to (i) establish a methodology to calculate an estimated RRS for each GRF in real time, and (ii) to publish the estimated RRS for each dispatch period of the market outlook scenario, pre-dispatch schedule scenario, short-term schedule and real-time schedule. **EMC is of the view that providing forecasted RRS have its benefits for the relevant owner-MPs at the individual MP level. Due to ‘transient’ market power concerns, it is not advisable to publish all forecasted RRS to all MPs.**

EMC recommends the following:

- To use the existing RRS calculation methodology to calculate forecasted RRS
- To calculate forecasted RRS for RTS and STS
- To provide forecasted RRS to the relevant owner-MPs only

6. Consultation

The concept paper was published for consultation on 3 July 2020 and comments were received from 7 stakeholders.

Comments from Senoko Energy

*We agree with the RRS calculation methodology to be used and that the results should only be published to owner-MPs. However, we strongly recommend that the calculated RRS should include the Pre-Dispatch Schedule (PDS a.k.a. day ahead run).*

*The benefits we see arising from having the calculated RRS figure for the PDS horizon is:*

1. Gives a full day’s picture of an MP’s RRS position allowing for market reflective offers to be submitted ahead of time.
2. Could potentially lead to better optimisation of MPs’ running regimes
3. Allows for earlier price discovery

*We note that there is an added cost of $15,235 and an extra week required for including the PDS run, but the benefits listed above clearly outweighs the marginal increase in cost and time.*

EMC’s Response

EMC noted Senoko Energy’s support for the proposal to publish forecasted RRS and preference to include the PDS run (Option 2).

Comments from Tuas Power

1. *We generally agree with EMC’s proposal to provide estimation of real-time and forecasted RRS for each GRF using the existing RRS calculation methodology for reserve costs settlement as this would allow the MPs to also consider the associated reserve costs when planning their generation levels.*

2. *However, given the lead time required for generation and gas planning (and nomination) is typically 1 day, we would like to propose for the RRS estimates to include RTS, STS as well as PDS (Option 2). In addition, we would like to request EMC to evaluate if the implementation schedule of 27 weeks for Option 2 can be shortened such that the Go-live can be by Jun-2021, given that the RRS calculation methodology is already established.*

3. *We would also like to highlight that the computation of pivotal suppliers using RSI methodology in the consultation paper may not be conclusive on whether there is ‘transient’ market power in*
SWEM. This is because the “MP total supply” calculations did not take into consideration the MPs’ contractual obligation, i.e. retail and vesting contract level, which will significantly reduce their incentives to exercise their market power.

The conclusion in the consultation paper that ‘transient’ market power exists during the specified duration (from 1 Jan 2019 to 31 May 2020) is controversial and may send the wrong signals to the industry to discourage further timely planting because potential new investors may be deterred by confusing statements of competitiveness in SWEM.

EMC’s Response

EMC noted Tuas Power’s support for the proposal to publish forecasted RRS and preference to include the PDS run (option 2).

EMC would like to highlight that system development and implementation for the Forward Capacity Market proposed by EMA would be on-going for the next few years and this may affect the system development for the forecasted RRS. EMC would evaluate the forecasted RRS implementation timeline again together with the rest of the EMA-Directed and RCP projects if the forecasted RRS concept is approved by the RCP for projects implementation efficiency.

EMC noted Tuas Power’s concern with the use of the term ‘transient’ market power. EMC would like to clarify that the term ‘transient’ market power was used by Frontier Economics in the EMA’s Review of Vesting Contract Regime where they drew references from the Australia Energy Market Commission’s (AEMC) definition of ‘transient’ pricing power, which involves a transient ability to increase prices above estimates of costs for a short period of time.

The AEMC considers “that ‘transient’ pricing power, manifesting itself through occasional price spikes, is an inherent feature of a workably competitive wholesale market, and is only a concern if it occurs frequently enough and to a significant enough magnitude to lead to an average annual wholesale prices being above the Long Run Marginal Cost of generation.”

EMC would like to also highlight that the RSI methodology is commonly used as a market power screen in overseas jurisdictions for the purpose of mitigating energy offers. However, the RSI only measures the pivotal suppliers’ ability to exercise pricing power and not their incentives to exercise this ability. As correctly stated by Tuas Power, consideration of MPs’ contractual obligation and other operational constraints, may significantly reduce their incentives to exercise any ‘transient’ pricing power. Nevertheless, the ability to exercise ‘transient’ pricing power for pivotal MPs remains a concern since contractual obligations (excluding vesting contracts) could be changed by the respective MPs unilaterally over time.

Comments from Keppel Merlimau Cogen

Keppel has no objection to the proposal to provide real-time estimates of the Reserve Responsibility Share (RRS) for each Generation Registered Facility (GRF) to the relevant owner- MPs only. We agree with EMC’s view to not publish all forecasted RRS as the data is commercially sensitive.

Keppel supports EMC’s recommendation to provide the forecasted RRS for RTS+STS dispatch schedules (option 1).

Keppel would like EMC to clarify how the proposed project costs are to be recovered:

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1. What is the expected increase in EMC fees (in cents/MWh) due to the proposed project?
2. What is the expected time duration for the recovery of costs?

Keppel would like to know how EMC intends to publish the forecasted RRS to allow MPs to better plan their existing infrastructure to accommodate new input data

EMC’s Response

EMC noted Keppel Merlimau Cogen’s support for the proposal to publish forecasted RRS and preference for option 1.

EMC would like to highlight that system development and implementation for the Forward Capacity Market proposed by EMA would be on-going for the next few years and this may affect the system development for the forecasted RRS. EMC would evaluate the forecasted RRS implementation timeline again together with the rest of the EMA-Directed and RCP projects if the forecasted RRS concept is approved by the RCP for projects implementation efficiency.

Therefore, the expected increase in EMC fees and the time duration for the recovery of costs can only be calculated after the evaluation with other market projects.

Comments from PacificLight Power

We believe that publishing the RRS at this point in time will yield limited benefits to Market Participants:

a. At an individual MP level, each MP should be able to estimate its RRS using their own scheduled load and standing probability of failure (SPF). The forecast can be easily back tested using historical RRS.

b. At an industry level, while we agree information asymmetry tends to create competitive disadvantage to smaller MPs, we believe it is not applicable to the reserve market. RRS is a measure of the relative risk exposure each unit poses to the market, regardless of the size of the MP.

Hence, we do not consider that this proposal currently justifies the cost involved in its implementation.

PLP would propose that this proposal is put on hold and revisited after implementation of the Intermittency Pricing Mechanism (IPM) where the RRS forecast may become complex. At that time, if the benefits of providing such forecast outweigh the cost, probably we could consider implementing this proposal.

EMC’s Response

EMC agreed that RRS is a measure of relative risk exposure each unit poses to the market, regardless of the size of the MP. However, at the industry level, it is possible for a MP to improve their estimation of another MP’s energy schedule if RRS is published to all MPs. A MP coupled with all the forecasted RRS may be able to backward engineer the forecast RRS to estimate the energy schedules of the various MPs since most of the RRS calculation components are available in the public domain. Therefore, the publication of RRS does not only affect the reserve markets, it will also indirectly affect the energy market. As a result, the argument on information asymmetry due to the size of MP is applicable as well.

EMC noted PacificLight Power’s preference to put this proposal on hold till the implementation of the Intermittency Pricing Mechanism (IPM) as PacificLight does not consider that the current proposal’s benefits outweigh the expected implementation costs.
Comments from Power System Operator

It is given in the paper that this information will allow MPs to optimize their offers between energy and reserve products so that they are able to act to maximize net revenue from the market and minimize the risks associated with their bidding strategies.

For example, if the RRS for an upcoming dispatch period indicates that a GRF will be allocated a large share of the reserve costs, the GRF may reduce its energy offer (potential exercise of market power or strategic bidding) to reduce its scheduled quantity, thereby reducing reserve costs. This may encourage Gencos to withhold capacity in order to reduce reserve costs. Can EMC determine whether it will result in more reserve shortfall or higher USEP prices?

If there is more reserve shortfall due to this proposal, it is even more important to review the CVP to ensure reserve requirements are met.

Other than providing more information to specific Market Participants, are there other tangible benefits for the industry? If not, the implementation cost should be borne by the specific Market Participants, who will benefit from this information.

Similar to the publication of offers, to avoid gaming, EMC should consider only publishing the historical RRS rather than providing forecasted RRS. The format and publication of RRS should be similar to the historical offer data.

EMC’s Response

As discussed in Section 3.1, a MP generally have 2 options to reduce its net reserve cost, either by reducing its energy offer to lower its scheduled quantity or to offer more into the reserve market to lower the price. Depending on the MP’s contractual level and other operational constraints, the MP can apply either option in varying degrees to maximize its net revenue and satisfy operational needs. As different options have different impact, EMC is not able to come to a deterministic conclusion if it would result in reserve shortfall or high USEP.

As mentioned in Section 3.1, it is generally accepted that availability of information is vital for the efficient operation of markets. It is not the NEMS’ market practice to allocate market system enhancement costs only to selected MPs deemed to benefit from the enhancement. Such allocation would be inconsistent with non-discriminatory principles enshrined in both the Market Rules and the Electricity Act. EMC based its recommendations on whether the benefits outweigh the costs to the industry as a whole.

As historical RRS is already available for each relevant-owner MP, there is no need for EMC to publish historical RRS.

Comments from ExxonMobil

ExxonMobil does not support the proposal of providing Real-Time Estimates of Reserve Responsibility Share as it is unclear

1. if the potential benefits of optimizing offers between energy and reserve product would justify the investment cost and
2. whether all Market Participants would benefit from this new feature.

EMC’s Response

EMC based its recommendations on whether the benefits outweigh the costs to the industry as a whole and does not seek to differentiate between classes of participants. It is not realistic to expect all MPs to benefit from this new feature due to the diverse nature of the MPs’ businesses.
Comments from EMC’s Market Operations Team

EMC Market Operations (MO) would like to clarify on the use of Probability of Failure (PoF) in the calculation for RRS. Currently, PoF is updated at the end of the existing quarter for used in the next quarter. As a result, EMC (MO) would like to confirm that the forecasted RRS for the PDS and MOS nearer the end of the quarter will be calculated using the existing quarter PoF.

EMC Market Operations would like to confirm if the forecasted RRS for STS is for all load scenarios or only for the Medium scenario.

EMC Market Operations would like to propose that the calculation of forecasted RRS to only start after a successful MCE run where there are computing resources available to avoid complicating the optimization process. EMC Market Operations would make known to the MP on when the forecasted RRS will be available once the actual development of the forecasted RRS modules begin.

EMC’s Response

EMC noted that due to the PoF update frequency, the forecast RRS for PDS and MOS nearer the end of the quarter can only be calculated using the existing quarter PoF.

EMC would like to confirm that the forecasted RRS for STS would be for all load scenarios.

EMC agrees that the forecasted RRS should only start after a successful MCE run to avoid complicating the optimization process.

7. Conclusion and Recommendations

Information is vital for the efficient functioning of energy markets. EMC is of the view that publishing forecasted RRS to the industry benefits the market by enhancing the efficiency aspects of the market such as allowing for earlier price discovery and allowing MPs to adjust their offers to optimize their operations based on the forecasted RRS.

EMC would like to highlight that system development and implementation for the Forward Capacity Market proposed by EMA would be on-going for the next few years and this may affect the system development for the forecasted RRS. EMC would evaluate the forecasted RRS implementation timeline again together with other market projects if the forecasted RRS concept is approved by the RCP.

Therefore, we recommend that the RCP:

1. Support the proposal for EMC to:
   a. use the existing RRS calculation methodology to calculate forecasted RRS
   b. calculate forecasted RRS for RTS, STS and PDS – Option 2
   c. provide forecasted RRS to the relevant owner-MPs only; and

2. task EMC to draft the required market rules to effect the provision of forecasted RRS.

8. Decision at the 118th RCP Meeting

The concept paper was discussed at the 118th RCP meeting and the panel by majority vote

1. Support the proposal for EMC to:
   a. use the existing RRS calculation methodology to calculate forecasted RRS
   b. calculate forecasted RRS for RTS, STS and PDS – Option 2
   c. provide forecasted RRS to the relevant owner-MPs only; and
2. task EMC to draft the required market rules to effect the provision of forecasted RRS.

The following Panel members **supported** EMC’s recommendation:

1. Mr. Henry Gan (Representative of EMC)
2. Mr. Marcus Tan (Representative of Generation Licensee)
3. Mr. Tony Tan (Representative of Generation Licensee)
4. Mr. Sean Chan (Representative of Retail Electricity Licensee)
5. Mr. Sim Meng Khuan (Representative of Retail Electricity Licensee)
6. Mr. Matthew Yeo (Representative of Wholesale Electricity Trader)
7. Ms. Ho Yin Shan (Representative of the Market Support Services Licensee)
8. Dr. Toh Mun Heng (Representative of Consumers of Electricity in Singapore)
9. Mr. Fong Yeng Keong (Representative of Consumers of Electricity in Singapore)
10. Mr. Tan Chian Khong (Person experienced in financial matters in Singapore)

The following Panel members **did not support**:

1. Mr. Soh Yap Choon (Representative of PSO)
2. Mr. Teo Chin Hau (Representative of Generation Licensee)

The following Panel members **abstained from voting**:

1. Ms. Carol Tan (Representative of the Transmission Licensee)
Annex A - HHI and RSI Analysis of the SWEM

Herfindahl-Hirschman Index (HHI)

The HHI is commonly used by market monitors and regulators globally as a measure of market concentration. The HHI increases as the number of firms in the market decreases and/or the disparity in size between firms increases. A higher HHI generally indicates greater market concentration, with near zero being perfect competition and 10,000 being a monopoly.

The United States Department of Justice and the Federal Trade Commission\(^\text{10}\) classify markets into 3 types, namely Unconcentrated Market (HHI below 1,000), Moderately Concentrated Markets (HHI between 1,000 and 1,800) and Highly Concentrated Markets.

The HHI is calculated by summing the square of the market share (in decimal) of each firm in a market and multiplying by 10,000. For the purposes of this paper, the market share is computed based on the MP’s registered units’ capacity with EMC.

Generally, the SWEM’s HHI has been falling since Jan 2013 from a highly concentrated market (HHI: 2,516) to a moderately concentrated market (1,532 as of May 2020). Please refer to Table A1 below for the historical HHI.

<table>
<thead>
<tr>
<th>Month</th>
<th>Herfindahl-Hirschman Index (HHI)</th>
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</thead>
<tbody>
<tr>
<td>May-20</td>
<td>1,532</td>
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<tr>
<td>Apr-20</td>
<td>1,532</td>
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<tr>
<td>Mar-20</td>
<td>1,532</td>
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<tr>
<td>Feb-20</td>
<td>1,532</td>
</tr>
<tr>
<td>Jan-20</td>
<td>1,533</td>
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<tr>
<td>Jan-19</td>
<td>1,663</td>
</tr>
<tr>
<td>Jan-18</td>
<td>1,680</td>
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<td>Jan-17</td>
<td>1,709</td>
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<td>Jan-16</td>
<td>1,812</td>
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<tr>
<td>Jan-15</td>
<td>1,838</td>
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<tr>
<td>Jan-14</td>
<td>2,021</td>
</tr>
<tr>
<td>Jan-13</td>
<td>2,516</td>
</tr>
<tr>
<td>Jan-12</td>
<td>2,430</td>
</tr>
</tbody>
</table>

\(^{10}\) The HHI thresholds used in this paper are based on the thresholds adopted by FERC using the US DOJ and FTC’s 1992 guidelines, see https://www.ferc.gov/whats-new/comm-meet/2012/021612/E-2.pdf.
Residual Supplier Index (RSI)

The RSI is another commonly established concentration index used by competition regulators and market monitors. Specifically, the RSI measures the extent to which competitors of a given MP can meet the current demand with their supply offers.

For any MP, the RSI is defined as follows:

\[ RSI = \frac{\text{total available supply} - \text{MP total supply}}{\text{market demand}} \]

An inverse relationship between the RSI and the Lerner Index, a well-known measure of competition, can be derived. Based on certain assumptions of a profit maximization oligopoly firm facing a residual demand, it can be shown that the Lerner Index is a simple linear function of RSI such that the RSI is a compelling explanatory variable for price-cost margins.

The RSI is usually expressed as a decimal number. If the RSI has a value of 1 and above in each half hour period, it would mean that other competing MPs are able to meet 100% of demand. Hence an RSI value greater than one indicates that the MP has little influence on the market price. Conversely, the MP is pivotal if the RSI is less than one.

For the purpose of this paper, supply is defined as energy offers that were used by the MCE to generate the real-time dispatch schedule. Similarly, demand is defined as the forecast demand for energy used by MCE to generate the real-time dispatch schedule. The number of pivotal suppliers is defined as the number of MPs that failed the threshold of RSI < 1. Data from 1 Jan 2019 – 31 May 2020 was used in the computation of the RSI resulting in 24,816 observation points.

Figure A1: Percentage of periods where pivotal suppliers are present across the day (2019)

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11 Please refer to the following document by CAISO on a summary of how RSI is used to monitor market power and a brief explanation on how RSI is related to the Lerner Index. Link

12 Energy supply offers were used instead of the reserve offers as a pivotal MP is more likely to exercise market power in the energy market than the reserve markets as they need to pay for reserve charges. Furthermore, forecasted RRS will give MPs an idea on what is the possible energy dispatch schedule of the largest unit rather than the reserve dispatch schedule.
Both Figure A1 and Figure A2 show that the ability for a pivotal MP to exercise market power exists during peak periods in which energy demand is high. In 2019, the number of pivotal MPs from Period 1 – 14 (0.1% of the total periods) was minimal. However, in the first 5 months of 2020, periods with at least 1 pivotal supplier increased slightly to 1.5% of total periods for the same reference periods. Another observation is that periods with no pivotal MPs during the peak periods (P20 – P24) increased from 34.3% in 2019 to 41.4% in the first 5 months of 2020.

Overall, the number of periods in which pivotal MPs exist increased slightly from 32.3% to 33.5%. Interestingly, there was also an increase in the maximum number of pivotal MPs from 4 in 2019 to 5 in the first 5 months of 2020.

Therefore, we assess that concerns on ‘transient’ market power are still valid even though for more than 65% of the time, no pivotal MP existed based on the analysis above. The ability to exercise of market power by pivotal MPs is still possible during certain parts of the day. Therefore, releasing information that can facilitate anti-competitive behaviour has to be considered carefully.