

RCP PAPER NO. : **EMC/RCP/91/2017/CP67**

SUBJECT : **ENHANCEMENT TO THE PROCESS OF UPDATING
GENERATION OUTAGE PLAN AND SECURITY
CONSTRAINTS**

FOR : **DECISION**

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DATE OF MEETING : **10 JANUARY 2017**

Executive Summary

This paper assesses the proposal to enhance the process in order for the industry to receive timely updates to the generation outage plan and security constraints.

We examined the existing process of updating the generation outage plan and security constraints. We are of the view that the generation outage plan is generally updated promptly. It is proposed that this process should be formalised in the market rules and an explicit timeline should be set out so as to provide more certainty for the market participants. On the other hand, information on security constraints is only updated via advisory notices and not easily retrievable. It is thus proposed that details on security constraints be included in the Adequacy and Security Assessment (ASA) report so as to keep all market participants informed of security constraints that will be in effect for the upcoming trading days.

EMC sought the industry's view on the proposed enhancement. The industry, in general, is of the view that the current process of updating generation outage plan works well. Therefore EMC recommends that current process be formalised in the System Operation Manual. With respect to the proposals related to updating of security constraints, although it would enhance the transparency on the security constraints, some industry players raised the concern that there could be potential adverse impact if a lead time is required for PSO to update the security constraints.

At its 91st RCP meeting, the Panel **unanimously supported** the proposal to formalise the current process, where the PSO updates the UGOP on the same business day that a planned outage is approved, in the System Operation Manual (SOM).

The Panel, by majority vote, do not support the following proposals:

- to require PSO to release the approval of planned outage and the updated generation outage plan at the same time (Proposal 1.2);
- to require PSO to update the expected end date of forced outage within a specific timeframe after receipt of preliminary report (Proposal 1.3); and
- to require details of security constraints to be included in the ASA (Proposals 2.1 and 2.2).

1. Introduction

This paper assesses a proposal to improve the process to update the annual generation outage plan (AGOP) and security constraints so that Market Participants (MPs) can receive timely updates of such market information.

2. Background

2.1 Update of AGOP (Issue 1)

The AGOP sets out the planned outage that has been scheduled for all MPs' generating units.

Under the System Operation Manual (SOM), the PSO is required to develop the final AGOP of the next calendar year by 15 October of the current year and publish it on EMC's website. After the AGOP is finalised and published, MPs are still allowed to make revisions to the outage plan. A request to revise the outage plan shall be submitted no later than (at least) four trading days¹ before the scheduled outage and the approval should be granted no later than two trading days before the scheduled outage. After the PSO has approved the outage revision request, the updated generation outage plans (UGOP) will be updated by the PSO and published on EMC's website. In addition to any changes to the planned outage of generating units, forced outage events² of generating units are currently also updated in the UGOP.

During the 2016-2017 Rules Change Work Plan consultation, a proposer observed that the UGOP is usually only published on business days, and not on weekends and public holidays and requested for the outage plan to be updated more promptly, for example, within one hour of the PSO's approval.

2.2 Update of Security Constraints (Issue 2)

Security constraints are generic constraints that can be imposed by the PSO to restrict dispatch solutions for the purpose of maintaining the security of power system, which would consequently affect market outcomes especially the scheduled quantities for generation and transmission facilities as a result. The Market Rules³ include provisions for the PSO to add constraints into the Market Clearing Engine (MCE) to restrict, in dispatch schedules, the output of generation registered facilities, the line flow on transmission facilities, and/or net injection at dispatch network nodes.

In reality, all security constraints that have been applied in the past were to restrict the flows on transmission lines for the purpose of preventing potential overloading on the affected transmission lines. The imposition and lifting of security constraints is conveyed to the industry via advisory notices.

¹ According to section 6.5 of Chapter 6 of SOM (Rev 9), the request shall be submitted to the PSO no later than 09:00 on the business day that is one business day in advance of the trading day that is two trading days prior to the day on which the planned outage is scheduled to commence.

² Forced outage includes any planned outage that has not received final approval/consent from the PSO or that takes place at a time or other than the time approved by the PSO.

³ Under section 5.4 of Chapter 5, the PSO can use dispatch related data (which security constraints form a part of) to respond to violation of security limits.

When security constraints are in effect and binding, it would likely result in price separation, which will have a financial impact on those generators located at the two ends of the transmission lines.⁴

During the 2016-2017 Rules Change Work Plan consultation, MPs requested for improved visibility on security limits and greater transparency on what steps are being conducted to address the security limit and the timing for resolution to be communicated to the MPs.

3. Analysis

3.1 Issue 1: Update of Generation Outage Plan

Currently, EMC publishes the UGOP on EMC's website automatically as soon as the UGOP is submitted to the EMC by the PSO via the Single Electronic Window (SEW) system. The UGOP covers the planned outages that have been approved by the PSO and forced outages that have occurred.

Table 1 below summarises how information on planned outages and forced outages is currently updated, and the respective requirements under the Market Rules and the SOM.

Table 1: Updates of Planned and Forced Outages of Generating Units

Outage Type	Content of Update	Timing of Update	Means of Update	Requirements under Market Rules/SOM
Planned Outage	New request(s) that has been approved, cancellation and revision to previously approved planned outage	Same calendar day the changes are approved	UGOP	SOM ⁵ requires UGOP to be published monthly, at least 5 business days before the end of current month
Forced outage	Occurrence of forced outage	Immediate ⁶	Advisory notices	Advisory notices to be issued as soon as practicable (by EMC) ⁷
	The start date and the expected end date of the forced outage	Same or next business day of the start date of the forced outage	UGOP	Not stated in the Market Rules/SOM

It can be seen that, although the UGOP is only required to be updated on a monthly basis under the SOM, in practice, the changes to the planned outages of generating units are updated in the UGOP in a timely manner, being published on the same calendar day of approval, which gives the MPs at least two trading days advance notice⁸. Nevertheless, considering that the information on planned outages is an important factor for price discovery

⁴ Please refer [CP55 Increase in Transparency in Market Information on Transmission Congestion and Price Separation](#) for an explanation of the impact of price separation.

⁵ Section 3.3.1 of SOM.

⁶ For forced outages, advisory notices are typically issued within half an hour.

⁷ Under section 9.3.2.1 of Chapter 6, EMC is required to issue an advisory, as soon as practicable, if it has been informed by the PSO that a major equipment outage is occurring. Currently such advisory notices are issued automatically after the information is submitted by the PSO via the SEW.

⁸ Under section 6.5 of SOM, the PSO shall confirm the outage request no later than 12:00 on the trading day that is two trading days in advance of the planned outage.

in the real-time markets and would have downstream effects on the pricing in the electricity futures market and/or any Contract-for-Differences, it can be considered that such practice be formalised in the SOM so as to provide certainty to the MPs that the UGOP will be updated in a timely manner. **[Proposal 1.1]**

Further, although the approved planned outages are updated in the UGOP on the same day, there might still be concern on information asymmetry since the generation company, which requested for the planned outage of its generation facilities, may receive the approval hours before the rest of the market is informed of the planned outage via the UGOP. In order for all MPs to have equal access to such information, it can be considered that the approval and the update of the UGOP be released at the same time. **[Proposal 1.2]**

For forced outages, advisory notices are issued immediately after the PSO informs the EMC of their occurrences. In addition, although currently not required under the Market Rules, the occurrence and the expected duration of forced outages are also updated in the UGOP, on the same or the next business day, after the MP submits the preliminary outage report, which could take up to 24 hours⁹. If the forced outage happens before a weekend or public holiday, MPs could be informed of the expected duration of the outage only after two or more trading days since the UGOP is only updated on business days. EMC is of the view that this can be improved by requesting the PSO to update, via either advisory notice or UGOP, the expected duration of forced outages within, for example, 12 hours of receipt of the preliminary report for the forced outage. **[Proposal 1.3]**

3.2 Issue 2: Update of Security Constraints

3.2.1 Causes of Security Constraints

Currently, security constraints are imposed for the purpose of preventing potential overloading of transmission equipment¹⁰ resulted from inadequate transmission capability.

In the PSO's operation of the PSO controlled grid, an "N-1" requirement is adopted, which means that all equipment should still operate within their maximum continuous ratings under any single contingency conditions, where a single element, either generating unit or transmission equipment is on forced or planned outage.

For single contingency condition due to outage of single generating unit, it is addressed through the market clearing methodology where enough reserves would be procured to cover the risk of outage of a generation registered facility.

For single contingency condition due to outage of single transmission equipment, it is addressed through transmission planning and imposition of security constraints where necessary. As currently required under the Transmission Code¹¹, the transmission system should be built to meet the N-1 requirement, which means under single contingency conditions, all equipment should operate within their maximum continuous rating and voltage limits immediately after the contingency and there should not be any power interruption, prolonged overloading on the remaining network or system instability.

⁹ Section 6.2.2 of SOM.

¹⁰ As stated in section 11.2 of the SOM that under normal operating condition, the PSO controlled system does not have constraint in transfer capabilities with regards to transient stability, voltage stability, dynamic stability and voltage decline limits. However, likelihood of excessive generation at certain region of the PSO controlled system and/or major equipment outage could necessitate the imposition of security limits (typically maximum power flow) on part of the PSO controlled network to pre-empt severe overloading. These security limits are determined on a case-by-case basis.

¹¹ Section G.2 of Transmission Code

(Short term) inadequate transmission capability can be caused by the planned or forced outage of transmission equipment. When this happens, if the remaining lines in service may not be able to sustain another contingency, the PSO would impose security constraints to restrict the line flows on affected transmission equipment to prevent them from being overloaded in the event of another contingency event. Please refer to Scenario A in Annex 1 for an illustration of why a security constraint is imposed in this scenario.

In addition to outage of transmission equipment, inadequate transmission capability could also occur when there is excessive generation while the demand has not increase enough and/or the transmission system¹² has not been expanded sufficiently. Under such scenarios, localized transmission constraints may occur and the PSO may also impose security constraints to prevent overloading of transmission equipment. Please refer to Scenario B in Annex 1 for an illustration.

Annex 1 illustrates how security constraints are imposed to prevent the overloading in the above two scenarios.

3.2.2 Update of Security Constraints

For security constraints to take effect, the PSO needs to inform the EMC of the relevant inputs¹³ for EMC to update in the MCE. The EMC, after receiving the relevant inputs from the PSO, will update the MCE and confirm to the PSO the dispatch periods for which the security constraint will apply. The PSO will then update MPs on the activation of such security constraints via SEW and advisory notices will be automatically issued to MPs by the EMC. The advisory notice will state the start and the end date/time that the security constraint is effective, the security limit and a short description of the reason and the affected transmission equipment. Annex 2 shows a sample of such advisory notices.

Generally, MPs are informed of the imposition of security constraints in advance. However, the lead time given to MPs differs under different scenarios.¹⁴

For security constraints arising from a forced outage of transmission equipment, security constraints are imposed usually with immediate effect. MPs are typically given less than 30 minutes' notice in this case. Due to the nature of the forced outages, which is not predictable in advance, it is inevitable that only very short notice can be given to MPs.

For security constraints arising from the planned outage of transmission equipment, typically the PSO would have such information on the transmission equipment outage in advance. When the PSO foresees the possibility that security constraints may need to be imposed during the period that the transmission equipment is on planned outage, the PSO would also inform the industry of such intention via different platforms such as the market information sharing forums, usually a few weeks before the planned outage.

For security constraints arising from inadequate transmission capacity when there is excessive generation, the PSO generally would also engage MPs in advance and inform them of their intention to apply security constraints. Such security constraints are usually in effect for a sustained period of time and sometimes could last for years, with possible extensions.

¹² Please note that EMA has stated in 2011 in the information paper "[Developments In the Singapore Electricity Transmission Network](#)", that there is no obligation on Transmission Licensee to reinforce the network to ensure the network is always congestion free,

¹³ Such inputs include the identities of the transmission facilities, the applicable security limit and the dispatch periods for which the security constraint applies.

¹⁴ Based on historical record of 2015 and 2016, the lead time ranges from a few minutes to more than 5 days. For security constraints arising from forced outages, the advance notice is usually short and in two cases, the advisory notices are issued at the beginning of the first dispatch period that the security constraints took effect.

Sometimes, MPs are only informed of the extension of a security constraint a few days before the original end date¹⁵.

3.2.3 Areas for Improvement

Availability of detailed information of security constraints

Unlike generation outages which are updated in the UGOP that is published from time to time, MPs are only informed of the imposition of security constraints via advisory notices. Although the PSO also indicates in its daily Adequacy and Security Assessment (ASA) report that the potential congestion is expected in certain part(s) of the grid and security constraints are applied, no details of the duration and the affected transmission lines are given.

For MPs who would like to find out the details of the security constraints that are in effect, it would be quite a tedious process, as they would need to search from historical published advisory notices to obtain such information. This is especially so for new MPs who may not have much knowledge of the background of the security constraints.

Proposed solution

To include in the ASA report the details of security constraints that are expected or planned to be in effect in the next 14 days/1 month. Details should include a) duration, b) the affected transmission equipment and respective maximum rating, and c) the applicable security limit. **[Proposal 2.1]**

After such information is updated in the ASA report, the PSO should also direct EMC to include the security constraints into the MCE so that subsequently MPs would be able to see the impact of such security constraints from forecast schedules and prices, as early as possible. **[Proposal 2.2]**

Transparency on transmission constraints and grid upgrading progress

Some MPs also requested for regular updates of the progress on the grid upgrade work that is being conducted in order to address the security constraints issue.

Similar issues regarding the transparency/visibility of transmission constraints have been discussed at a few RCP meetings.¹⁶ The Panel's decision was to write to the EMA to request for more regular updates on the estimated timeline of when transmission constraints will be alleviated. EMC is of the view that the RCP should follow up with the EMA, if necessary.

¹⁵ For example, the PSO decided to extend the duration of the security constraint (Jurong Pier 1450MW) twice: one extension for 6 months and the other one for 4 months, with advance notice of two days and 5 days respectively.

¹⁶ At the 62nd RCP in 2011, the Panel requested that regular updates on transmission developments and potential constraints be provided by EMA and SPPA to the industry, so as to allow investors to make informed decisions in their investments, when discussing [CP40: Management of Transmission Constraint](#). At the 89th RCP in 2016, the Panel decided to write to EMA and request EMA to provide more information and regular updates on when transmission constraints will be alleviated.

4. Consultation

EMC published the proposal for industry's comments on 2 December 2016. Table 2 summarises the comments received and EMC's response.

Table 2: Summary of Comments Received and EMC's response

Organisation	Comments	EMC's response
Issue 1	<i>General comments</i>	
PacificLight Power	Currently, PSO is required to develop an annual generation outage plan (AGOP) by 15th October of the current year. Once the plan is finalized, AGOP can still be revised and an updated generation outage plan (UGOP) is then approved, updated and published by PSO on EMC's website on the same calendar day of approval. PLP is of the view that the current process in the release of information on planned outages works well which provide sufficient time for gencos to react to any change in outage plan.	PLP's view that the current process works well is noted.
Issue 1	<i>Proposal 1.1 To formalise in the SOM the timely update of the UGOP</i>	
PSO	It is already acknowledged that changes in the AGOP are published in a timely manner. For price discovery, it is more important that the dispatch coordinator of the Generation Licensee offer responsibly according to the plant's availability and capability.	For certainty, it would be advisable to have this practice formalised in the SOM.
Tuas Power Generation	Tuas Power has no objection, subject to the cost of implementation.	Tuas Power's comments are noted.
Issue 1	<i>Proposal 1.2 To release PSO's approval and update of the UGOP at the same time</i>	
PSO	PSO will endeavour to provide the necessary information to the market as soon as possible once approval is given.	We note that the PSO will endeavour to update the UGOP as soon as possible and Tuas Power's view that the time gap between the release of the approval and the UGOP is small and it is not considered critical to change the current process.
Tuas Power Generation	Generation companies require approval from PSO on their planned outage in order to finalise the maintenance plan of their generation facilities. Given that the time gap between PSO's approval to Gencos and the release of UGOP to the market is relatively small, i.e. on the same calendar day, it may not be critical to change the current process to align both the timings.	
Senoko Energy	We would like to point out that the implementation of concurrent release of approval and update of UGOP should not hinder or delay the outage approval process.	We note Senoko's concern.
Issue 1	<i>Proposal 1.3 Update forced outage duration in UGOP or advisory</i>	
PSO	The accuracy and validity of the information received by PSO in the preliminary report depends on what the Generation Licensee can provide. It is not uncommon that Generation Licensee is unable to ascertain	If the Genco cannot ascertain when the unit is able to return to service at the time of submission of the preliminary report, the

Organisation	Comments	EMC's response
	when the generating unit will be back from forced outage. To provide inaccurate information to the Market will cause additional administrative burden to PSO and unnecessary confusion to the market. It is more important that the dispatch coordinator of the Generation Licensee offer responsibly according to the plant's availability and capability.	market should be informed as well. Once the Genco is able to provide an expected date/time that its unit is able to return to service, such date/time should be informed to the market in a timely manner.
Tuas Power Generation	The preliminary report submitted to PSO (within 24 hours of the forced outage occurrence) does not require the MP to indicate the duration of the outage. In addition, depending on the nature of the forced outage, the generating unit may recover fairly quickly, say within the same day, making the proposed update timeline (within 12 hours of receipt of the preliminary report) no longer relevant; or may require longer maintenance period, which will be promptly updated in the UGOP as per the process in proposal 1.1. Hence, implementation of proposal 1.3 may not be practical.	
Issue 2 <i>General comments</i>		
Keppel Merlimau Cogen	The proposal highlights the generic benefits of transparency and visibility. However, it fails to cover or consider the risks associated with it, such as potential exercise of locational market power and its impact on the market should the unaffected gencos be informed in advance of imposition of security constraint on particular transmission line. EMC should conduct a more thorough analysis including the risks and implications of such proposals for a balanced assessment and consideration. We believe that EMC does recognize that such locational market power exists from the past observations.	If there is concern on potential exercise of locational market power, it should not be dealt with by withholding such information from market participants. EMA has reiterated in its reply on 22 Dec 2016 to the industry's concerns on exercise of market power during nodal price separations situations that EMA does not take lightly any abuse of market power and will not hesitate to take regulatory actions. Please refer to Annex 3 for the EMA's reply.
Issue 2 <i>Proposal 2.1 To include in the ASA report the details of security constraints expected or planned to be in effect</i>		
PSO	It is already stated that PSO would engage MPs in advance and inform them of our intention to apply security constraints. During the meeting, SPPG and PSO will provide the necessary details like the expected duration, the affected transmission equipment and respective maximum rating, and the	Details such as the expected duration, the affected transmission equipment and respective maximum rating, and the applicable security limit should be included in the ASA Report so that any

Organisation	Comments	EMC's response
	<p>applicable security limit. PSO would also inform the industry of such intention via different platforms such as the market information sharing forums, usually a few weeks before the planned outage. Therefore, the information is already given.</p> <p>PSO has already provided the necessary information to the market and it is not feasible to mandate lead time, especially for urgent repair/maintenance, and close coordination is required between SPPG, Generation Licensees, PSO and EMC. It will impede the need to carry out necessary repair/maintenance to the transmission equipment/cables resulting in adverse impact to system security and reliability.</p>	<p>new MP can easily obtain such information.</p> <p>We understand that for urgent cases, only limited lead time can be provided. However, once the decision has been made that security constraints will be imposed, PSO should update the market as soon as possible, similar to how it is currently communicated to the market via advisory notices. To require the information to be included in the ASA (in addition to the advisory notice) is to allow easy reference by MPs for future periods.</p>
Tuas Power Generation	Tuas Power has no objection to include the details of the security constraints in the ASA report, subject to the cost of implementation.	Tuas Power's comments are noted.
Senoko Energy	Proposal 2.1 would be more useful to market participants, if we have more details of the whole transmission system to analyse the impact of the equipment outages and imposed security constraints. Also, the data in ASA report could be considered to be made available in a more accessible format, such as Excel or EMC WebServices.	We are of the view that the impact should already be reflected in the forecast schedules, if Gencos have offers reflecting their availability.
PacificLight Power	PLP understands that certain feeders' planned outage requires the imposition of security limit by PSO who needs collaboration effort from the affected parties to mitigate any potential disturbance in the market and maintain system security. As such, any publication of information to the market prior to the confirmation of outage plan will not be helpful as they will be subjected to changes.	PSO's decision on the imposition of security constraints should be after the outage plan is finalised. Once the decision has been made that security constraints will be imposed, PSO should inform the market promptly.
	Other Comments	
PSO	<p>There are inconsistencies in the proposal below:</p> <p>In the paper it is stated "In addition to outage of transmission equipment, inadequate transmission capability could also be caused by excessive generation and <u>lag in upgrade of transmission</u> system to keep up with the growth in generation/demand."</p> <p>This statement is incorrect that there is 'lag' in upgrade of transmission system. EMA had published an information paper "Developments In the Singapore Electricity Transmission Network" in 2011 that network</p>	We have revised the paper to align with the information paper, where EMA had stated that "If new generation capacity exceeds demand, then there may be periods of localised transmission constraints for such time until demand grows to absorb the excess supply, or the grid is expanded to free up the constraints."

Organisation	Comments	EMC's response
	planning in Singapore is executed on the principle of open access. i.e. there is no obligation on Transmission Licensee to reinforce the network. In other words, there is no guarantee that the transmission network will always be constraint free and the Gencos will have to compete with the other Gencos for network resources, should there be a constraint.	

5. Conclusion and Recommendations

We conclude that currently the UGOP is updated in a timely manner. Although further enhancements, such as those suggested in Proposal 1.2 and Proposal 1.3 in section 3 of this paper, can be made, the industry has not indicated that such enhancements would be critical.

On the other hand, the transparency on the security constraints should be further improved, by including details of the security constraint in ASA reports. However, we do note that there is concern that informing the industry of the imposition of security constraints in advance may facilitate potential exercise of market power.

Taking into account the industry's feedback, EMC's recommendation to the RCP with regard to the proposals stated in section 3 of this paper is summarised in Table 3 below.

Table 3: Summary of EMC's recommendation

Proposal		Industry's view	EMC's recommendation
1.1	To formalize the current process, where planned outages are updated in the UGOP on the same calendar day of approval, in the SOM	Current process works well.	Support
1.2	To release PSO's approval of planned outage and update of the UGOP at the same time	<ul style="list-style-type: none"> • PSO will endeavour to update UGOP as soon as possible • The time difference between the approval and the update of UGOP is small • The update of UGOP should not delay the approval 	Do not support
1.3	To update forced outage duration in UGOP or advisory, within 12hours of preliminary report	<p>Generation Licensee sometimes is unable to ascertain when the generating unit will be back from forced outage when submitting the preliminary report and inaccurate information may cause confusion.</p> <p>Forced outages that require a longer maintenance will be promptly updated in UGOP once it is approved by PSO.</p> <p>The unavailability of the generating unit, which is on</p>	<p>Support</p> <p>In the case where the generation licensee is unable to ascertain the expected data/time that the unit is able to return to service, the market should be also informed that it is still unknown that when the units is able to</p>

Proposal		Industry's view	EMC's recommendation
		forced outage, should be already reflected in its offer.	return to service.
2.1	To include details of security constraints that are expected to take effect in ASA reports	Information already shared via different platforms.	To require the information on the security constraints to be included in the ASA, once the decision to impose security constraints has been made by the PSO.
2.2	PSO to direct EMC to include the security constraints in the MCE	Mandating a lead time for updating the security constraints in the ASA reports may have adverse impact, such as: <ul style="list-style-type: none"> not practical in the event of urgent repair work/maintenance; information published prior to the confirmation of transmission equipment outage may still be subject to change, thus may cause confusion to the market risk of potential exercise of market power 	No explicit lead time to be set.

6. Deliberation and Decisions at the 91st RCP Meeting

The RCP considered the above proposals and EMC's recommendation at its 91st meeting.

With regards to the proposals related to issue 1, the RCP **unanimously supported** Proposal 1.1 and requested that the PSO update the SOM to reflect the current process. The RCP **by majority vote do not support** Proposals 1.2 and 1.3.

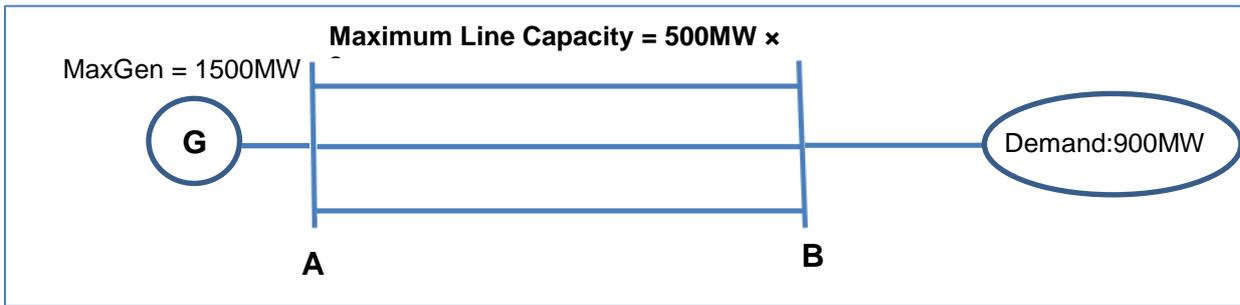
With regards to proposals related to issue 2, the RCP **by majority vote do not support** Proposals 2.1 and 2.2. Notwithstanding, the PSO agreed to include information on the original maximum rating of the affected transmission equipment in future advisory notices pertaining to security constraints.

The details of the voting outcomes for each proposal are provided in Table 4 overleaf.

Table 4: Detailed Voting Outcomes

Member	Proposal 1.1	Proposal 1.2	Proposal 1.3	Proposal 2.1 and 2.2
Ms. Priscilla Chua (Representative of Generation Licensee)	Support	Do not support	Do not support	Do not support
Mr. Luke Peacocke (Representative of Retail Electricity Licensee)	Support	Do not support	Support	Do not support
Mr. Daniel Lee (Representative of Retail Electricity Licensee)	Support	Do not support	Support	Support
Mr. Sean Chan (Representative of Retail Electricity Licensee)	Support	Do not support	Do not support	Do not support
Mr. Dallan Kay (Representative of Wholesale Electricity Trader)	Support	Support	Support	Support
Mr Soh Yap Choon (Representative of Power System Operator)	Support	Do not support	Do not support	Do not support
Mr. Lim Han Kwang (Representative of Transmission Licensee)	Support	Do not support	Do not support	Do not support
Mr. Lawrence Lee (Representative of Market Support Service Licensee)	Support	Do not support	Do not support	Do not support
Mr. Henry Gan (Representative of the EMC)	Support	Abstain	Do not support	Do not support
Mr. Phillip Tan (Person experienced in financial matters in Singapore)	Support	Do not support	--	Do not support
Dr. Toh Mun Heng (Representative for the interests of the consumers of electricity in Singapore)	Support	Do not support	Do not support	Support

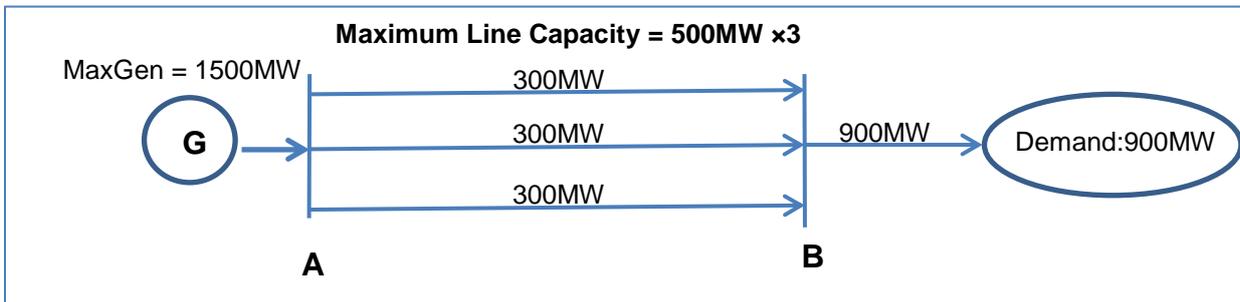
Annex 1: Illustration of Scenarios of Security Constraints applied on Transmission Lines



The diagram above illustrates a simple grid, which is used to deliver energy produced at Node A to serve demand at Node B. There are three transmission lines connecting A and B, each with maximum capacity of 500MW. The demand is normally at 900MW.

Base Scenario (No security constraint)

All three lines are in service

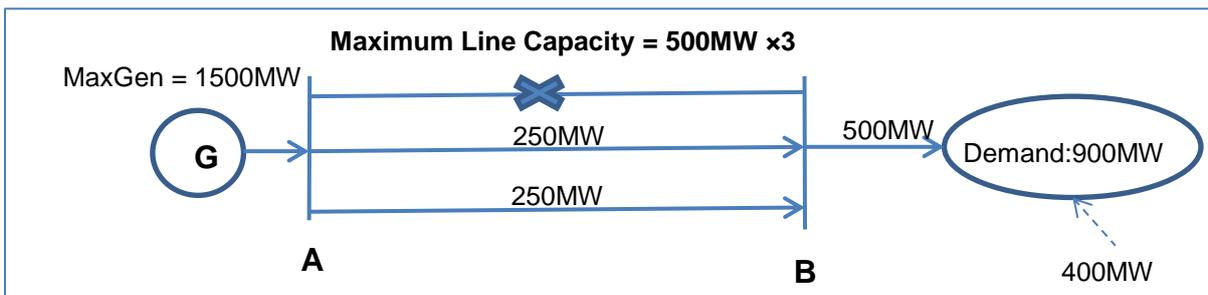


In order to meet the 900MW demand, the line flow on each line shall be 300MW. In the event that one line goes on forced outage, the remaining two lines (with total capacity of 1000MW) are still able to deliver to 900MW of energy to serve the demand. Therefore, the N-1 requirement is met and there is no need to imposed any security constraint.

Generator will be scheduled to generate 900MW

Scenario A (security constraint imposed due to inadequate transmission capability caused by forced/planned outage of transmission equipment)

Demand remains the same and one line is on outage



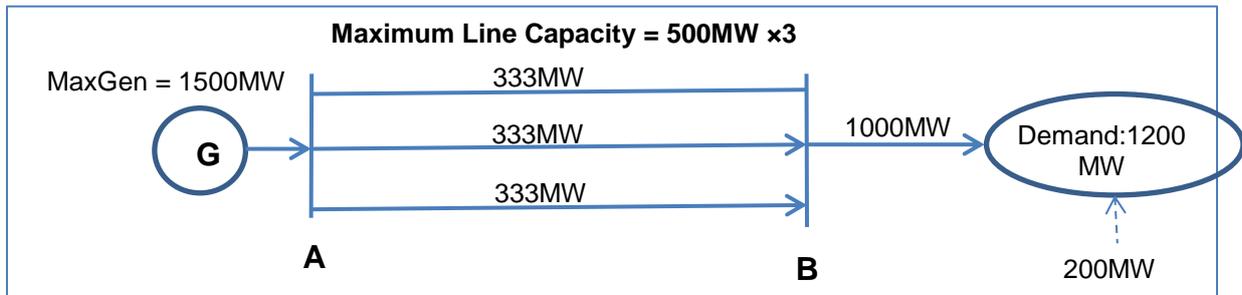
When one of the three lines is down due to planned or forced outage, each of the remaining two lines would need to carry 450MW in order to serve the demand of 900MW. In the event that one

of the two remaining lines also goes on forced outage, the only remaining line whose capacity is only 500MW would be overloaded. Therefore, to meet the N-1 requirement, a security constraint will be imposed to limit the total line flow between A and B to 500MW.

As a result, the demand at Node B cannot be fully supplied by generators from Node A. Part of the demand (400MW) will have to be served by some local generators near Node B.

Scenario B (security constraint imposed due to inadequate transmission capability caused by excessive generation)

Demand increased to 1200MW and transmission line capacity remains the same.



In this scenario, it would seem that the 1200MW of demand can be fully supplied by generators from Node A since the total capacity of the three lines between A and B is more than 1200MW. However, if one of the three transmission lines is down, the remaining two lines with total capacity of only 1000MW is not enough to carry the 1200MW required to meet demand, which means the N-1 requirement is not met. In this case, the PSO would apply a security constraint of 1000MW on the three transmission lines to prevent potential overloading of transmission lines in the event of an outage.

As a result, the demand at Node B cannot be fully supplied by generators from Node A. Part of this demand (200MW) will have to be served by local generators near Node B. In addition, upgrade to the transmission system will be required in order for it to meet the N-1 requirement under the Transmission Code.

Annex 2: Example of Advisory Notice Pertaining to Security Constraint

ABNORMAL CONDITION anticipated between:

31 Dec 2014 00:00 and 30 Jun 2015 23:30

Abnormal condition type: Other

Description of abnormal condition: In view of the excess generation expected and to prevent severe overloading, the security limit of 1150MW shall be applied on the affected feeders at Tembusu 230kV substation.

Annex 3: EMA's reply to the RCP's concern on exercise of market power during nodal price separations situations



22 Dec 2016

Energy Market Company
4 Shenton Way
#03-01 SGX Centre 2
Singapore 068807

Attention: Mr Paul Poh Lee Kong
Chairman
Rules Change Panel

Dear Sir

INFORMATION REGARDING TRANSMISSION NETWORK CONSTRAINTS

I refer to your letter dated 13 Sep 2016.

2 With regard to the RCP's request for more information and regular updates on when prevailing transmission network constraints would be alleviated, EMA understands that this is being addressed as part of EMC's proposal (RCP Paper No. EMC/RCP/xx/2016/CP67) to enhance the process of updating generation outage plans and security constraints.

3 We have also noted the industry feedback that there is still concern of nodal price separation due to the exercise of locational market power that may be facilitated by transmission network constraint, even if this occurs infrequently. We would like to reiterate that EMA does not take lightly any abuse of market power, and will not hesitate to take regulatory actions against the relevant market participant.

Yours faithfully

A handwritten signature in black ink, appearing to be "Soh Sai Bor", written over a faint circular stamp.

Soh Sai Bor
Acting Assistant Chief Executive
Economic Regulation Division