National Electricity Market of Singapore

MINUTES OF THE RULES CHANGE PANEL
23rd PANEL MEETING
HELD ON MONDAY 21 NOVEMBER 2005 AT 10.30AM
AT ENERGY MARKET CO. PTE LTD
9 RAFFLES PLACE #22-01
REPUBLIC PLAZA, SINGAPORE 048619

Present:	Allan Dawson (Chairman)	Eu Pui Sun
	Low Boon Tong	Robin Langdale
	T P Manohar	Kng Meng Hwee
	Ben Lau	Dr. Daniel Cheng
Absent with apologies	Tan Boon Leng	Yip Pak Ling
	Francis Gomez	
In Attendance: (EMC)	Paul Poh	Poa Tiong Siaw
	Ramon Staheli	Teo Wee Guan
	Janice Leow	

1.0 Notice of Meeting

The Chairman called the meeting to order at 10.30am. The Notice and Agenda of the meeting were taken as read.

2.0 Confirmation of Minutes of the 22nd Rules Change Panel Meeting

The Minutes of the 22nd Rules Change Panel meeting held on Monday, 12 September 2005 was tabled and taken as read.

There being no amendments to the Minutes, the Rules Change Panel unanimously accepted and approved the Minutes.

3.0 Matters Arising from the 22nd Rules Change Panel Meeting held on 12 September 2005

The Panel noted that the matters arising as outlined had been completed.

4.0 Monitoring List

The Panel noted the contents of the paper.

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5.0 Appointment of Technical Working Group Member
(Paper No. EMC/RCP/23/2005/01)

The Panel was informed that the PSO had nominated Dr. Kang Cheng Guan to replace Mr. Kng Meng Hwee as a member of the Technical Working Group.

EMC is of the view that Dr. Kang meets the necessary criteria and would be able to contribute effectively to the workings of the TWG. Thus, it recommended that the RCP appoint Dr Kang Cheng Guan to the TWG, and that Dr Kang's term of appointment on the TWG be from 21 November 2005 to 20 January 2007.

The Panel **approved** the appointment of Dr. Kang Cheng Guan to the TWG from 21 November 2005 to 20 January 2007.

6.0 Gate Closure Reduction (Paper No. EMC/RCP/23/2005/246)

The Panel was informed that at the 13th RCP meeting on 11 May 2004, the RCP supported a rule change to reduce the gate closure period from four hours to two hours. At that meeting, the RCP also tasked EMC to review whether the two-hour gate closure period could be reduced further after it has been implemented for nine months.

EMC initiated the review in May 2005. A survey was conducted with market participants, MSSL and PSO. The survey results showed that all respondents supported a one-hour gate closure period. According to the respondents, a shorter gate closure period would enable them to react to changing market or plant conditions closer to real-time. It would also encourage more responsive biddings based on most recent market information.

However, EMC noted that a one-hour gate closure period may give rise to a minimum reaction time of only 25 minutes. Such a short reaction time may have an adverse impact on system security and unit commitment. EMC recommended that the proposed one-hour gate closure period be extended by 5 minutes, i.e. to set it to 65 minutes (instead of one hour). This will ensure that the system operator and gencos have a minimum reaction time of 55 minutes to manage system security and unit commitment respectively. This slight extension would not erode the benefits of a shorter gate closure period to the gencos significantly. Conversely, it would help to increase the reaction time and reduce dispatch uncertainty considerably.

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The Panel **supported** EMC's recommendation to reduce the gate closure period to 65 minutes and to make the necessary recommendation to the EMC Board for adoption.

7.0 Composition of RCP (Paper No. EMC/RCP/23/2005/248)

This proposal seeks to amend Chapter 3 of Section 2.3.3 of the Market Rules.

The current market rules give an exemption so that affiliates of Temasek Holdings Pte Ltd can be concurrently represented on the Rules Change Panel (RCP). The rules are designed to ensure there is fair representation and no conflict of interest for the composition of the RCP. However, this is feasible only in a privatized industry where ownership is not concentrated. This is not the case with our current industry structure as the intended sale of gencos by Temasek has not been carried out. Hence, there is a need for the rules to provide an exemption so that the gencos and retailers of which are affiliates of Temasek Holding Pte Ltd can concurrently be represented on the RCP. The exemption in the rules will expire on 31 December 2005. Hence, there is a need to extend this exemption until the gencos are fully privatized. This rule change proposal seeks to extend this exemption by one more year (i.e. till end of 31 December 2006).

The Panel **supported** EMC's recommendation and to make the necessary recommendation to the EMC Board for adoption.

8.0 Shortening of Settlement Cycle
(Paper No. EMC/RCP/23/2005/249)

The Panel was informed that EMC's conceptual proposal is to shorten the wholesale electricity market settlement cycle.

The proposal to shorten the settlement cycle would involve the following changes:

1. Remove the preliminary settlement run;
2. Produce the final settlement run on TD+6 business days;
3. Bring forward MPs' payment (to EMC) date to TD+9 business days;
4. Bring forward EMC's payment (to MPs) date to TD+10 business days; and
5. Reduce the amount of required credit support from 30 times to 25 times the estimated average daily exposure.

The estimated resource requirement for this one-time implementation of system change is 46 man-days at S$39,000.

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The Panel was informed that the MSSL had objected to the rule change proposal on the following grounds:

- Higher working capital cost for MSSL
- Inequity because consumers would bear these cost
- Cost of changes to MSSL systems may be significant

The MSSL considered that the issue of equity should be addressed before it studies the impact of the change on MSSL's systems.

The Panel noted the merits of the proposed change but would like to see more precise figures on costs and savings on gencos, retailers and MSSL.

The Panel requested the MSSL to provide information on the type of changes and estimated costs required to change the MSSL system. — T P Manohar

The Panel noted EMC's estimation of the cost and benefits accruing to each MP. However, it felt that each MP should be asked to provide its own estimate of savings and cost for more precision. The Panel then requested EMC to obtain such figures and update the cost and benefit analysis of the conceptual proposal. — EMC

9. Re-write of Appendix 6D.22 (Paper No. EMC/RCP/23/2005/250)

The Panel was informed that the current rules in Appendix 6D.22 are poorly drafted for the following reasons:

1) the rules are not structured logically;
2) some terms used are inappropriate; and
3) there is a lack of explicit instructions for the actual loss calculation correction procedures.

These make the existing rules very difficult for a reader to understand. The purpose of the re-write is to correct these deficiencies and thus, make the rules clearer and more readable.

The Panel was informed that the Technical Working Group (TWG) had considered the proposed re-write and had recommended that the RCP support the re-write.

Transmission flow-loss model

Mr. Poa Tiong Siaw explained to the Panel the transmission flow-loss model used in the market clearing engine (MCE). For a given transmission line, the actual physical relationship between flow and loss is a quadratic function.

However, since the MCE employs a linear program, it has to approximate the quadratic function using 8 piece-wise linear segments connected by 9 line flow/line loss points. Based on the model, a correct loss-flow value must lie on a line joining two adjacent nodes.

Non-physical losses

Mr Poa went further to explain that non-physical losses (NPL) can arise from a MCE solution. NPL could arise during periods of negative energy price, where the MCE may try to maximize losses through calculating higher losses for a given flow on a line because doing so will maximize Net Benefit. Negative prices can arise from the demand being entirely met by negatively priced offers (either globally or in a constrained area), or as a result of a binding line constraint giving rise to the "spring–washer" effect. The loss-flow value with NPL would lie outside any piece-wise linear segments (i.e. straight line joining two adjacent nodes).

The implication of using a schedule with NPL is that some generators are over-dispatched because higher losses (than actual) have been calculated by the MCE. Thus, there is a need to correct for NPLs if they are too large.

Correcting for non-physical losses

Each MCE solution is checked for NPL. The MCE is programmed to accept NPL only if any of the following condition applies:

1) a line violation is triggered;
2) the resulting system-wide losses (called 'SysError') is lower than a pre-determined threshold; or
3) the number of MCE solves carried out for the purpose of loss calculation correction has reached a pre-determined threshold.

Otherwise, the MCE has to perform loss calculation correction to reduce produce a schedule that minimises over-dispatch of generators.

Poor drafting – lack of logical flow

With respect to the loss calculation correction process, Mr Poa explained to the Panel that one main deficiency of the existing rules is the lack of logical flow.

Logically, the process should be as follows:

1) Detection of non-physical losses
2) Identification of circumstances when an MCE solution may be accepted.
3) Loss calculation correction method

The sequence of the existing rules did not reflect that and is potentially confusing to the reader.

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To correct the deficiency, the re-written rules have been arranged so that they follow the above logical sequence.

Poor drafting – improper/ambiguous use of terms
Mr Poa also informed the Panel that the existing rules use terms such as 'forward direction limit' and 'reverse direction limit', which are not applicable all the time. The rules also use words like 'outer points of the line loss function', which are terms not defined in the Market Rules.

To correct this, inappropriate terms have been removed in the re-written rules and replaced with those that are defined in the Market Rules.

Poor drafting – Unclear instructions
The third deficiency of the existing rules is lack of clear instructions to carry out some steps in the loss calculation correction process. Specifically, the following instructions in the existing rules are not explicit:

- D.22.3 on calculating and checking the variable 'SysError' and
- D.22.4.1 and D.22.4.2 on finding the line flow/ line loss point *i*.

To correct this, the re-written rules have been drafted to explicitly articulate these instructions in Plain English.

Conclusion
Mr. Poa concluded that with the plain English drafting, the re-written rules follow a logical flow and have now become clearer and more readable.

The Panel was requested to support the re-write.

The Panel **supported** EMC's recommendation and to make the necessary recommendation to the EMC Board for adoption.

10. Concept Paper – Imposition of Default Levy
(Paper No. EMC/RCP/23/2005/CP08)

The Panel was informed that the Concept Paper was first presented at the 18th RCP Meeting on 15 March 2005 and further discussed at the 21st RCP Meeting on 5 July 2005. At the 22nd RCP Meeting on 3 September 2005, EMC was tasked to clarify 2 issues.

1) How charging the default levy to all MPs would result in Intra-class inequity.

2) How the market rules is intended to be amended to implement charging default levy only to "net creditors" and whether that would result in any issues when there are negative prices?

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Mr Poa illustrated conceptually how the current default levy arrangement resulted in inequity within the retailer class of MP. He also illustrated with examples how the proposed change works and how negative prices do not create any issue with the proposed arrangement. The Panel noted these points.

However, Mr Eu Pui Sun described a possible scenario where, under the proposed arrangement, intra-class equity within the Generation Class of MPs may be compromised. This takes place when a single-unit generator trips and is unable to fulfill its vesting contract quantity. It then purchases from the spot market and becomes a net debtor in the market for that trading day, while other generators remained net creditors. Concurrently, the outage may have caused the USEP to increase which forces a retailer into default. If a default levy is imposed as a result, the generator that tripped would not be allocated a share of the levy because it was a net debtor. This is seen as inequitable within the generator class of MPs, especially given the fact that the generator that tripped brought about the default in the first place.

Mr. Langdale suggested that the allocation of default levy should be based on a longer period than one day, say one month's trading. This would decrease the risk of distortion due to exceptional trading conditions on a single day. — EMC

The Panel requested EMC to study this issue raised by a Panel member on intra-class equity. It also asked that EMC obtain the Panel's decision by way of circulating the analysis on the issue and final recommendation.

11. Concept Paper on Review of Constraint Violation Penalty Structure (Paper No. EMC/RCP/23/2005/CP10)

The Panel was informed that the paper contained the results of EMC's review of the CVP structure and that the Technical Working Group (TWG) had reviewed it and had recommended that the RCP support the recommendations.

The MCE produces pricing and dispatch schedules which maximise net benefits in the objective function whilst meeting certain constraints. However, in some cases, MCE may not find a feasible solution within this set of constraints. Hence, one or more of the constraints will need to be violated in order for MCE to arrive at a solution.

The purpose of the Constraint Violation Penalty (CVP) is to tag a different cost (or penalty) to the violation of each constraint. With this, in cases where MCE needs to violate constraint(s) to arrive at a solution, it will always choose to violate the 'cheapest' constraint first (i.e. to incur the least penalty) and the 'most expensive' constraint last.

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Mr Ramon Staheli explained the current CVP structure to the Panel. The structure reflects the desire to shed regulation first, followed by reserves and finally energy if necessary. Other violations (e.g. line flow) have very high penalties (multiples of VoLL) to reflect that these constraints should never be violated, even under extreme circumstances.

The table below summarizes the CVP structure:

Name of CVP	Value	$Value
Deficit Regulation	0.6*VoLL	$3,000
Deficit Reserve 10 Minute (Contingency Reserve)	0.7*VoLL	$3,500
Deficit Reserve 30 Second (Secondary Reserve)	0.8*VoLL	$4,000
Deficit Reserve 8 Second (Primary Reserve)	0.9*VoLL	$4,500
Deficit Generation	VoLL	$5,000
Line Flow	2.2*VoLL	$11,000
Deficit Security	6*VoLL	$30,000
Facility (Various)	20*VoLL	$100,000
Excess Generation	CDC	-$5,000

Observed Problems with the CVP structure

Mr Staheli explained that there are several problems observed in the current CVP structure (i.e. there exists cases where the CVP structure has not worked as intended in the MCE).

Severity of problems

Mr Staheli highlighted to the RCP that, although the three problems associated with the current CVP structure have been experienced in the past, they rarely occur and they have never affected settlement because their effects have always been removed subsequently in re-runs. Hence, the problems are only modeling problems which, to date, have had no physical impact. Also, he added that none of the problems occurred on 29 June 2004 (when Singapore experienced a major blackout).

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Specifically, the problems are:

Problem (1): The Deficit reserve penalties are too high relative to the deficit generation.

This means that energy will be shed before reserve. However, the desired outcome should be that reserve is shed before energy (as reflected in the table on CVP structure above).

This situation happens because in some cases where the MCE works out that by shedding 1MW of energy, 1 MW could be scheduled for all three classes of reserve, and thus MCE could avoid incurring a potential penalty of 2.4*VoLL (i.e. sum of CVPs for all three classes of reserves - (0.7+0.8+0.9)*VoLL =2.4 VoLL) by incurring a penalty of 1*VoLL (i.e. the CVP for shedding energy).

Problem (2): The Line Flow Penalty is set too low relative to the Deficit Generation Penalty

The desired outcome should be for load shedding (i.e. deficit generation) to occur before a line flow constraint is violated. However, currently, the opposite could happen (i.e. line flow constraint violated before deficit generation).

This situation can happen where the violation of a single line constraint can allow increased flow to occur across multiple parallel lines.

For example, where there are three parallel lines and a binding constraint on one of the lines constrains the flow across all three lines, the MCE has two choices. It can either shed 3MW of load, incurring a total penalty of $15,000 (3*VoLL), or it could violate the line constraint on the binding line by 1MW, allowing a total of 3MW to flow across the parallel lines. This would incur a penalty of only 2.2*VoLL, making it the preferred solution in this scenario.

Problem (3): The Excess Generation Penalty is set too low relative to the Deficit Generation Penalty

This means that excess generation penalty may be incurred before the deficit generation penalty, which is not the desired outcome.

This can result from a spring washer effect where one end (the high price side) of a binding line constraint has its prices being pushed up, while prices at the other end (the low price side) are being pushed down. Where this occurs, the price at the low price side of the spring washer can drop to a level where the excess generation penalty is incurred before prices rise high enough to cause the deficit generation penalty to be incurred on the high price side of the spring- washer effect.

When this happens, the MCE schedules artificial load, and the solution shows an energy surplus instead of an energy shortfall, incurring the generation excess penalty. The correct outcome should be for an energy shortfall to occur instead. This is preferable because it is physically feasible to shed load whereas it is physically impossible to create artificial load to compensate for an energy surplus (i.e. generation excess).

Identification of possible solutions

Despite the problems not having a physical or commercial impact to date, EMC identified and evaluated a few possible solutions to solve these problems.

Option 1 – To solve Problem (1)

To rectify problem (1), we need to reduce the three deficit reserve penalties so that their total is less than the deficit generation penalty. This can be done by:

1. reducing the price caps for the three classes of reserve and reducing the constraint violation penalties accordingly so that their total is less than VoLL; or
2. increasing VoLL to above $12,000.

However, there are downsides to these two possible solutions. For (1), a significant reduction in reserve price caps may potentially reduce the amount of reserve offered to the market. Since this has potential negative effects on the reserve market, it was abandoned without testing. For (2), EMC recalculated VoLL using more updated data and using existing methodology of dividing GDP by electricity consumption. The calculated value of $5,250 does not support a significant increase in value of VoLL (i.e. to $12,000).

It is thus not advisable to implement this option since the outcome would be more severe than the problem itself. The problem rarely occurs and when it occurs, the problem is likely to be a modeling problem with no real physical or commercial impact.

However, should VoLL be increased for other reasons in the future, for example to incentivise investment in new generation, EMC would review whether the Deficit Reserve CVPs should be revised to solve Problem 1.

Option 2 – To solve Problem (2) and Problem (3)

This option involves increasing line flow penalty to 18*VoLL, deficit security penalty to 19*VoLL and decreasing excess generation penalty to -21*VoLL.

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A series of tests has been carried out to evaluate this option. While this option will solve problems (2) and (3), it will result in more extreme prices when a spring-washer effect occurs. This is because the very low excess generation penalty (-21*VoLL) will result in prices on the low price side of a binding line constraint to fall very low before the prices at the other high price side can rise to VoLL, which then may result in a more negative USEP. Even with the price cap and floor applied in post processing, the result is still more extreme nodal prices in the area affected by the spring-washer effect.

Again, it is not advisable to implement this option as the outcome of the solution could be more detrimental than the problem itself.

Option 3 – To solve Problem (2)

This option varies from option 2 in that the excess generation penalty remains unchanged. It involves increasing line flow penalty to 18*VoLL and deficit security penalty to 19*VoLL.

The test carried to evaluate this option showed that the prices are less extreme with an unchanged excess generation penalty compared to decreasing it to -21*VoLL. Test results also showed that the USEP under this option is fairly close to that under the current CVP structure

The Panel was informed that the **TWG recommended that the current CVP structure be left unchanged**. This recommendation was based upon the TWG's view that the problems were not severe enough to warrant changes to the CVP structure.

The Panel noted that, should VoLL be increased for other reasons in the future, for example to incentivise investment in new generation, EMC would review whether the Deficit Reserve CVPs should be revised to solve Problem 1.

The TWG's recommendation was supported by the Panel.

There being no other matters, the meeting ended at 12.15pm with a vote of thanks to the Chair.

ALLAN DAWSON
Chairman

Minutes taken by:
Eunice Koh
Market Panel Administrator