Energy Market Company

RCP PAPER NO. : **EMC/RCP/60/2012/CP38**

SUBJECT : **REVIEW OF THE VALUE OF LOST LOAD (VoLL)**

FOR : **DECISION**

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DATE OF MEETING : **13 MARCH 2012**

Executive Summary

This paper assesses the proposal received during the 2011/12 Rules Change Prioritisation Exercise to increase the Value of Lost Load (VoLL) from the current level of $5000/MWh to $10,000/MWh. This would have a corresponding effect on the nominal values of all price ceilings and constraint violation penalties.

Following a conceptual review of VoLL and an examination of the various estimation methods that are commonly used, various factors relating to a higher level of VoLL were presented and analysed in the context of the SWEM.

Based on the current paradigm of estimating VoLL using gross domestic product divided by electricity consumption, there is justification to support an increase in VoLL to around $6500/MWh, but not to the proposed level of $10,000/MWh. However, as VoLL can impact other market outcomes, these factors have to be taken into consideration as well.

First, a higher level of VoLL may theoretically encourage investment in peaking generation plants and, to a smaller extent, base-load plants. However, in SWEM, the methodology adopted to estimate VoLL was not designed to explicitly incentivize peaking plant investments and, even if VoLL was raised to the economic estimate figure of $6500/MWh, it still does not provide enough financial incentives to attract new peaking plant investments. For base-load plants, investment decisions are driven more by average spot prices, on which VoLL currently has little effect.

Second, a higher VoLL/price ceiling could lead to more extreme price spikes and resultantly increase the level of risk in the market. This could have a knock-on effect on risk premiums in retail and bilateral contracts. Third, the market is expected to remain

fairly concentrated in the foreseeable future. Given the possibility of hockey-stick pricing and weak demand responsiveness, a higher VoLL/energy price ceiling could render consumers to become vulnerable to more extreme price spikes in the spot market.

Taking the above factors into consideration, EMC recommends that the RCP hold off the proposal to raise VoLL until such time when there is (1) a lower level of market concentration, (2) more demand response initiatives, and/or (3) better risk management mechanisms that could mitigate the effects of a higher VoLL.

At the 60th RCP Meeting, the Panel, by majority vote, decided not to support the proposal to increase VoLL.

1. Introduction

This paper assesses the proposal received during the 2011/12 Rules Change Prioritisation Exercise to increase the Value of Lost Load (VoLL) from the current level of $5000/MWh to $10,000/MWh. The proposer noted that this is in line with the Energy System Review Committee's recommendation in 2005 to consider raising the spot price ceiling "in order to promote more reliable and efficient market operations and to provide incentives for future capacity investment"[1].

2. Background

2.1. Concept of VoLL

VoLL is defined as the value that an average consumer puts on an unsupplied unit of energy, and measures consumers' valuation of the opportunity costs of outages, i.e. the benefits foregone due to supply interruption (Willis & Garrod, 1997). Alternatively, it is also the average willingness to pay to avoid an additional hour without power (Leahy & Tol, 2011).

This concept is reflected in the Singapore Wholesale Electricity Market (SWEM), where VoLL sets the constraint violation penalty for deficit generation. Since consumers in SWEM are unable to declare their willingness to pay by submitting demand bids into the market, the use of VoLL proxies the average consumer's valuation of energy, beyond which the market clearing engine (MCE) would incur an energy deficit and schedule a load shed.

The true VoLL is highly variable and influenced by a multitude of factors such as the duration and timing of interruption, perceived reliability of power supply (which in turn affects the extent to which consumers prepare for potential interruptions e.g. backup generators), availability of advance notice and consumer dependency on electricity (i.e. type of consumers, and standard of living). The single most reflective figure of VoLL will thus be the expected aggregate of all its possible values across a mix of consumer types and outage circumstances.

2.2. Estimation of VoLL

As most consumers neither respond directly to real-time prices nor experience frequent blackouts, there is almost no market information on VoLL. This lack of information, coupled with the absence of demand-side participation, implies that alternative methodologies are often used to determine the value consumers place on maintaining electricity supply. These methods are described below.

<u>Estimating VoLL from the demand perspective</u>

There are generally two basic approaches to estimate the value consumers place on electricity supply.

Economic estimates: A rule-of-thumb estimate of VoLL is derived by dividing the country's gross domestic product (GDP) by its total energy consumed, which proxies the

[1] Page 49, *Energy System Review Committee Report*, March 2005.

costs of lost production due to power supply interruption. The current VoLL used in the SWEM was set based on this approach[2].

Consumer surveys*:* Alternatively, VoLL could be measured by surveying consumers' stated preferences. There are generally two stated preferences methods – contingent valuation and conjoint analysis (van der Welle & van der Zwaan, 2007). In contingent valuation, consumers directly value reliability in monetary terms, indicating their explicit willingness-to-pay for more reliability or willingness-to-accept for lower reliability. Conjoint analysis, on the other hand, requires consumers to indicate their preferences with regard to both reliability and electricity prices, ranking a variety of reliability-price choice sets.

Estimating VoLL from the supply perspective

The lack of information on disruption costs and poor estimates of VoLL to consumers have given rise to alternative methods to estimate the relevant price cap. For example, several markets have employed supply-side calculations, which are based on reliability standards from an engineering perspective (rather than grounded in economic theory), to approximate VoLL (Stoft, 2002).

Supply-side calculations: This approach estimates the costs required to induce investment to the point where load shedding is reduced to some desired pre-determined level of reliability (e.g. X hours of load shed per annum) (Stoft, 2002).

Under this regime, the VoLL and correspondingly the market price cap is set high enough to allow a new entrant peaking plant to recover its total costs if it were to operate at the price cap for the acceptable number of hours of load shed. In other words, given a desired level of reliability (X hours of load shed per annum) and cost structure of a peaking plant, the regime will work backwards to derive the VoLL which would allow this plant to at least break even, assuming it runs X hours a year.

2.3 VoLL in other jurisdictions

Table 1 below provides an overview of the level of VoLL and corresponding estimation method employed in other jurisdictions.

[2] PA Consulting (2002) recommended a VoLL of $5,000/MWh for the SWEM at that time. This recommendation was derived after reviewing a combination of literature on VoLL studies, figures used in the Australian National Electricity Market and the England and Wales Pool then, and the economic estimate method using Singapore data.

Table 1: Summary of VoLL in other markets

Market	Level of VoLL ($/MWh)*	How VoLL is set	What VoLL is used for	Energy price ceiling ($/MWh)
Australia National Electricity Market	AUD$12,500 [3] (≈S$16,824)	**Supply-side calculation**: set to achieve reliability standard of 0.002% un-served energy annually for each region and NEM-wide	Regional price cap for energy	AUD$12,500
Ireland Single Electricity Market	€10,519.75 [4] (≈S$17,848)	**Supply-side calculation**: based on average cost of a best new entrant peaking plant and a generation security standard of 8 hours. i.e. (fixed cost of peaking plant per MW per annum/ 8 hours) + (variable cost of peaking plant)	Determination of capacity payments	€1000
New Zealand Electricity Market	NZ$20,000 [5] (≈S$20,606)	**Supply-side calculation**: based on value of un-served energy arising from primary transmission equipment outages	For regulated transmission investment purposes	No price ceiling
Philippines Wholesale Electricity Spot Market (WESM)	PHP100,000 [6] (≈S$2987)	**Economic estimate**: GDP divided by electricity consumed	Linked to constraint violation penalties	No price ceiling, but there is an offer price cap of PHP62,000
Midwest ISO	US$3500 [7] (≈S$4533)	**Econometric analysis based on prior literature**: econometric model developed for residential, small commercial and industrial (C&I, e.g. services) and other large C&I customers based on	Market price cap for energy	US$3500

[3] References to "VoLL" in the Australia NEM pertain to periods prior to June 2009. On 28 May 2009, a rule change was implemented to rename VoLL as the "market price cap" on the basis that naming what was clearly an upper limit on market prices as VoLL is misleading. A true VoLL should be based on the theoretical price above which consumers would prefer to have interrupted supply, rather than be set in reference to projections of meeting some reliability standard. Source: Australian Energy Market Commission (2009). *NEM reliability settings: VoLL, CPT and future reliability review*, from http://www.aemc.gov.au/Electricity/Rule-changes/Completed/NEM-Reliability-Settings-VoLL-CPT-and-Future-Reliability-Review.html

[4] Figure refers to VoLL in 2012. The VoLL figure was initially set at $10,000/MWh from 1 November 2007 to 31 December 2008, and is adjusted annually based on a weighted average of price indexes. Sources: All Island Project (2007). *The value of lost load, the market price cap and the market price floor – A response and decision paper*, AIP-SEM-07-484; Single Electricity Market Committee (2011). *Policy parameters 2012 Decision paper, SEM-11-073.*

[5] Source: New Zealand Electricity Authority (2011). *Industry Participation Code 2010*, Part 12, Schedule 12.2, Section 4, from: http://www.ea.govt.nz/document/11336/download/act-code-regs/code-regs/the-code/part-12/

[6] Initial estimate is PHP104,600/MWh, but PHP100,000 is used as the actual value. The level of VoLL is not to be confused with 'Nodal VoLL' (i.e. CVP for deficit generation), which is priced at PHP1,100,000 (or 11xVoLL). Contrary to the SWEM, the VoLL figure (PHP100,000) is used in WESM as the CVP for deficit interruptible load, the lowest prioritized soft constraint, with subsequent CVPs separated by 1xVoLL. Source: *WESM Manual – Constraint Violation Coefficients Issue 2.0*, Section 6.2: http://www.wesm.ph/UserFiles/File/Visays%20Trial%20Operations%20Program/Constraint%20Violation%20Coefficient%20(CVC).pdf; WESM (2004). Annex B- *Compliance to ERC Directives: WESM Price Determination Methodology*, from: http://www.erc.gov.ph/pdf/PDM%20Annex%20B.pdf

[7] Sources: Midwest ISO (2011). *Business Practices Manual – Energy and operating reserve markets*, BPM-002-r10; FERC (2008). *Order on ancillary services filing*, Midwest Independent Transmission System Operator, from: http://www.ferc.gov/EventCalendar/Files/20080225183304-ER07-1372-000.pdf; The Brattle Group (2010). Midwest ISO's Resource Adequacy Construct, from: http://www.brattle.com/_documents/uploadlibrary/upload832.pdf

Market	Level of VoLL ($/MWh)*	How VoLL is set	What VoLL is used for	Energy price ceiling ($/MWh)
		data from past studies. However, the final VoLL estimate used is lower than the average VoLL, as it is obtained by applying weights of 0.18 and 0.15 on the median VoLL of only the residential and small C&I groups respectively, in order to reflect the VoLL of the market segment that values uninterrupted service least.		

*Singapore dollar equivalents are rounded to nearest dollar and approximated at the exchange rates: AUD$1/S$1.3459; €1/S$1.6966; NZ$1/S$1.0303; PHP$100/S$2.9871; US$1/S$1.2950, as at 4 January 2012.

A brief scan of the usage of VoLL within each market shows up significant differences across the surveyed jurisdictions. Accordingly, the methodology employed and level of estimated VoLL also differs. While several markets have adopted supply-side calculations to estimate VoLL, leading to a very high price cap, these markets usually have either additional price mitigation measures to limit the duration of high prices (e.g. Australia), or low price caps that are delinked from VoLL (e.g. Ireland).

2.4 Impact of VoLL

As highlighted previously, VoLL sets the constraint violation penalty for deficit generation as well as other CVPs as follows:

Table 2: Violation penalties and price ceilings, expressed in multiples of VoLL

Products/ Constraints	Price ceiling (x VoLL)	Violation penalty (x VoLL)
Energy	0.9	1
Primary reserve	0.85	0.9
Secondary reserve	0.75	0.8
Contingency reserve	0.65	0.7
Regulation	0.06[8]	0.6
Line constraint	-	2.2
Security constraint	-	6
Facility constraint	-	20

With the current ratios unchanged, altering the figure for VoLL will not impact their relative priority. However, it would change the nominal values of the violation penalties and price ceilings, which could have a corresponding upward effect on the prices of energy, reserve and regulation.

[8] The initial regulation price ceiling was (0.6x VoLL), but was lowered to (0.06x VoLL) from 14 May 2009, after an EMA directed rule change, RC283: Revision of regulation price cap. Source: http://www.emcsg.com/f127,12270/183902_MS283_Final_.pdf

3. Analysis

The following section presents various arguments for and against raising VoLL, and evaluates their applicability to SWEM.

3.1 Economic estimate of VoLL

Using the current method of VoLL estimation (i.e. GDP/Energy Consumed), the estimated VoLL figures over the past few years are tabulated in Table 3 below.

Table 3: Revised VoLL using the economic estimate[9], from 2004 – 2010

Year	GDP at current market price (S$m)[10]	Load settled through SWEM (GWh)	Embedded load (GWh)[11]	VoLL = ——— (S$/MWh)
2004	190,484	32,805	2,976	5,324
2005	208,764	35,628	2,976	5,408
2006	230,923	36,724	2,976	5,817
2007	267,254	38,311	2,514	6,546
2008	267,952	38,900	2,184	6,522
2009	266,659	39,040	2,184	6,469
2010	303,652	42,522	2,184	6,792

*Figures correct to nearest whole number

At first glance, it appears justifiable to increase VoLL to a level of about $6500/MWh, though not to a value of $10,000/MWh as originally proposed. However, as raising VoLL could have significant implication on other market outcomes, the ensuing sections will extend the analysis to examine these effects.

3.2 Incentive for investment

Since there are no capacity payments in SWEM, all generation facilities recover their fixed costs exclusively through revenue from energy and ancillary services earned during periods when the clearing price is above their marginal costs[12]. In periods when supply is scarce, prices rise above marginal operating costs to include a "scarcity premium". These premiums allow both base-load and peaking plants to recover contributions towards their fixed costs.

Given its strong linkage with the respective price caps, VoLL thus plays a crucial role in influencing the price signals that guide generation investment and ensure supply

[9] This calculation follows the methodology proposed in Annex 6 of the concept paper, CP17: Modelling of Multi-unit Contingency Risk. Source: http://www.emcsg.com/f770,54072/CP_17_Modeling_of_Multi-unit_Contingency_Risk_publication_with_TL_comment_clean.pdf

[10] Figures obtained from: Singapore Department of Statistics (17 Feb 2011), http://www.singstat.gov.sg/stats/themes/economy/hist/gdp2.html

[11] Embedded load figures assume that embedded generators were generating 75% of the time. Based on "The Electricity (Electricity Generation and Retail Licence) (Exemption) Order (O1)", 452.9MW of embedded generation were exempt from participating in the SWEM from 1 Jan 2002 to 31 May 2007. With effect from 1 June 2007, based on "The Electricity (Electricity Generation and Retail Licence) (Exemption) Order 2007", 332.4MW of embedded generation is currently exempted from participating in the SWEM.

[12] Assuming an un-contracted generator. For contracted generators, they will recover their fixed costs from the contract strike price that is above its marginal costs.

adequacy. In the following sections, we will examine how VoLL may impact base-load and peaking plant investments differently.

Peaking Plants

For energy-only markets without capacity payments, VoLL will strongly influence peaking plant investments as these plants run only a few hours per year, and rely almost entirely on price spikes for the bulk of their revenue. Hence, an oft-cited argument is that if there is a need to incentivise more peaking plants in the system, then VoLL should be adjusted upwards to incentivise their investments.

However, the current methodology of computing VoLL using the economic estimate is not meant to incentivize peaking plant investments explicitly. As such, given the frequency that peaking plants are running (in SWEM's context, the peaking plants are open cycle gas turbines, OCGTs, which ran approximately 0.02% of the time in 2011), even adjusting VoLL to $6500/MWh is not enough to attract new entrants. For instance, the three OCGT units in SWEM received average gross revenues of $1.90m per unit in 2011. Even if VoLL were increased to $6500 (and the energy price cap increased to $5850), their average revenue would rise to $2.25m. This is not enough to cover the estimated annual fixed operating and maintenance costs of between $3.56m to $5.54m for an OCGT unit[13] and associated variable costs (e.g. fuel).

As such, increasing VoLL to $6500/MWh using the economic estimate is unlikely to have any impact on attracting new peaking plant investments.

Base-load Plants

In contrast, investment decisions for base-load plants are driven more by long-term considerations such as the average spot price over time, rather than the number and extent of price spikes. To quantify the impact of raising VoLL, Table 4 estimates the impact on average prices corresponding to a higher VoLL of $6500/MWh.

Table 4: Impact of increasing VoLL to $6500/MWh on average prices[14]

Products	Current VoLL ($5000/MWh)	VoLL at $6500/MWh	Percentage Change
USEP	$230.99	$231.91	0.40%
Primary Reserve	$0.43	$0.43	0.00%
Secondary Reserve	$3.31	$3.31	0.00%
Contingency Reserve	$23.18	$23.96	3.35%
Regulation	$76.51	$77.71	1.57%

The impact of increasing VoLL on average prices was estimated by zooming in on periods where the finalised prices for any of the products reached its respective price ceiling, and increasing these prices from the current price ceiling to the revised one pegged to a higher VoLL of $6500/MWh. Based on this static simulation, average prices do not change significantly.

[13] Estimates for fixed operating and maintenance costs include the costs for machine maintenance and staffing, and are obtained from: Page 26, Parsons Brinckerhoff (2011). *Electricity generation cost model - 2011 Update Revision 1*. An exchange rate of £1/S$1.978 were used.

[14] Using finalised prices from June to November 2011, and adjusting prices for periods where the respective price caps of the products were reached, to the new price caps based on VoLL at $6500/MWh while keeping the ratio to VoLL unchanged (i.e. the price ceilings of energy, primary reserve, secondary reserve, contingency reserve and regulation were raised to $5850, $5525, $4875, $4225 and $390 respectively).

On one hand, the simulation could overestimate the price changes arising from the MCE's co-optimisation effect (e.g. instead of scheduling more expensive contingency reserve, the MCE could schedule generating units in a way to reduce the procurement requirement for contingency reserve). On the other, the raising of VoLL and spill-over effect on price ceilings could lead to changes in bidding behaviour which is indeterminate.

Given the healthy supply margin and prospective new generation investments in Singapore, there is no need to incentivise base load plants at the current moment[15] by raising VoLL. In any case, doing so would have minimal impact on their investment driver (i.e. average spot price), as evident from Table 4.

3.3 Risk

A higher VoLL (and price ceiling) could increase the risks faced by key stakeholders, which in turn increases the cost of risk premiums charged (e.g. for fixed price retail contracts for contestable consumers).

Essentially, a higher VoLL/price ceiling could lead to more extreme price spikes during periods of price volatility. For gencos or retailers contracted at fixed or fuel-indexed prices, they would be subjected to higher financial risks if they were unable to cover their contract positions (for instance, when out on planned maintenance or forced outages). They would in turn charge higher risk premiums when pricing fixed or fuel-indexed contracts.

3.4 Market concentration

In competitive markets, it is efficient not to impose price caps. As such, in the market design paper[16], PHB Hagler Bailly had recommended uncapped energy prices for the SWEM although in practice, for technical computation reasons, the price will be capped at a specified large number reflecting the cost of shortage if the system was unable to satisfy load, i.e. VoLL. However, when the market does not clear, the price for energy is theoretically indeterminate and in reality, sellers have unlimited market power. In fact, the greatest drawback of VoLL pricing is the strong incentives it provides for the exercise of market power (Stoft, 2002)[17].

Although SWEM's market concentration has improved in recent years, it is still relatively high with the Herfindahl-Hirschman Index (HHI) at 2430 (based on generation installed capacity, as at September 2011). Taking into account indicative new plantings in the years ahead, the HHI is expected to fall to approximately 2381 and 2222 in years 2012 and 2013 respectively. In all cases, the HHI is above the threshold of 1800 which delineates a highly concentrated market[18].

[15] According to EMA's Statement of Opportunities (2011), disregarding indicative new generation capacity over the next few years, the regulatory minimum reserve margin of 30 per cent will be breached only in year 2018.

[16] Page 7 of the memorandum titled 'Wholesale Market Design' by PHB Hagler Bailly, 2 August 2000.

[17] VoLL pricing describes the practice of setting the price of energy in the spot market to VoLL whenever load is shed. Reference: Stoft (2002). Chapter 2-5: Value-of-lost-load pricing.

[18] According to the United States Federal Trade Commission/ Department of Justice Merger Guidelines, a HHI above 1800 corresponds to a concentrated market.

In view of SWEM's market concentration, there is a need to consider the possible changes to bidding behaviour in response to a higher price cap should VoLL increase. In particular, the following factors should be considered:

- **Hockey Stick Pricing** – This describes offer prices that ramp up steeply beyond a given quantity threshold, and which are unlikely to be reflective of the true marginal costs of production. With a higher price ceiling, the effect could be more pronounced, leading to clearing prices that are not indicative of underlying true demand and supply. And while vesting contracts are in place to control the exercise of market power, they can be circumvented if there is collusion in the market.
- **Weak Demand Response** – For markets with developed demand response programs, consumers can respond to price spikes by curtailing consumption, effectively interacting with suppliers on an equal footing. Given that Singapore is bereft of such demand response initiatives, there is a case for a more conservative price ceiling to protect consumers from extreme price spikes.

Overall, given the weak justification of attracting more investments, coupled with concerns over market concentration and increased risk premiums imposing additional costs on consumers, there does not appear to be strong support to increase VoLL at this moment.

4. Conclusion

To sum up, based on the current paradigm of estimating VoLL using GDP divided by energy consumed, there is justification to increase VoLL to $6500/MWh (and correspondingly raise price ceilings).

However, when considering the proposal holistically, a higher VoLL does not appear warranted at present for the following reasons:

- Raising VoLL to the economic estimate level is not meant to, and is found to be inadequate in, incentivising investment in peaking plants.
- There is currently no compelling need to incentivize investment in base load generation plants.
- A higher VoLL could raise the level of risk in the market and resultantly increase risk premiums charged on retail and bilateral contracts.
- The market is expected to remain fairly concentrated in the foreseeable future. Coupled with weak demand responsiveness, a higher VoLL/price ceiling could render consumers to become vulnerable to more extreme price spikes in the spot market.

5. Industry consultation

We published the concept paper for consultation on 20 January 2012 and received the following feedback:

Comments from the Power System Operator (PSO)

EMA's consultant, PricewaterhouseCoopers, reported in 2007 that a change in price cap level likely to have only a small change in the pattern of prices and possibly on contracting risk. The vesting contracts and the current price cap result in appropriate signals for investment in new plants and support the sustainability of the NEMS. Hence, the decision not to increase VoLL.

EMC's response

We note PSO's comments.

Comments from Tuas Power Supply

The market is working well with the current VoLL level. We support EMC's recommendation to hold off the proposed change.

EMC's response

We note Tuas Power's comments.

Comments from Senoko

Senoko supports updating the VoLL using the existing market design principle. A correctly specified VoLL will incentivise peaking plant (including maintenance and operation of existing units) as well as contribute to the enhancement of demand response and price risk management mechanisms.

EMC's response

While there is justification to increase VoLL to $6500 based on the existing methodology, the methodology was not designed to incentivise peaking plants. As analysed in section 3.2, the revenue earned by peaking plants, even if VoLL was raised to $6500, remains insufficient to cover their annual fixed maintenance and operating costs. And while a higher VoLL could encourage more price risk management mechanisms, it would do this possibly at the expense of a higher risk premium charged.

Key comments from Diamond Energy (Comments reproduced verbatim in Annex 1)

We suggest that a more appropriate estimate of VoLL would be to exclude the load of embedded generators which have been granted an exemption from market participation by the EMA. This equates to an estimated VoLL for 2010 of S$7141/MWh.

We note EMC's comment in the consultation paper "the methodology adopted to estimate VoLL was not designed to explicitly incentivize peaking plant investments" and therefore recommend that VoLL be increased to S$7100/MWh.

The market surveillance and monitoring capability of the MSCP is sufficient to safeguard the interests of consumers. Moreover, vesting contracts, which were introduced in 2004, curbed the potential exercise of market power in the NEMS.

A regular review of VoLL is encouraged to ensure that it appropriately reflects the current economic environment.

EMC's response

The economic estimate of VoLL, which is calculated by dividing GDP by total load, proxies the cost of power supply interruptions to the average consumer. The loads of embedded generators constitute part of the total load in Singapore, regardless of whether they are exempted from participating in the market. Hence, EMC disagrees with Diamond Energy's suggestion to exclude embedded loads from the calculation of VoLL.

We agree with Diamond Energy's suggestion for a regular review of VoLL, but suggest that this be done only when there are other conditions in place (e.g. when there are improvements in market concentration, demand response or risk management mechanisms) to complement the existing surveillance and monitoring framework.

6. Recommendation

EMC recommends **holding the proposal to raise VoLL in abeyance** until such time when there is (1) a lower level of market concentration, (2) more demand response initiatives, and/or (3) better risk management mechanisms that could mitigate the effects of a higher VoLL.

7. Decision at the 60th RCP meeting

At the 60th RCP meeting, the Panel by majority vote decided **not to support** the proposal to increase VoLL.

The details of the voting outcome are as follows:

Those who voted not to increase VoLL:

1.	Mr. Toh Seong Wah	Representative of EMC
2.	Mr. Michael Wong	Representatives of Retail Electricity Licensee
3.	Mr. Phillip Tan	Person experienced in Financial Matters in Singapore
4.	Dr. Toh Mun Heng	Representative of Consumers of Electricity in Singapore
5.	Mr. Lawrence Lee	Representative of the market support services licensees
6.	Mr. Pak-Juan Koe	Representatives of Generation Licensee
7.	Mr. Daniel Lee	Representatives of Generation Licensee
8.	Mr. Kng Meng Hwee	Representatives of the Power System Operator

Those who voted to increase VoLL:

1.	Mr. Luke Peacocke	Representatives of Generation Licensee
2.	Mr. Dallon Kay	Representative of Wholesale Electricity Trader

Those who abstained:

1.	Mr. Chan Hung Kwan	Representative of Transmission Licensee

References

1. Leahy, E., & Tol, R.S.J. (2011). An estimate of the value of lost load for Ireland. *Energy Policy, 39*, 1514-1520.
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4. van der Welle, A., & van der Zwaan, B. (2007). *An overview of selected studies on the value of lost load*. Energy research centre of the Netherlands, Policy Studies Department working paper.
5. Willis, K.G., & Garrod, G.D. (1997). Electricity supply reliability – estimating the value of lost load. *Energy Policy, 25*(1), 97-103.

Annex 1 – Comments received from Diamond Energy

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20th February 2012

Energy Market Company Pte Ltd
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Attention: Ms. Lucia Loh

Subject: Review of the Value of Lost Load (RCP Paper No: EMC/RCP/XX/2012/CP38)

Dear Ms. Loh,

I refer to RCP Paper No: EMC/RCP/XX/2012/CP38 which was released to industry for consultation.

NEMS was established in 2003 and the Value of Lost Load ("VoLL") has not been reviewed since market start. As NEMS is currently in the 10th year of operation, the review of VoLL is timely and overdue considering the Ministry of Trade and Industry's Energy System Review Committee recommended a review of VoLL back in 2005.

We suggest that a more appropriate estimate of VoLL would be to exclude the load of embedded generators which have been granted an exemption from market participation by the EMA. This equates to an estimated VoLL for 2010 of 7,141 S$ per MWh.

We note EMC's comment in the consultation paper "the methodology adopted to estimate VoLL was not designed to explicitly incentivize peaking plant investments" and therefore recommend that VoLL be increased to 7,100 S$ per MWh.

The market surveillance and monitoring capability of the MSCP is sufficient to safeguard the interests of consumers. Moreover, vesting contracts which were introduced in 2004, curb the potential exercise of market power in NEMS.

A regular review of VoLL is encouraged to ensure that it appropriately reflects the current economic environment.

Yours faithfully,

Rozaiman Rosidi

COMPANY REGISTRATION NUMBER
200208266G