



DRAFT DETERMINATION

REVIEW OF THE PARAMETERS FOR SETTING VESTING PRICE FOR THE PERIOD 1 JANUARY 2010 TO 31 DECEMBER 2010

Closing date for submissions of comments and feedback:
30 Sep 2009

Note: There will be no extension of deadline beyond 30 Sep 2009, 5 pm

9 SEP 2009 | ENERGY MARKET AUTHORITY
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1 Introduction

1.1 Energy Market Authority (“EMA”) had on 24th Jun 2009, published the Consultation Paper on the Review of Vesting Parameters for Setting Vesting Price for the Period 1 January 2010 to 31 December 2010. EMA has carefully considered the feedback it has received and as a result, has made further revisions to the vesting parameters as set out in this Draft Determination.

1.2 EMA has also engaged a consultant to review the LRMC adjustment indices that are used to scale the vesting parameters for each quarter¹. The proposed methodology is in Part C Section 1 of this Draft Determination. There are benefits in applying the proposed methodology as soon as practicable. Hence, EMA’s intention is to apply the new methodology for indexation of the vesting parameters from 1st quarter 2010 onwards.

¹ Refer to Section 3.8 of Vesting Contracts Procedures

2 Timeline

The timeline for this review is shown in the following table:

Date	Item
24 Jun 2009	EMA published consultation paper
3 Jul 2009	Plenary session between EMA and industry/consumers on consultation paper
17 Jul 2009	Deadline for submission of comments to the consultation
9 Sep 2009	EMA publishes draft determination
Week of 22 Sep 2009	Plenary session between EMA and industry/consumers on the draft determination
30 Sep 2009	Deadline for submission of comments to the draft determination
20 Oct 2009	EMA issues final determination

EMA invites comments and feedback to the draft determination. Please submit all feedback, in writing, to Mr Ang Zi Kai (ang_zi_kai@ema.gov.sg) or Mr Eugene Toh (eugene_toh@ema.gov.sg).

Alternatively, you may send the submissions by post/fax to:

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Please note that any anonymous submissions will not be considered. EMA reserves the right to make public all or parts of any written submissions made in response to this Draft Determination and to disclose the identity of the source. Any part of the submission, which is considered by respondents to be confidential, should be clearly marked and placed as an annex. EMA will take this into account regarding disclosure of the information submitted.

Review of the Parameters for Setting Vesting Price for the Period 1 January 2010 to 31 December 2010 – Draft Determination

Part A

1 Review of the WACC parameters

1.1 In this review, EMA has used March 2009 as the base month. All available market data up to 31 March 2009 would be used in the review of the parameters (including both the parameters for the weighted cost of capital (WACC parameters) and the technical parameters (Part B of this paper)). March 2009 was chosen as the base month because this was the latest month where data for all parameters used for this review was available at the start of the review process.

1.2 EMA takes the Capital Asset Pricing Model (“CAPM”) approach to estimate the WACC of the capital investment. The formula is as follows:

$$WACC = [g \times (r_f + DP)(1 - t)] + \{(1 - g)[r_f + \beta(r_m - r_f)]\}$$

Where:

r_f	is the risk-free rate
DP	is the debt premium
r_m	is the market rate of return
$(r_m - r_f)$	is the market risk premium (MRP);
β (equity)	is the measure of the sensitivity of the company’s returns to market returns;
g	is the proportion of debt to total assets;
t	is the corporate tax rate

1.3 For each review, EMA would review the values of and methods used to estimate:

- the risk-free rate
- the credit rating to calculate the debt premium
- the applicable corporate tax rate
- the proportion of debt to total assets
- the equity beta
- the market risk premium

Response to feedback

SembCorp Cogen asked if June 2009 can be used as the base month, and would like to know what other parameters would not be available for June by the date of determination. EMA clarifies that March 2009 was selected as the base month because it was the latest month where data for most of the parameters used for this review was available at the start of the review process and that EMA had not received other objections to using March 2009 as the base month. EMA intends to use March 2009 as the base month for this review, and would further clarify that for subsequent reviews of the vesting parameters i.e. for reviews of the vesting parameters for Jan 2011 and beyond, instead of using one month as the Base Month, EMA intends to use a 3-month period as the “Base Month”. See Part C of this paper for more details.

2 Selection of comparator companies

2.1 EMA selected the comparator companies from publicly listed electric utility companies² which satisfy the selection criteria set out below.

2.2 Selection Criteria

- 1. The company operates principally (i.e. the company has the majority of its businesses) in developed economies that have similar risk characteristics as Singapore.**

The market equity beta of a company is affected by the country risk of the countries in which the company operates.

- 2. Availability of market and financial data of the company for the last 5 years.**

² Comprises all listed utility companies that are in the Bloomberg database as of 31 March 2009.

The most recent 5 years of market and financial data is a good balance between using recent data and having a sufficiently long period to allow the averaging of the likely effect of economic cycles on the financial ratios of a company.

3. *The company should be in good financial health.*

The market and financial data of companies with significant or frequent operation losses or in financial distress would not reflect the average risks an efficient new entrant would face, or the sustainable long-term financial ratio of the generation investment.

4. *The majority of the company's income should be from its non-regulated generation business.*

The risk associated with the uncertainty in revenue from the generation business would be reflected in the market equity beta of the comparator company.

5. *The company's generation portfolio should have a majority of fossil fuels based generation.*

The risk associated with the fossil fuel price risk would be reflected in the market equity beta of the comparator company.

2.4 Appendices 1 and 2 show the list of companies that satisfied the selection criteria and the relevant financial data of the companies respectively. For this review, EMA has removed a criterion used in previous determinations that the equity beta of a comparator has to be more than 1. The reason for the removal is that the link between the equity beta and the business risk of the entrant is indirect as the equity beta is an end-function of the asset beta and financial leverage of a company. Also, market evidence shows that companies with significant interests in generation businesses can have a low gearing level and thus an equity beta less than 1.

Response to feedback

SembCorp Cogen commented that companies with majority coal-fired plants in their generation portfolio should also be excluded as appropriate comparator companies as this technology is not available in Singapore. EMA clarifies that coal-fired plants and gas-fired CCGTs faces comparable risk such as the fuel price risk. Further, the potential new entrant's gas-fired CCGTs are likely to serve as base-load plants and hence would face similar competitive risk in the market as companies with majority coal-fired plants which also serve as base-load plants.

Senoko Power, PowerSeraya and SembCorp Cogen commented that they were surprised that EMA is revising the criteria for the selection of the comparator companies and requested the review to be postponed to the next vesting review for 2011 – 2012 such that sufficient time would be available for a comprehensive study of the methodology.

EMA notes that it had informed the industry in the final determination of last review in Nov 2008 that EMA would be reviewing the criteria for the selection of the comparator companies in view of the general concern that the previous set of criteria has led to identifying only one comparator and that having just one comparator may make the estimates of the cost of capital less reliable.

Senoko Power and PowerSeraya commented that it is inappropriate to determine the applicable beta for the entrant based on the comparator companies which have large, diversified portfolios. They requested a previous criterion that comparator companies are to have an equity beta more than 1 to be reinstated. However, EMA points out that the link between the equity beta and the business risk of the entrant is indirect as the equity beta is an end-function of the asset beta and financial leverage of a company. EMA also notes that empirical evidence does not show that companies with large, diversified portfolios will have lower asset betas than an efficient entrant which would be running at base-load. As such, a criterion based on the equity beta would not be appropriate.

PowerSeraya added that there is a reasonable case to have a threshold of the comparator companies to have a minimum equity beta in the absence of an asset beta threshold to remove overly low equity beta outliers. PowerSeraya pointed out that the asset betas of NRG Energy and International Power, which have equity betas higher than 1, are higher than the asset betas of Allegheny Energy and Transalta Corporation. EMA agrees with the opinion that data outliers should be reviewed whether they are appropriate for use. While the asset betas of Edison SpA (0.546) and NRG (0.661) may be of some deviation, the remaining 3 comparator companies have asset betas very close to the average of 0.602³. EMA has cross-checked that the slight increase in asset beta from the previous review (0.581) is reasonable in the current market.

3 Risk free rate

3.1 EMA used the yield to maturity of the “AAA” rated Singapore Government Securities whose time to maturity would closest match the term of the generation investment as the proxy for the risk free rate in Singapore.

3.2 At this moment, the furthest dated bond is the 20 year NZ07100S, which was issued in 2007 and would mature in Mar 2027. The average daily closing yield of this bond for the Base Month of Mar 2009 was 3.02% (refer to Appendix 3).

Response to feedback

There was no feedback on the risk free rate.

4 Proportion of debt to total assets

4.1 EMA used the average proportion of debt to total assets⁴ for the comparator companies of 0.456 to proxy for proportion of debt to total assets for the entrant.

³ The asset beta for International Power was corrected for a calculation discrepancy, and the average asset beta is adjusted accordingly.

⁴ The debt-to-equity for International Power was corrected for a calculation discrepancy, and the average proportion of debt to total assets is adjusted accordingly.

Response to feedback

There was no feedback on the proportion of debt to total assets

5 Credit rating and debt premium

5.1 EMA has used a credit rating of BBB- to set the debt premium. This is one-notch higher than the BB+ assumed in the previous review of the WACC parameters. In Standard and Poor's (S&P)'s nomenclature, BBB- is considered investment grade and BB+ is non-investment grade.

5.2 Since the unfolding of the subprime crisis and financial risk posed by sub-investment grade entities, EMA has reviewed whether it is appropriate to continue using the BB+ debt premium to proxy the debt premium for the entrant. Power generation is an important and capital intensive infrastructure investment in Singapore. A generation company with non-investment grade credit rating would suggest that the company is facing adverse business conditions which could lead to it being unable to meet its financial obligation. EMA's assessment is that it would be more appropriate to consider the entrant to be of minimum investment grade. We also note that this is consistent with that used by regulators in other jurisdictions. For example, the debt premium used by the Ireland's Commission for Energy Regulation in its recently concluded consultation on the Best New Entrant plant was based on the BBB debt premium.

5.3 Based on the above considerations, the debt premium for the setting of the vesting price is 464bps. This is obtained by taking the difference between the average of the daily yield of the Bloomberg Fair Value US Utility BBB- 20yr Index⁵

⁵ The Bloomberg Fair Value US Utility BBB- 20yr Index represents the average bond yields issued by utility companies having credit ratings of BBB- from S&P, Moody's, Fitch and/or DBRS of 20 years' maturity.

(8.84%) and the Moody's Baa Utility Bond Index⁶ (8.00%), and the yield on the 20-yr U.S. Treasury bond⁷ (3.78%) for March 2009 (see [Appendix 3](#)).

Response to feedback

Senoko Power, PowerSeraya and Tuas Power commented that the "backward induction" method was an inappropriate and incomplete method to determine the credit rating of the entrant. They do not support the methodology and request that a more robust approach using more sophisticated models or engaging a financial consultant to assess the likely credit rating of the entrant.

Senoko Power and PowerSeraya commented that it is not correct to determine applicable debt premiums based on comparator companies which represent much larger and more diversified portfolios. They requested EMA to revert to using a BB+ rating for the entrant as in the previous review. Senoko Power added that EMA has claimed, without basis, that a major new capital investment project must have a minimum investment grade credit rating of BBB- just because non-investment grade bonds carry a significant premium in the existing debt market. Senoko Power commented that EMA has disregarded that fact that the investment grade comparator companies have long term PPAs and support from parent companies. Since a single-asset new entrant without contract cover or support from parent companies would never attain an investment grade status under such challenging circumstances, the debt premium should reflect the dramatic deterioration in the debt markets since the last review.

EMA clarifies that assessing the required debt premium to finance a generation investment in Singapore requires an element of benchmarking and comparative assessment. EMA has not only relied on comparing the likely level of gearing and the risk matrices described by the credit rating agencies, the credit rating used to proxy the debt premium is also consistent with that used by regulators

⁶ The Moody's Baa Utility Bond Index represents the average bond yields issued by utility companies having credit ratings from Baa1 to Baa3. The minimum maturity for the bonds in this index is 20 years.

⁷ Information of the Federal Reserve Treasury Bond is available at <http://www.federalreserve.gov/releases/h15/data.htm>

and consultants around the world to derive estimates of the cost of capital for regulatory purposes.

In response to the feedback on the change from using the BB+ debt premium to the BBB- debt premium, EMA clarifies that since the unfolding of the subprime crisis, and the significant changes in the credit markets, it is necessary for EMA to assess whether we need to modify the previous approach to estimating the cost of debt finance. EMA has made this decision based on the following considerations: (1), the assumption that the entrant is of non-investment grade would not be consistent with EMA's regulatory practices to monitor and minimise the default risk of power generation companies; (2), in the context of the current credit market, an entrant of non-investment grade would struggle to find financing in the debt market, and hence would not be sufficiently competitive to be considered as the most efficient entrant and (3), the cost of debt determined based on the assumption of the new entrant being of minimum investment grade is consistent with that used by other regulators.

In relation to the points made on the comparator companies having larger and more diversified portfolios and whether the entrant would benefit from a relationship with a strong parent company or long-term contractual protections, it is important to bear in mind that a large proportion of the investment in power generation of this scale (about 800MW) is undertaken by companies that are already active in the power industry. To achieve a high degree of stability in cash flows, it is to the entrant's beneficial interests to enter into medium to long-term PPAs. EMA views that it is possible for the entrant to earn stable streams of revenue by securing long term agreements with retailers or large consumers. Having such financial support from parent companies and achieving stability in cash flows is part of the entrant's consideration to achieve investment grade financing.

Senoko Power, PowerSeraya and SembCorp Cogen questioned why EMA changed the source to find the debt spread from bondsonline.com that was used in previous review. EMA clarifies that the data from bondsonline.com was a snapshot of the debt spread for a particular day whereas the data from Moody's can be collected over the entire Base Month. In this draft determination, EMA has

supplemented Moody's data with data from Bloomberg to get a more robust estimate of the debt spread. EMA has also assessed that the average debt spread from Bloomberg and Moody is comparable with the data from bondsonline.com.

6 Tax Rate

6.1 As announced by the Ministry of Finance on 22 January 2009, the corporate income tax rate will be reduced to 17% from Year of Assessment 2010. Hence, the tax rate applicable for the purpose of calculating the vesting price is 17%.

Response to feedback

There was no feedback on the tax rate.

7 Equity Beta

7.1 The equity beta measures the standardised correlation between the returns of the entrant and that of the market. In essence, it represents the sensitivity of the firm's long-term returns relative to that of the market as a whole.

7.2 To calculate the proxy equity beta for the new entrant, the average asset beta⁸ (0.602) is re-levered using the debt-to-equity ratio (0.838) and the corporate income tax rate for Singapore (17%) by the following formula:

$$\beta_{equity-adjusted} = \beta_{asset} * \left(1 + (1 - T_c) * \frac{D}{E} \right)$$

The proxy equity beta for the entrant is determined to be 1.020. EMA has cross-checked this proxy equity beta with that of the MSCI World Electric Utilities Index⁹ of 0.796. The higher proxy equity beta compared to that of the MSCI World Electric Utilities Index is a reasonable reflection that a generation company without regulated returns would have a higher business risk.

⁸ See Appendix 2 for the average asset beta and average debt-to-equity ratio of the comparator companies

⁹ The MSCI World Electric Utilities index has an equity beta of 0.796 regressed against the MSCI World Index.

Response to feedback

Senoko Power commented that a higher equity beta should be expected since most asset classes risk premiums have increased in recent months. EMA is of the view this opinion may not be entirely correct. EMA has noted that the asset beta has increased in this review from 0.581 to 0.602, but the influence in the equity beta may not be direct because companies would generally have reduced their financial leverage.

8 Market Risk Premium

8.1 The Market Risk Premium (MRP) represents the expected return over the risk free rate that investors require in order to invest in a well-diversified portfolio of risky assets.

8.2 To estimate Singapore's MRP, EMA has taken into consideration (1) the difference between the expected long-run market return in Singapore, based on the forward-looking Dividend Growth Model approach,¹⁰ and the risk free rate; (2) the MRP determined by regulators in Australia¹¹ and UK and (3) the MRP used by Singapore listed companies such as SembCorp Industries, Keppel Corporation and Capitaland¹².

8.3 As the MRP is a long-run forward looking parameter, EMA assessed the risk premium to remain as 7% as in the previous review.

Response to feedback

There was no feedback on the market risk premium.

¹⁰ The expected market return in Singapore is 9.822%. The equivalent MRP is 6.806% (Source: Bloomberg)

¹¹ Australia Energy Regulator used the MRP of 6% for the review on WACC parameters completed in December 2008.

¹² The 3 listed companies mentioned used MRPs of 5% to 6% in the financial reports for 2009.

9 WACC

9.1 A summary of the WACC parameters is as follows:

Risk-free rate	3.02%
Debt premium	464bps
Tax rate	17%
After-tax cost of debt	6.35%
Equity beta	1.020
Market risk premium	7%
Cost of equity	10.16%
Gearing	0.456
Post tax nominal WACC	8.42% ¹³

9.2 The WACC of 8.42% is also used in the calculation of the Technical Parameters (see Part B of this paper).

¹³ The final WACC to be applied is rounded off to 2 decimal places. 5 significant figures are used for intermediate calculations in the WACC parameters.

Part B

1 This section summarises the technical parameters. KEMA Netherlands B.V. has assisted EMA in the review of the technical parameters for setting the vesting price for the period 1 Jan 2010 to 31 Dec 2010. KEMA's final report and KEMA's responses to industry participants' comments to KEMA's draft report are circulated together with this draft determination.

Generating Technology

2 Currently the most efficient technology that accounts for at least 25% of the system demand in Singapore is the 'F' class technology of the combined cycle gas turbine ("CCGT"). In the determination of the vesting price, EMA considers the entrant will have a plant size of 2 CCGTs units of 400MW each (ISO-rated). The costs of common items such as land, site development and basic infrastructure to support the operation of the CCGT would be shared between the 2 plants.

Response to feedback

Four of the respondents raised concerns on the appropriateness of using the Mitsubishi generation units as one of the units used to proxy the plant characteristics. The respondents commented that the Mitsubishi unit has clear differences in the plant characteristics (i.e. size, and associated cost economies and heat rate performance) from the other 3 Type F CCGT units. Taking into considerations some respondents' comments, KEMA had removed the Mitsubishi unit for calculating the Capital Cost and Heat Rate of the proxy generation unit for this review. However, EMA also notes KEMA's suggestion that the Mitsubishi generation unit can be considered for further reviews.

Capacity per generating unit

3 Taking into account typical energy losses, local air temperature, local air pressure, local cooling water temperature, ageing of plant and compressor fouling,

the achievable effective plant capacity in Singapore for a 'F' class CCGT (based on ISO rating capacity of 400 MW) would be 359 MW.

Heat Rate

4 The heat rate of 7,084 Btu/kWh is used for the proxy plant. This is the simple average of the heat rates of the modeling results in KEMA's report over 20 years (with refurbishment). It takes into account the average plant heat rate on site, the impact of ageing, part load, number of starts, lifetime extension and reserve allocation, as well as adjustment for house loads.

Response to feedback

The heat rate for the proxy plant is remodeled to be 7,084Btu/kWh from 7,047Btu/kWh with the removal of the Mitsubishi generation unit as one of the proxy units.

Build Duration

5 The build duration of the proxy plant is taken to be 30 months.

Economic Life

6 The economic life of the proxy plant is set at 20 years.

Plant Factor

7 The plant factor is set at 73%, based on the actual performance of the "F" class CCGTs in operation in the system (Senoko CCP 3 to 5, Seraya CCP1 and CCP2, Tuas CCP 1 to 4) over the preceding 12 months up to the Base Month (Apr 2008 to Mar 2009) and checked to be achievable for the period of review, i.e. Jan to Dec 2010.

Capital cost

8 The capital cost includes the cost of purchasing the plant and all associated equipment, including the cost of delivery of the plant in a state suitable for installation in Singapore. The total capital cost for 1 unit of 400MW CCGT is \$353.6 million, comprising of:

- Single gaseous fuel plant \$336.67 million
- Dual fuel hot switching capability \$9.99 million
- Transport cost \$6.93 million

Response to feedback

The capital cost for the proxy plant is recalculated to be \$353.6 million from \$351.8 million with the removal of the Mitsubishi generation unit as one of the proxy units.

Land and site preparation cost

9 The total land and site preparation cost for each 400 MW unit is \$61.1 million, comprising of:

- Land lease cost, water front fees and land preparation \$12.67 million
- Ancillary buildings, demineralization plant, seawater intake/outfall structures, constructing the jetty for emergency fuel unloading facility, and gas receiving facilities \$27.50 million
- Emergency fuel facilities \$20.90 million

Connection and installation cost

10 The total connection and installation cost for each 400 MW unit is \$108.0 million, comprising of:

- Connection charge based on standard connection charge (\$50,000 per MW) and cost of 230kV switchgear \$34.09 million
- Civil works for the plans, erection and assembly, detailed engineering and start-up costs, as well as contractor soft costs \$73.86 million

Other costs

11 Other costs for each 400 MW unit is \$27.6 million, comprising the following:

- Consultant's fees for basic engineering studies, legal and financial advice \$9.50 million
- Owners' manpower cost up to and including contract award, owners' manpower cost during construction, taxes and insurance during construction, and purchased electricity, water and fuel during construction \$10.29 million
- Reinvestment Cost after 12 operating years to extend the lifetime of the plant \$7.78 million

Fixed Annual Running Cost

12 The fixed annual running cost includes the maintenance, operating and overhead costs that are incurred annually to keep the plant in a ready state for supplying energy and reserves.

13 The fixed annual running cost for one unit of 400MW CCGT is \$37.9 million per annum comprising of:

- Manpower and overheads \$8.96 million
- Carrying cost for backup fuel \$5.29 million
- Maintenance \$23.61 million

Variable Non-Fuel Cost

14 The variable non-fuel cost, estimated at \$1.16/MWh, includes the costs, other than fuel costs, that vary with the level of energy output. This comprises \$0.3126/MWh for EMC charges, \$0.2244/MWh for PSO charges, \$0.1675/MWh for the average annual license fees paid by the proxy plant and \$0.4513/MWh for consumables (specifically water and chemicals).

Summary of Technical Parameters

	LRMC Review for 2010	LRMC Review for 2009
Capacity per generating unit (MW)	359	359
HHV Heat Rate (Btu/kWh)	7084	7085
Build Duration (months)	30	30
Plant Factor	73%	74%
Capital Cost (S\$million)	353.6	325.1
Land, Infrastructure and Development Cost (S\$million)	196.6	208
Fixed Annual Running Cost (S\$million/year)	37.9	41.0
Variable Non-fuel Cost (S\$/MWh)	1.16	1.05
Nominal post tax WACC (from Part A)	8.42%	9.25%
Vesting Price ¹⁴ (S\$/MWh)	144.44	146.62

¹⁴ Based on gas price of S\$12.808/GJ used for 3rd quarter 2009's vesting price

Part C

1 Review of LRMC Scale Factor Indices

1.1 EMA has engaged KEMA to review the existing methodology of scaling the LRMC base parameters to derive the non-fuel component for each quarterly vesting price. In particular, the review was to assess whether the Domestic Supply Price Index (DSPI) and the Consumer Price Index (CPI) were appropriate indices as proxies for the capital cost and overhead cost indices, and whether the extrapolation method to approximate the relevant costs for the quarter in review was reflective of the actual cost the gencos face. KEMA's draft report on the indexation methodology is circulated together with this Draft Determination.

1.2 An extensive review of the various costs for constructing a power plant is conducted biennially. KEMA's recommendation is that for the purpose of scaling the base cost parameters to derive the quarterly vesting price, the Power Generation Machinery index (PGMI), a sub-index under the DSPI, can be used as a suitable single proxy. EMA agrees with KEMA's recommendation. The PGMI reflects the local cost of imported materials related to power generation. Unlike the DSPI, the PGMI is not exposed to the volatility in the price of crude oil and other related products. For the purpose of scaling the overhead cost in deriving the quarterly vesting prices, EMA also concurs with KEMA's recommendation to continue to use the CPI as the proxy. The CPI is a commonly used measure of inflation in most jurisdictions and is a fair reflection of operating costs changes under local conditions.

1.3 EMA also agrees with KEMA's recommendation to use the latest available data for indexation purposes i.e. (d-1) quarter's data will be used for indexation purposes in determining the vesting price for quarter d+1. For example, EMA will use the PGMI and CPI for the months of July, August and September 2009 for the determination of the vesting price for Q1 2010. The revised scaling indices in this example would be as follows:

$$\begin{aligned} \text{Capital Cost Index}_{d+1} &= \frac{PGMI(d-1)}{PGMI(B)} \\ &= \frac{PGMI(\text{Jul, Aug, Sep } 09)}{PGMI(\text{Mar } 07)} \end{aligned}$$

$$\begin{aligned} \text{Overhead Cost Index}_{d+1} &= \frac{CPI(d-1)}{CPI(B)} \\ &= \frac{CPI(\text{Jul, Aug, Sep } 09)}{CPI(\text{Mar } 09)} \end{aligned}$$

where B is the Base Month of the biennial review

1.4 EMA is of the view that the above changes would better reflect the changes in the cost of generation in between each biennial review. Hence, EMA intends to apply the new methodology for indexation for the vesting price from 1st quarter 2010 onwards. Table 2 below illustrates the effect when applying the change to the LRMC scale factor indices. The vesting price using the updated parameters and the proposed indexation would be higher in most quarters in 2009 compared with the current parameters and indexation. However, EMA also notes from KEMA's report that the vesting price using the proposed indexation would be more reflective of the costs of a genco in Singapore.

Table 2: Quarterly vesting price with change in LRMC scale factor indices

Non-fuel Vesting Price	Current parameters under current indexation	Updated parameters using proposed indexation
Base Parameters	\$50.84/MWh ¹⁵	\$48.67/MWh
Q1 2009	\$50.67/MWh	\$45.39/MWh
Q2 2009	\$38.95/MWh	\$46.44/MWh
Q3 2009	\$43.14/MWh	\$48.37/MWh
Q4 2009	\$46.44/MWh	\$47.48/MWh

2 Change in Data Source for 3 month forward exchange rate

2.1 In the consultation paper, EMA has proposed to change the data source for US\$/S\$ 3-month forward exchange rate from the rates published by the Association

¹⁵ From Oct 2008 review

of Banks in Singapore (ABS) in Reuters to the rates published by Bloomberg BGN. This is to minimize the risk of input errors in calculating the US\$/S\$ 3-month forward exchange rate, which under the current method is inherent due to constraints of the Reuters system. The Bloomberg source would also allow industry participants to easily verify the US\$/S\$ 3-month forward exchange rate used in the calculation of the vesting price at retrospect. As part of the assessment for the suitability of the Bloomberg BGN source, EMA has also found no statistical difference between the rates quoted at ABS or BGN over the period 1 July 2007 to 15 June 2009. Hence the change to using the rates quoted by BGN is a refinement of EMA's data collection procedures.

Response to feedback

PowerSeraya and SembCorp Cogen are concerned that the fixing time that Bloomberg uses for the SGD spot is approximately 4am Singapore time which is low in liquidity and the timing at which it is fixed is not suitable for Asian trading hours. EMA has clarified with Bloomberg and understand that the Bloomberg algorithm respects local market trading hours i.e. if a particular currency pair trades more actively only when the local market is open, Bloomberg will adjust to take more weights from the contributions during those hours even if the fixing time does not coincide with the local market trading hours.

PowerSeraya claims to observe a significant difference between the ABS and Bloomberg rates. SembCorp Cogen commented that it is possible to do retrospective extraction of historical data on ABS and provided the relevant tickers and method to extract the data and was also concerned that the Bloomberg rates would have offshore rates which would be an additional source of uncertainty, in contrast with using the conventional ABS rates that has been widely accepted for referencing.

EMA points out that PowerSeraya has not used the (ask) US\$/S\$ spot rates and the (ask) 3-month swap points from Bloomberg when comparing with the ABS rates. In addition, it would also not be appropriate to claim for significant difference by using a small sample size of only 12 data points. While EMA acknowledges that the Bloomberg rates may include offshore quotes, EMA's statistical test of the rates

quoted at ABS and BGN over the period 1 July 2007 to 15 June 2009 showed that there was no statistical difference between the rates. In response to SembCorp Cogen's comment, EMA had also checked that the retrospective extraction of the ABS data given by SembCorp would have given the (mid) US\$/S\$ spot rates, but this is not the same data as the (ask) US\$/S\$ spot rates under the current methodology.

2.6 EMA's assessment is that the change in data source will not have a significant impact on the vesting price, but will largely address the risk of having input errors when calculating the US\$/S\$ exchange rate. As such, EMA will move towards using US\$/S\$ 3-month forward exchange rate from Bloomberg BGN for calculating the vesting price from 1Q 2010.

3 Review of Methodology to LRMC parameters: Duration of data

3.1 As indicated in the consultation report, EMA intends to increase the number of months from which data is taken to set the "Base Month" from one month to three months. This is to minimize the volatility as certain parameters can be highly dependent on the choice of the base month. As there is no objection from the industry, EMA will use 3 months of data to set the "Base Month" for determining the following parameters for future reviews:

- a. Exchange rate to convert the costs denominated in foreign currencies into Singapore Dollars;
- b. Diesel price to calculate cost of carrying fuel;
- c. Risk-free rate;
- d. Debt premium to calculate cost of debt;
- e. Consumer Price Index;
- f. Power Generation Machinery Index;
- g. Imported Iron & Steel Index.

List of comparator companies

Allegheny Energy, Inc – Allegheny is an integrated energy business that owns and operates electricity generation facilities and delivers electric services to customers in Eastern United States. It has a generation portfolio of 9,730 MW, of which 8,588 MW is fossil fuels based. 82% of Allegheny's net income in 2008 is derived from non-regulated generation business.

Edison SpA – Edison is an Italy-based energy operator that produces, imports and sells electric power and hydrocarbons. It has a generation portfolio of 12,070 MW, of which 10,074 MW is fossil fuels based. 81% of Edison's EBITDA in 2008 is derived from electric power operations, where 74% of the electricity is sold to the deregulated market.

International Power plc – International Power is an independent power generator that operates in Europe, North America and Australasia. It has a generation portfolio of 21,358MW in operation, of which 87% is fossil fuels based. 60% of the capacity operates in merchant markets or under short-term contracts.

NRG Energy – NRG is a wholesale power generation company operating throughout the United States. It has a generation portfolio of 24,200 MW, of which 21,750 MW is fossil fuels based.

Transalta Corporation – Transalta is a wholesale power generator and marketer operating in the western regions of Canada, United States and Australia. It has a generation portfolio of 8,432 MW, of which 7,081 MW is fossil fuels based.

Appendix 2

Financial data of comparator companies

Company	Adjusted equity beta ¹⁶	Market debt-to-equity ratio (D/E)	Debt/EBITDA	CFO/Debt	Tax Rate ¹⁷	Asset Beta ¹⁸	Total debt/Capital ¹⁹	S&P Rating	Credit
Allegheny Energy, Inc	0.945	0.937	4.257	0.196	39.3%	0.602	0.484	BBB- (since 8/5/07)	
Edison SpA	0.770	0.599	3.130	0.240	31.4%	0.546	0.375	BBB+ (since 21/5/08)	
International Power plc	1.063	1.079	8.630	0.087	28%	0.598	0.519	BB- (since 11/9/07)	
NRG Energy, Inc	1.115	1.130	5.048	0.110	39.3%	0.661	0.530	BB- (since 22/5/09)	
Transalta Corporation	0.837	0.592	2.966	0.247	30%	0.601	0.372	BBB (since 15/10/08)	
Average						0.602	0.456		

Source: Bloomberg and Standard and Poor's

¹⁶ Adjusted equity beta is calculated using the Blume formula: $\beta_{equity-adjusted} = (0.67) * \beta_{equity-raw} + (0.33) * 1.0$

¹⁷ The marginal tax rate for Edison SpA, International Power and Transalta Corporation are obtained from the relevant companies' 2009 financial reports. The average US tax rates from <http://www.taxfoundation.org/publications/show/22917.html> is used for Allegheny Energy and NRG Energy as they have business operations in different states in United States.

¹⁸ Asset beta is calculated by $\beta_{asset} = \beta_{equity-adjusted} * \left(1 + (1 - T_c) * \frac{D}{E} \right)$

¹⁹ Total debt/capital is calculated by $\frac{D}{E} / \left(1 + \frac{D}{E} \right)$

Appendix 3

Interest rate and yield data

Date	SGS NZ07100S (Note 1)	Moody's Baa Utility Bond Index (Note 2)	BFV US Utility BBB- 20yr Index (Note 3)	Fed H.15 Constant Maturity 20yr (Note 4)
2/3/2009	3.06	7.8	7.88	3.89
3/3/2009	3	7.87	7.84	3.92
4/3/2009	3	7.89	8.25	3.96
5/3/2009	2.99	7.74	8.16	3.76
6/3/2009	2.94	7.75	8.30	3.74
9/3/2009	2.97	7.86	8.41	3.83
10/3/2009	3.04	8	8.62	3.94
11/3/2009	3.05	7.97	9.06	3.88
12/3/2009	3.01	7.95	8.89	3.82
13/3/2009	3.04	8	9.01	3.84
16/3/2009	3.04	8.09	9.13	3.93
17/3/2009	3.05	8.2	9.44	3.99
18/3/2009	3.07	7.97	9.10	3.65
19/3/2009	3.02	8.03	9.10	3.64
20/3/2009	3.06	8.1	9.26	3.67
23/3/2009	3.04	8.14	9.25	3.7
24/3/2009	3.02	8.06	9.27	3.64
25/3/2009	3.01	8.18	9.25	3.76
26/3/2009	3.01	8.11	9.14	3.69
27/3/2009	3	8.09	9.11	3.66
30/3/2009	2.95	8.07	9.06	3.64
31/3/2009	2.98	8.04	8.95	3.61
Average	3.016	7.996	8.840	3.780

Source: MAS and Bloomberg

Notes

(1) Singapore Government 20 year bond "NZ07100S", which was issued in 2007 and would mature in Mar 2027.

(2) The Moody's Baa Utility Bond Index represents the average bond yields issued by utility companies having credit ratings from Baa1 to Baa3. The minimum maturity for the bonds in this index is 20 years. Moody's Baa is the equivalent rating to S&P's BBB-.

(3) The Bloomberg Fair Value US Utility BBB- 20yr Index represents the average bond yields issued by utility companies having credit ratings of BBB- from S&P, Moody's, Fitch and/or DBRS of 20 years' maturity.

(4) 20 year US Federal Reserve Treasury Bond.