REVIEW OF VESTING CONTRACT PRICE PARAMETERS FOR THE PERIOD 1 JAN 2015 TO 31 DEC 2016

FINAL DETERMINATION PAPER

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1. INTRODUCTION

1.1. The Energy Market Authority ("EMA") implemented vesting contracts on 1 January 2004. The objective of vesting contracts is to mitigate the exercise of market power by the generation companies ('gencos') in the wholesale electricity market. Vesting contracts mandate a specified amount of electricity (viz. the vesting contract level) to be hedged at a specified price (viz. the vesting contract price), which in turn removes the incentives for gencos to exercise their market power by withholding their generation capacity to push up spot prices in the wholesale electricity market.

1.2. The vesting contract price is set based on the long run marginal cost ("LRMC") of the most efficient generation technology that accounts for at least 25% of the system demand in Singapore. The most efficient technology at present is the F-class combined cycle gas turbine ("CCGT"). EMA reviews and sets the vesting contract price parameters biennially or when necessary in accordance with the published *EMA's Procedures for Calculating the Components of the Vesting Contracts* ("Procedures").

1.3. EMA has engaged PA Consulting Group Pte Ltd ("PA") and Sinclair Knight Merz ("SKM") to assist in the review of the vesting contract price parameters for the period 1 Jan 2015 to 31 Dec 2016. On 25 Jul 2014, EMA issued a draft determination paper to which 3 gencos (viz. PacificLight Power, Senoko Energy and YTL PowerSeraya) responded. EMA's responses to their comments are set out in ***Appendix A***.

1.4. This paper sets out EMA's final determination on the LRMC parameters to set the vesting contract price for the period 1 Jan 2015 to 31 Dec 2016 after taking into consideration all the comments and feedback received.

2. BASE MONTH

2.1. EMA has used May 2014 as the *Base Month* to determine the following parameters to set the vesting contract price for the period 1 Jan 2015 to 31 Dec 2016:

a. Exchange rate to convert costs denominated in foreign currencies to Singapore dollars;

b. Diesel price to calculate the cost of holding emergency fuel inventories;

c. Risk-free rate;

d. Debt premium to calculate the cost of debt; and

e. Core inflation index published by the Monetary Authority of Singapore ("MAS").

2.2. The above parameters are set by averaging over the three-month period leading up to and including the Base Month i.e. Mar 2014 to May 2014.

3. WEIGHTED AVERAGE COST OF CAPITAL ("WACC")

3.1. The following formula based on the Capital Asset Pricing Model ("CAPM") is used to determine the post-tax nominal WACC for a new entrant:

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

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 rate of return;
g	is the level of gearing i.e. debt as a proportion of total assets; and

t is the corporate tax rate.

Risk-Free Rate

3.2. Following the 18 Dec 2013 press release by the US Federal Open Market Committee ("FOMC")[1], the financial markets have adjusted and bond yields have stabilised. As such, it is appropriate to use current yields of the "AAA" rated Singapore Government Bond ("SGB") as a proxy for the risk-free rate for 2015-2016.

3.3. Consistent with the previous determination, EMA has adopted the SGB with the longest tenure closest to the lifespan of the relevant asset, specifically the 20-year SGB "NZ13100V" which was issued in 2013 and maturing on 1 September 2033. Based on the average daily closing yields during the three-month period from Mar 2014 to May 2014, the risk-free rate is 3.08% (refer to ***Appendix B*** for the closing yields).

Debt Premium and Cost of Debt

3.4. Consistent with previous reviews, EMA estimates the cost of debt taking into account the average yield to maturity of investment grade rated "Baa" bonds in Moody's Bond Indices for the utility sector and also relevant market information.

3.5. The debt premium, based on the average yield to maturity of the said bonds *less* the average yield of the US Government 30-year bond for the same period, is 1.33% as shown in ***Appendix C***. Accordingly, the pre-tax cost of debt is 4.41% (debt premium of 1.33% plus risk-free rate of 3.08%).

3.6. EMA recognises that the 4.41% figure is too low. Instead of applying the formula rigidly, we looked for other relevant market benchmarks to determine the debt premium. The market information provided by our consultants and the industry suggests a cost of debt of between 5% and 6%. Taking a balanced view of these references, EMA has adjusted the cost of debt to 5.5% which implies a debt premium of 242 bps above the risk-free rate of 3.08%.

[1] FOMC's press release: *http://www.federalreserve.gov/newsevents/press/monetary/20131218a.htm*

Gearing

3.7. EMA has selected comparator companies based on a set of selection criteria which are similar to the selection criteria adopted in the previous review. The selection criteria and the list of comparator companies are set out in ***Appendix D***.[2]

3.8. Consistent with the previous review[3], EMA has determined the gearing parameter at 0.50 based on the median of the average debt-to-equity ratios of the comparator companies. The ratios are averaged over 4 years from 2010 to 2013. 2009 data is not included to avoid distorting the estimate of the gearing parameter, as many companies increased their short-term debt during the global financial crisis.

Equity Beta

3.9. The equity beta derived based on the comparator companies' R-squared weighted unlevered beta of 0.39 is 0.71. Given the expectation that the returns for Generation Licensees in Singapore would be closely correlated with general economic returns, EMA has adjusted the equity beta to 1.00. This adjustment is consistent with the approach used for the 2011/2012 and 2013/2014 determinations. Details of the comparator companies' gearing and beta are set out in ***Appendix E***.

Market Risk Premium ("MRP")

3.10. EMA has considered the various approaches to derive the MRP, including historical and also forward looking methodologies for Singapore and similar jurisdictions. Taking a balanced view of the range of MRPs derived under the different approaches, EMA will set the MRP at 6.0% (refer to ***Appendix F*** for details).

Tax Rate

3.11. The tax rate is 17% which is the corporate tax rate in Singapore.

[2] For this review, PA has removed three comparator companies which were used in the previous review viz. Great Plains Energy Incorporated, American Electric Power Co. Inc, and Iberdrola SA. Great Plains Energy Incorporated and American Electric Power Co. Inc did not meet the "source of revenue" criteria i.e. the bulk of the company's revenue does not come from non-regulated generation activities, whereas Iberdrola SA did not meet the "location of business" criteria i.e. majority of their revenue comes from Spain and Latin America.

[3] In the previous review, EMA had set the gearing parameter using the 2-year average debt-to-equity ratios of the comparators, instead of the 5-year average, taking into consideration the financial turmoil which only stabilised by mid-2010.

4. TECHNICAL PARAMETERS

Generating Technology

4.1. Currently, the most efficient generation technology that accounts for at least 25% of the system demand in Singapore is the F-class CCGT.

Capacity per generating unit

4.2. A new entrant is assumed to install two units of CCGTs. Taking into account the effects of degradation due to fouling, erosion and material losses in the turbine section, local air temperature and conditions, and allowance for gas compression, the achievable effective plant capacity in Singapore for an F-class CCGT is 386.7 MW.

Higher Heating Value ("HHV") Heat Rate

4.3. The HHV heat rate of the CCGTs is 7103.8 Btu/kWh after taking into account the effects of degradation, local air temperature and conditions, part-loading factor, start-up gas usage, and adjustments for gas compressor.

Build Duration

4.4. The build duration is 30 months.

Economic Lifetime

4.5. The economic lifetime of the CCGTs is 24 years.

Plant Load Factor

4.6. The plant load factor is set at 64.4% based on the actual performance of existing F-class CCGTs in operation in our system (i.e. Senoko Energy's CCP 3 to 7, YTL PowerSeraya's CCP 1 to 4, Tuas Power Generation's CCP 1 to 5, Keppel's CCP 3 and 4, and PacificLight Power's CCP 1 and 2) over the period Jun 2013 to May 2014, and checked to be achievable for 2015 and 2016. Station load has been subtracted to determine the plant load factor.

Investment Cost

Capital Cost

4.7. 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 one CCGT unit is $455.7 million comprising:

a. Turnkey Engineering, Procurement and Construction ("EPC") cost:[4] $447.4 million

b. Discounted through-life capital cost: $8.3 million

Land and Site Preparation Cost

4.8. The total land and site preparation cost for one CCGT unit is $21.2 million comprising:

a. Land lease cost and waterfront fees: $20.1 million

b. Land preparation cost: $1.1 million

Connection Cost

4.9. The total connection cost for one CCGT unit is $44.8 million comprising:

a. Electrical connection cost including standard connection charge payable to SPPG ($50,000 per MW), switchgear GIS and underground cable: $37.5 million

b. Gas connection cost: $7.3 million

Miscellaneous costs

4.10. The total miscellaneous cost for one CCGT unit is $85.3 million comprising:[5]

a. Owner's costs after financial close including engineering, initial spares, start-up costs and construction related insurance: $55.7 million

b. Owner's costs prior to financial closure including

[4] The EPC costs include the cost for specialised equipment, mechanical and electrical engineering, gas compressors, jetty and fuel tanks.

[5] Figures do not add up due to rounding.

permits, licence fees, legal and financial advice services, engineering and in-house costs: $29.5 million

Non-Fuel Operating Costs

Fixed Annual Running Cost

4.11. The fixed annual running cost includes the operating and overhead costs that are incurred to have the plant available to supply energy and reserves, and do not vary with the level of energy output. The fixed annual running cost for one CCGT unit is $23.8 million per annum comprising:

a. Manpower and allowance for head office services: $4.3 million

b. Emergency fuel usage: $1.1 million

c. Fixed maintenance and other fixed operations including start-up impact on turbine maintenance, and distillate usage on turbine maintenance: $8.6 million

d. Working Capital: [6] $6.9 million

e. Insurance, property tax and EMA licence fee: $2.9 million

Variable Non-Fuel Cost

4.12. The variable non-fuel cost includes costs, other than fuel costs, that vary with the level of energy output. The variable non-fuel cost for one unit of CCGT is $6.56/MWh comprising:[7]

a. Long term service agreement ('LTSA') for maintenance of gas turbine and steam turbine: $5.13/MWh

b. EMC, PSO and EMA licence fees: $0.70/MWh

c. Consumables (chemicals and town water): $0.73/MWh

[6] The working capital costs include the costs of holding emergency fuel inventories, which is currently based on EMA's requirement on gencos to maintain a 45-day backup fuel stockpile onsite with exclusive right of use, and an additional 45-day backup fuel stockpile offsite with first right of use by the gencos.

[7] Figures do not add up due to rounding.

5. SUMMARY OF EMA'S FINAL DETERMINATION ON THE VESTING CONTRACT PRICE PARAMETERS FOR THE PERIOD 1 JAN 2015 TO 31 DEC 2016

WACC Parameters	2013-2014	2015-2016
Risk-free rate (%)	2.41	3.08
Debt Premium (%)	2.59	2.42
Gearing	0.497	0.50
Equity Beta	1.00	1.00
Market Risk Premium (%)	6.0	6.0
Corporate Tax Rate (%)	17.0	17.0
Post-tax nominal WACC (%)	**6.29**	**6.82**

Technical Parameters	Biennial review for 2014-15	Mid-term review for 2014-15	Biennial review for 2015-16
Base Month	May 2012	May 2013	May 2014
Capacity per generating unit (MW)	382.1	382.1	386.7
HHV heat rate (Btu/kWh)	7103.4	7103.4	7103.8
Build duration (months)	30	30	30
Economic lifetime (years)	22.0	22.0	24.0
Plant load factor (%)	67.3	67.3	64.4
Capital cost (S$ million) • Turnkey EPC cost • Discounted through-life capital cost	479.5	465.2	455.7
Land, infrastructure & development Cost (S$ million) • Land & site preparation cost • Connection cost • Miscellaneous costs	150.2	151.6	151.3
Fixed annual running cost (S$ million/year)	23.5	23.5	23.8
Variable non-fuel cost (S$/MWh)	6.42	6.42	6.56

	1 Jan 2013 to 31 Dec 2013	1 Jan 2014 to 31 Dec 2014	1 Jan 2015 to 31 Dec 2015
Vesting Contract Price ($/MWh)	193.80	193.50	194.55 *
Non-Fuel Component ($/MWh)	45.51	45.20	46.25
Fuel Component ($/MWh)*	148.30	148.30	148.30 *

* *Based on gas price of SS$19.44/GJ and regasified LNG price of S$20.24/GJ for Mar-May 2014.*

6. PRICING PLATFORMS FOR HIGH SULPHUR FUEL OIL 180 CST ("HSFO")

6.1 Under the current methodology, EMA calculates the daily average price of the quarterly forward fuel oil swaps by averaging the prices published by the InterContinental Exchange ("ICE") and Platts respectively.

6.2 With effect from 1 Jan 2015, EMA will discontinue the use of the ICE platform and only use Platts to obtain the HSFO price for setting the vesting price. The Procedures will be amended as shown in ***Appendix G***.

7. BALANCE VESTING PRICE FORMULA

7.1 Currently, EMA determines the fuel cost component of the Balance Vesting Price ("BVP") using the gas price which is calculated based on the average of the gas prices under the three major contracts for the supply of piped natural gas ("PNG") from Malaysia and Indonesia (Sumatra and West Natuna). There is a need to modify the computation of BVP to include LNG contracts, so that the fuel cost component is more reflective of the gas contracts available for commercial power generation.

7.2 With effect from 1 Apr 2015, EMA will calculate the fuel cost component of the BVP based on the weighted average gas price under the gas supply contracts (both PNG and regasified LNG) for commercial power generation, *excluding* the following contracts:

a. regasified LNG in relation to the LNG vesting scheme;

b. gas supply for non-commercial power generation or industrial use;

c. LNG spot cargo and short-term annual quantities ("STAQ"),

d. LNG for commissioning the LNG terminal; or

e. any gas contract with annual contracted quantity of *less than* 60,000 tonnes per annum.

7.3 To set the BVP for each calendar quarter (starting with Q2 2015), EMA will calculate the weighted average gas price based on the daily contract quantities ("DCQ") under the relevant gas supply contracts for commercial power generation using CCGTs. EMA will continue to use the relevant fuel price and exchange rate data, where available, for every Singapore business day in the preceding quarter up to the 15th calendar day of the 3rd month in the preceding quarter. To facilitate gencos' hedging activities:

a. EMA will, *no later than 20th Dec of each year* ('Y'), inform gencos of the proportion of gas quantities, and the corresponding fuel price index and exchange rates, under the relevant contracts as described in paragraph 7.2.

b. EMA will only consider the relevant contracts:

   i. Commencing no later than 15th Dec of year 'Y'; and

   ii. Covering at least 6 months during the period from the beginning of Q2 of year 'Y+1' till the end of Q1 of year 'Y+2'.

c. The proportion will be fixed from the beginning of Q2 of year 'Y+1' till the end of Q1 of year 'Y+2'.

RESPONSE TO COMMENTS ON DRAFT DETERMINATION PAPER

Financial Parameters

Parameter	Comments	EMA's Response
Overall WACC	**Senoko Energy:** We would like to reiterate our position that the WACC parameters retained in the Draft Determination, and the resulting level of WACC, cannot be considered a realistic estimate of the cost of capital for a new entrant generator in the Singapore merchant market. This is particularly so, given the electricity market demand/supply balance that is forecast for the review period. We believe that the comments we have outlined before remain valid, including: • the inappropriateness of the selection of certain comparator companies, • the invalidity of the "implied investment grade rating" approach, • the inconsistency in the methods used to determine the assumptions for the gearing level and debt premium respectively, • the inconsistency in approaches used to determine estimates for Risk Free Rate and Market Risk Premium, and • the lack of consideration for actual (project finance based) debt cost of a new entrant.	EMA disagrees with Senoko's comment that the WACC parameters in the Draft Determination Paper "*cannot be considered a realistic estimate of the cost of capital for a new entrant generator*" in Singapore. In determining the WACC parameters, EMA has used relevant market information provided by our consultants and the industry, and applied a consistent methodology as previous reviews in accordance with the published Procedures. The revised WACC of 6.82% (up from 6.29%) is a fair reflection of the cost of capital that a new entrant will face.

Parameter	Comments	EMA's Response
Debt premium	**YTL PowerSeraya:** The debt premium of 242 bps appears to be low given that the theoretical new entrant would be facing a market with a significant capacity oversupply. We also note that one of the comparator companies, Calpine Corp has an S&P credit rating of only B+ with such credit ratings correlated with significantly higher debt premiums than 242bps. The debt premium has been determined on the basis of 20 year debt. The assumption of 20 year debt financing is consistent with an economic life of 20 years. If the economic life were to be more than 20 years, then the debt premium should be based on debt with tenure of more than 20 years. Data for debt with a tenure of 20 years can still be used but with an upward adjustment to the debt premium to reflect tenure of more than 20 years.	Consistent with the previous review, EMA has estimated the cost of debt taking into account the average yield to maturity of investment grade rated "Baa" bonds in Moody's Bond Indices for the utility sector and also market information. The debt premium, based on the average yield to maturity of the said bonds *less* the average yield of the corresponding US Government bond for the same period is 1.33%. Accordingly, the pre-tax cost of debt is 4.41% (debt premium of 1.33% plus risk-free rate of 3.08%). The market information provided by our consultants and the industry suggests a cost of debt of between 5% and 6%. Taking a balanced view of all these data points, EMA has adjusted the cost of debt to 5.5%.
Debt premium	**Senoko Energy:** As indicated in our earlier response, we have retained a consultant to review the debt premium, who concluded that the cost of debt should range between 5.7% and 6.0%, which is higher than EMA's draft determination.	Consistent with previous review, EMA has estimated the cost of debt taking into account the average yield to maturity of investment grade rated "Baa" bonds in Moody's Bond Indices for the utility sector and also market information. The debt premium, based on the average yield to maturity of the said bonds *less* the average yield of the corresponding US Government bond for the same period is 1.33%. Accordingly, the pre-tax cost of debt is 4.41% (debt premium of 1.33% plus risk-free rate of 3.08%). The market information provided by our consultants and the industry (including Senoko's consultant) suggests a

Parameter	Comments	EMA's Response
		cost of debt of between 5% and 6%. Taking a balanced view of all these data points, EMA has adjusted the cost of debt to 5.5%.
Risk-free rate	**Senoko Energy:** With the increase in economic lifetime, we believe that the appropriate SGB to be referenced for the Risk Free Rate should be NA12100N, as its remaining tenure is a closer match to the calculated economic life span of the new entrant, compared to NZ13100V.	The risk-free rate is determined based on the current yields of the "AAA" rated Singapore Government Bond ("SGB"). Consistent with the previous review, EMA has adopted the SGB with the longest tenure closest to the lifespan of the relevant asset, specifically the 20-year SGB "NZ13100V" which was issued in 2013 and maturing on 1 September 2033.
Comparator companies	**YTL PowerSeraya:** We note that one of the comparator companies Calpine Corp has a very high gearing ratio. High gearing ratios affect credit ratings adversely. We note that Calpine Corp has an S&P credit rating of only B+. If Calpine Corp is to be used as a comparator company for determining the gearing ratio, then the gearing ratio for Calpine Corp should be adjusted downwards taking into account its low credit rating or the debt premium adjusted upwards taking into account Calpine Corp's low credit rating. We note that the equity beta of one of the comparator companies, SSE plc happens to be very low. We view that it is because it is viewed mainly as a networks company as the bulk of its profits come from the network business We note that for one of the comparator companies, TransAlta Corporation, less than 50% of its power generation capacity is both fossil-fuel fired and merchant as from data in TransAlta	The comparator companies including Calpine Corp have been selected using a comprehensive set of selection criteria similar to those adopted in the previous review. More than 50% of SSE's revenues were earned through unregulated power activities. TransAlta has passed all the selection criteria. Nearly 6500 MW of its 8,453 MW generation assets were gas or coal-fired. Furthermore, its generation

Parameter	Comments	EMA's Response
	Corporation's Annual Report 2013. Looking at the same data, we find that PA Consulting's finding that 97% of TransAlta Corporation's revenue comes from merchant power activities looks less than accurate. We therefore ask that TransAlta Corporation be reviewed for suitability with respect to its inclusion as one of the comparator companies. We disagree with the exclusion of Drax as one of the comparator companies. An "unusually small amount of debt" is not a valid reason to exclude a company. Investors generally take on debt to improve the return to equity, taking on debt until rising marginal cost of debt has reached the point that further increases in debt would be expected to reduce the return on equity. The low level of debt of Drax can be seen as reflecting market conditions which prevent taking on more debt in such a way as to benefit equity holders.	revenue of CDN$1,900 million (out of CDN$2,292 million) were from coal- and oil-fired generation assets. PA has reviewed Drax's suitability as comparator company and reasonably maintains the view that Drax does not feature a risk profile or capital structure that is representative of the hypothetical market entrant in Singapore.

Technical Parameters

Parameter	Comments	EMA's Response
Economic life	**Senoko Energy:** The current methodology to calculate the economic life fails to consider the impact of increasing non-CCGT generation (such as renewables, demand response) on the economic life span of CCGT generation in Singapore.	The economic lifespan of a new entrant CCGT is determined based on the rate of improvement in the heat rate and real reductions in capex of newer plants over time. This methodology is consistent with that used in the previous review.
Economic life	**YTL PowerSeraya:** PA Consulting uses the concept of technical obsolescence for determining the economic life of the generation facilities of the theoretical new entrant. For the technical obsolescence method that PA Consulting uses, economic life is determined based on how long it takes for the LRMC of a new entrant generation facility to fall below the SRMC of the incumbent generation facility. Conceptually, this is meant to reflect how long it takes before retiring the incumbent generation facility (reducing costs) and replacing it with a new entrant generation facility (adding costs) would on a net basis allow for lower power generation costs. The use of SRMC is not correct as avoidable costs should be used instead which reflect the reduction in costs from retiring the incumbent generation facility. Avoidable costs include not just SRMC but also fixed opex. The use of technical obsolescence can be used to set an upper limit on an estimate of economic life but investors would be more conservative, taking into account the risks of regulatory and technological changes. Given that, an estimate of an economic life of 15-20 years is more in line with investor practices. For combined cycle plants, PPAs tend to range from 15-25 years in length, but due to the inherently greater revenue certainty tied to PPAs which generally guarantee a minimum	PA maintains the view that in practice, the use of non-sunk cost will underestimate the actual life of the generation facility, as a significant portion of the non-sunk costs can be stripped out by the owner over a time-frame of 2 to 3 years when faced with being forced out of the market. This is a reasonable position. There is also no basis for the lifespan of the generation facility to be limited by the duration of any PPA.

Parameter	Comments	EMA's Response
	take by the buyer, the length of PPAs reflects a longer economic life than in a merchant market.	
Air filters	**Senoko Energy:** We note that the EMA has considered the industry's feedback and included the cost of an additional set of air filters. However, the actual cost of procuring back up filters is significantly higher than the determined cost and at least $0.5M.	PA/SKM has calculated the cost of air filters based on real data provided by their customers who are CCGT owners.
Plant load factor	**Senoko Energy:** Additional 'F' class CCGTs have been included in the calculation of the plant load factor and we believe that these new CCGTs should not be added, as the capacity of these new additions are much higher than the capacity of the reference plant (370 MW).	Consistent with the previous review, the plant load factor is determined based on actual performance of all F-class CCGTs in operation in our system over the period Jun 2013 to May 2014, and checked to be achievable for 2015 and 2016.
Plant load factor	**PacificLight Power:** PLP note that the Plant Load Factor has been revised from 63.1% in PA's report dated 29 May 2014 to 64.4% in PA's latest report dated 25 July 2014. Could the EMA please clarify: • What historical date range has been used to calculate the PLF for both the May and July reports • That only operational plant has been included in the PLF calculation and not plant that was still under commissioning.	The plant load factor in PA's May 2014 and July 2014 reports was calculated based on the actual performance of all the F-class CCGTs in operation from Jan 2013 to Dec 2013, and Jun 2013 to May 2014 (i.e. the Base Month) respectively. Commissioning CCGTs were not included.

Parameter	Comments	EMA's Response
EPC/Capital Cost	**Senoko Energy:** As noted in our previous responses, we believe that it is necessary to validate the 'mechanical' link between EPC/capital costs and other cost categories. We do not believe that this methodology results in sound outcomes. If it is not possible to prove that these costs have fundamentally decreased, it would be appropriate that these items should remain at least constant. EMA's claim that it is an industry norm to treat these items as percentages of Capex does not address the fact that prudent practitioners would update the percentages if the movements in values appeared inconsistent.	It is the industry norm and also a practical approach to calculate EPC and other costs as a percentage of capex, as actual cost data is not available. This methodology of using percentages is consistent with the previous determination and is not unreasonable.

Review of Balance Vesting Price ("BVP") Formula

Comment	EMA's response
Senoko Energy: On the basis that the fuel cost component of the Allocated Vesting Price (weighted average of Balance Vesting Price and LNG Vesting Price) is currently more than sufficiently reflective of the diversity of gas contracts available for commercial generation, Senoko considers that amending the BVP gas price at this time does not bring significant additional benefits. Instead, it would make the BVP more difficult to hedge hence potentially exposing vested gencos to financial risk. If the proposed changes were to be implemented we request that the EMA provides a proxy formula establishing the relationship between the determined gas price and the underlying (oil and FX) indices. We do not believe that a generic formula reflecting the above would reveal confidential information.	The revision to the BVP formula will ensure that the fuel cost component is more reflective of the gas contracts available for commercial power generation in Singapore (as compared to using only the 3 PNG contracts before the revision). To set the BVP for each calendar quarter (starting with Q2 2015), EMA will calculate the weighted average gas price based on the daily contract quantities ("DCQ") under the relevant gas supply contracts for commercial power generation using CCGTs. EMA will continue to use the relevant fuel price and exchange rate data, where available, for every Singapore business day in the preceding quarter up to the 15th calendar day of the 3rd month in the preceding quarter. To facilitate gencos' hedging activities, EMA will inform gencos of the proportion of gas quantities, and the corresponding fuel price index and exchange rates, to be used for calculating the fuel cost component of the BVP for each calendar quarter starting with Q2 2015.

Comment	EMA's response
YTL PowerSeraya: We still do not agree with EMA's intention to calculate the fuel cost of the Balance Vesting Price based on a weighted average of the basket of gas supply contracts in Singapore (both PNG and LNG) available for commercial power generation and maintain our comments as sent on 19 June 2014 in response to EMA's Consultation Paper "REVIEW OF THE LONG RUN MARGINAL COST (LRMC) PARAMETERS FOR SETTING THE VESTING CONTRACT PRICE FOR THE PERIOD 1 JANUARY 2015 TO 31 DECEMBER 2016" dated 29 May 2014.	EMA had responded to Seraya's earlier comments in our Draft Determination Paper.

Appendix B

Determination of Risk-Free Rate Based on Average Yield of Singapore Government 20-Year Bond [8]

Yield on Singapore Government 20-Year Bond "NZ13100V" Issued in 2013 and Maturing 2033			
3/3/2014	3.17	4/16/2014	3.13
3/4/2014	3.13	4/17/2014	3.13
3/5/2014	3.15	4/18/2014	3.17
3/6/2014	3.13	4/21/2014	3.14
3/7/2014	3.14	4/23/2014	3.14
3/10/2014	3.16	4/24/2014	3.10
3/11/2014	3.19	4/25/2014	3.04
3/12/2014	3.18	4/28/2014	3.04
3/13/2014	3.17	4/29/2014	3.07
3/14/2014	3.11	5/1/2014	3.05
3/17/2014	3.11	5/2/2014	3.00
3/18/2014	3.09	5/5/2014	2.96
3/19/2014	3.08	5/6/2014	2.99
3/20/2014	3.10	5/7/2014	2.94
3/21/2014	3.11	5/8/2014	2.94
3/24/2014	3.12	5/9/2014	2.97
3/25/2014	3.09	5/12/2014	3.01
3/26/2014	3.09	5/14/2014	2.97
3/27/2014	3.09	5/15/2014	2.94
3/28/2014	3.10	5/16/2014	2.91
3/31/2014	3.15	5/19/2014	2.95
4/1/2014	3.16	5/20/2014	2.97
4/2/2014	3.17	5/21/2014	2.96
4/3/2014	3.19	5/22/2014	3.00
4/4/2014	3.19	5/23/2014	3.00
4/7/2014	3.17	5/26/2014	3.01
4/8/2014	3.17	5/27/2014	3.02
4/9/2014	3.17	5/28/2014	2.96
4/10/2014	3.16	5/29/2014	2.89
4/11/2014	3.16	5/30/2014	2.92
4/14/2014	3.13	**Average**	**3.08%**
4/15/2014	3.13		

[8] *Source: https://secure.sgs.gov.sg/fdanet/BenchmarkPricesAndYields.aspx*

Appendix C

Average Yield on US Govt 30-Year Bond & Moody's Bond Indices for Utilities[9]

Date	Baa	30 Year T-Bill	Date	Baa	30 Year T-Bill
3/3/2014	4.90	3.55	4/16/2014	4.78	3.45
3/4/2014	4.98	3.64	4/17/2014	4.83	3.52
3/5/2014	4.98	3.64	4/21/2014	4.85	3.52
3/6/2014	5.03	3.68	4/22/2014	4.82	3.50
3/7/2014	5.07	3.72	4/23/2014	4.79	3.47
3/10/2014	5.08	3.73	4/24/2014	4.78	3.46
3/11/2014	5.07	3.70	4/25/2014	4.75	3.45
3/12/2014	5.03	3.66	4/28/2014	4.77	3.47
3/13/2014	4.98	3.6	4/29/2014	4.80	3.49
3/14/2014	4.97	3.59	4/30/2014	4.77	3.47
3/17/2014	5.03	3.63	5/1/2014	4.70	3.41
3/18/2014	5.02	3.62	5/2/2014	4.67	3.37
3/19/2014	5.08	3.66	5/5/2014	4.72	3.41
3/20/2014	5.06	3.67	5/6/2014	4.69	3.38
3/21/2014	5.01	3.61	5/7/2014	4.71	3.40
3/24/2014	4.97	3.57	5/8/2014	4.72	3.45
3/25/2014	4.97	3.59	5/9/2014	4.76	3.47
3/26/2014	4.93	3.55	5/12/2014	4.79	3.49
3/27/2014	4.89	3.52	5/13/2014	4.75	3.45
3/28/2014	4.92	3.55	5/14/2014	4.67	3.37
3/31/2014	4.93	3.56	5/15/2014	4.64	3.33
4/1/2014	4.97	3.60	5/16/2014	4.64	3.34
4/2/2014	5.02	3.65	5/19/2014	4.68	3.39
4/3/2014	4.99	3.62	5/20/2014	4.67	3.38
4/4/2014	4.94	3.59	5/21/2014	4.72	3.42
4/7/2014	4.90	3.56	5/22/2014	4.73	3.43
4/8/2014	4.90	3.54	5/23/2014	4.70	3.4
4/9/2014	4.91	3.57	5/27/2014	4.67	3.37
4/10/2014	4.84	3.52	5/28/2014	4.59	3.29
4/11/2014	4.81	3.48	5/29/2014	4.61	3.31
4/14/2014	4.81	3.48	5/30/2014	4.62	3.33
4/15/2014	4.78	3.46	**Average**	**4.84**	**3.51**

Source:
Bloomberg
US Treasury Website (http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yield)

Debt Premium = 4.84 - 3.51 = 1.33%

[9] The Moody's Bond Indices represents the average bond yields issued by utility companies having similar credit ratings. The minimum maturity for the bonds in this index is 20 years. Source: Bloomberg

Appendix D

COMPARATOR COMPANIES

SELECTION CRITERIA

1. **Availability of Data** – Only companies with five years of publically available data are considered, to ensure averaging of information across sufficient years.

2. **Financial Health** – Companies that have experienced adverse financial health in the past five years are not considered. This includes any firm that had undergone a significant reorganisation, acquisition, or bankruptcy; or that had experienced significant losses or problems covering interest payments on debt. Companies in poor financial health are likely to have a different capital structure and risk profile to the hypothetical new entrant.

3. **Location of Business** – A company's equity beta and structure will be impacted by where it operates. For a company to be considered, the majority of its revenues had to be generated in countries with a similar risk profile to that of Singapore. Risk is proxied by a country's credit rating issued by either S&P, Moody's or Fitch.[10]

4. **Source of Revenues** – Only companies that earned the majority of their revenues through unregulated power activities were considered. Revenues coming from regulated sales or alternative lines of business such as natural gas sales are exposed to different risks and not directly comparable to merchant generation.

5. **Generation Type** – Companies without a majority of fossil-fired generation assets were not considered. All power companies are subjected to the effects of weather, fuel price uncertainty, and regulatory activity; however, those with a majority of fossil-fired assets will be affected differently than those with a majority of nuclear or renewables.

DESCRIPTION

6. **Calpine Corp (NYSE:CPN)**. Calpine Corporation generates more electricity than any other independent power producer in America, with a fleet of 93 power plants in operation or under construction, representing more than 28,000 megawatts of generation capacity. Serving customers in 20 states and Canada, Calpine specialises in developing, constructing, owning and operating power plants to generate power in an environmentally responsible manner. Its modern, flexible fleet is positioned to benefit from the secular trends affecting industry, including the affordable supply of clean natural gas, stricter

[10] Singapore receives the highest rating from all three agencies. For a country to be considered comparable, it must have received similarly high ratings from at least two of the three agencies. This list includes the United States, Canada, Australia and several European nations.

environmental regulation, aging power generation infrastructure and the increasing need for dispatchable power plants to successfully integrate intermittent renewables into a grid. Calpine focuses on competitive wholesale power markets and advocates for market-driven solutions that result in non-discriminatory forward price signals for investors.[11]

7. **SSE plc (LSE:SSE)**. SSE plc, through its subsidiaries, generates, transmits, distributes and supplies electricity in the United Kingdom and Ireland. It also produces, stores, distributes and supplies natural gas. The company operates through Networks, Retail, and Wholesale segments. As of March 31, 2013, the company owned or had ownership interest in approximately 13,000 megawatts of generation capacity. In addition, the company offers energy-related products and services such as micro-generation; supplying, installing, maintaining and reading meters in residential, commercial, industrial and generation sectors; domestic, commercial, industrial, mechanical and electrical contracting; and electrical and instrumentation engineering services. It is involved in energy portfolio management, electricity generation, and gas production and storage activities. The company was formerly known as Scottish and Southern Energy plc. and changed its name to SSE plc in October 2011. SSE plc. is based in Perth, the United Kingdom.[12]

8. **TransAlta Corp (TSX:TA)**. TransAlta is a power generation and wholesale marketing company focused on creating long-term shareholder value. TransAlta maintains a low-to-moderate risk profile by operating a highly contracted portfolio of assets in Canada, the United States and Australia. Its focus is to efficiently operate facilities in order to provide customers with a reliable, low-cost source of power. For over 100 years, TransAlta has been a responsible operator and a proud contributor to the communities in which it works and lives. TransAlta has been selected as one of Canada's Top 50 Socially Responsible Companies since 2009 and is recognized globally for its leadership on sustainability and corporate responsibility standards by FTSE4Good.[13]

[11] Source: SNL Financial as of 4/21/2014

[12] Source: Yahoo Finance as of 4/21/2014

[13] Source: SNL Financial as of 4/21/2014

Comparator Companies' Beta

	31/12/2010			31/12/2011			31/12/2012			31/12/2013			Gearing	Beta			
Comparable Companies	**Net Debt (SGD)**	**Total Equity (SGD)**	**D/E Ratio**	**Net Debt (SGD)**	**Total Equity (SGD)**	**D/E Ratio**	**Net Debt (SGD)**	**Total Equity (SGD)**	**D/E Ratio**	**Net Debt (SGD)**	**Total Equity (SGD)**	**D/E Ratio**	**4-year average D/E Ratio**	**Company Beta**	**Tax Rate**	**Unlevered Beta**	**R-square**
Calpine Corp	10,627	6,581	161%	10,745	7,735	139%	10,950	8,851	124%	11,241	8,649	130%	139%	0.93	35%	0.49	0.30
SSE plc	6,047	10,164	59%	5,606	13,091	43%	6,246	12,468	50%	6,349	16,101	39%	48%	0.35	23%	0.26	0.15
TransAlta Corp	4,235	4,556	93%	4,037	4,602	88%	4,217	4,044	104%	4,347	3,682	118%	101%	0.54	25%	0.31	0.14
Median of the 4-year average D/E Ratio	**101%**																
Median of the average 4-year gearing (D/(D+E))	**50%**																
R-squared weighted unlevered beta	**0.39**																
Relevered R-squared weighted beta based on median D/E	**0.71**																

Notes:
Figures shown in this table are calculated using information from Capital IQ and 2013 Annual Reports

MARKET RISK PREMIUM ("MRP")

Table 1: Summary of MRP for Singapore under different approaches

Approach	MRP
Historical MRP (arithmetic average)	6.00%
Historical MRP (geometric average)	4.30%
Volatility adjusted premium (arithmetic average)	5.78%
Volatility adjusted premium (geometric average)	4.14%
Forward looking dividend growth model [14]	6.75%
Overseas benchmarks (refer to ***Table 4***)	6.25%
Local benchmarks (refer to ***Table 5***)	5.50%

Table 2: Overseas historical MRP [15]

	Geometric Mean	Arithmetic Mean
Australia	5.60%	7.50%
New Zealand	3.70%	5.30%
UK	3.70%	5.00%
US	4.20%	6.20%
Average	**4.30%**	**6.00%**

Table 3: Overseas volatility adjusted premium [16]

	Geometric Mean	Arithmetic Mean
Australia	5.05%	6.76%
New Zealand	4.45%	6.37%
UK	3.40%	4.60%
US	3.66%	5.40%
Average	**4.14%**	**5.78%**

[14] Source: Bloomberg

[15] Source: Equity Risk Premiums (ERP): Determinants, Estimation and Implications – The 2013 Edition, Aswath Damodaran, Stern School of Business, http://ssrn.com/abstract=2238064

[16] Volatility adjusted premium is calculated by multiplying the historical market risk premium by a volatility ratio. The volatility ratio used is as follows: Australia (0.90), New Zealand (1.20), UK (0.87) and US (0.92)

Table 4: Overseas Benchmarks [17]

Australia	6.50%
New Zealand	7.00%
UK	5.25%
Average	**6.25%**

Table 5: Local Benchmarks [18]

Keppel Corp	6.00%
Sembcorp Industries	5.00%
SMRT	5.00%
CapitaLand	6.00%
Average	**5.50%**

[17] Sources: Cost of capital determination for information disclosure year 2015 for specified airport services (March year-end) and electricity distribution services [2014] NZCC 1, New Zealand Commerce Commission, 04/30/2014; Decision on methodology for assessing the equity market return for the purpose of setting RIIO-ED1 price controls, UK Ofgem, 02/17/2014; and Final Decision on SP AusNet transmission determination, Australian Energy Regulator, January 2014.

[18] Source: 2013 company annual reports.

APPENDIX G

AMENDMENTS TO *EMA'S PROCEDURES FOR CALCULATING THE COMPONENTS OF THE VESTING CONTRACTS* ("PROCEDURES")

Section 3.7.1 of the Procedures shall be amended as shown below:

3.7.1 HSFO 180 CST Oil Price (US$/MT)

The HSFO 180 CST Oil Price (US$/MT) for the quarter is the average price of the quarterly forward fuel oil swaps, published on ~~Intercontinental Exchange (ICE), and~~ Platts for every business day in the preceding quarter, up to the 15th calendar day of the 3rd month in the preceding quarter (the "Period") for the quarter for which the Balance Vesting Price is to be calculated[14] and the forward exchange rate (US$/S$) for the quarter is the average of the 3-month forward exchange rate (US$/S$) quoted by Bloomberg Generic (BGN) at New York 17:00 for the same Period.

In calculating the average price of the quarterly forward fuel oil swaps, the Authority will determine it by ~~the following procedure:~~ taking the midpoint of the published values of AAHDD00 FO 180 S'pore Swap 1-Qr by Platts for each day in the Period.

~~(i) Take the weighted average price of consummated trades on ICE of each day where there are consummated trades, or the average offer prices of concurrent bid/offer (with a spread not exceeding US$2) on ICE for each day, in the Period, where there are no trades on ICE,~~

~~(ii) Take the midpoint of the published values of AAHDD00 FO 180 S'pore Swap 1-Qr by Platts for each day in the Period,~~

~~(iii) Calculate the daily average price of the quarterly forward fuel oil swaps by averaging (i) and (ii),~~

~~The average price of the quarterly forward fuel oil swaps for the Period will be the average of the daily prices in (iii).~~

In calculating the average 3-month forward exchange rate, the Authority will:

(i) use the historical *ask price* in <SGD Curncy HP> and <SD3M Curncy HP> for every business day in the Period to get the daily outright 3-month (US$/S$) forward ask rate for every business day.

(ii) Take the average of the daily outright 3-month forward ask rates.

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[14] This will be based on available price data published by ~~ICE and~~ Platts as at 10:00am on the first business day following the 15th calendar day of the 3rd month in the preceding quarter. For example, in calculating LRMC for 3rd quarter, the Authority will use the prices of the 3Q forward fuel oil swaps of each business day from 1st April to 15th June.