REVIEW OF THE VESTING CONTRACT LEVEL AND PERIOD WEIGHTING FACTORS FOR THE PERIOD 1 JANUARY 2011 TO 31 DECEMBER 2012

FINAL DETERMINATION PAPER

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ENERGY MARKET AUTHORITY
991G Alexandra Road
#01-29 Singapore 119975
www.ema.gov.sg

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1. INTRODUCTION

1.1. The Energy Market Authority ("EMA") implemented Vesting Contracts on 1 January 2004 as a regulatory instrument to control the exercise of market power by the generation companies ("Gencos"). Vesting Contracts commit the Gencos to sell a specified amount of electricity (viz. the Vesting Contract level) at a specified price (viz. the Vesting Contract price). This 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, which will in turn promote efficiency and competition in the electricity market, for the benefit of consumers.

1.2. To achieve the objective of effectively curbing the potential exercise of market power, EMA will, in consultation with the industry, review and reset the Vesting Contract level every two years based on supply and demand projections at the point of review in accordance with the procedures set out in the document "EMA's Procedures for Calculating the Components of the Vesting Contracts (Version 1.6)" ("Vesting Contract Procedures"). In particular, the Vesting Contract Procedures state clearly that the total average contract level will depend on several factors including the "robustness of different contract levels to data uncertainty" and "range of plant configurations that may exist", and that EMA "will *use its discretion to balance these and other relevant factors"* in choosing the contract levels and consequential rollback schedule".

1.3. At the last review, EMA had determined that the Vesting Contract level required was 55% for the period 1 January 2009 to 31 December 2010.

1.4. EMA appointed PA Consulting Group Pte Ltd ("PA Consulting") to assist in the review of the Vesting Contract level for the period 1 January 2011 to 31 December 2012. This paper summarises EMA's determination of the Vesting Contract level and period weighting factors for the period 1 January 2011 to 31 December 2012 taking into consideration the recommendations of its consultant, PA Consulting and industry feedback.

2. EMA'S DETERMINATION ON THE VESTING CONTRACT LEVEL AND PERIOD WEIGHTING FACTORS FOR THE PERIOD 1 JANUARY 2011 TO 31 DECEMBER 2012

2.1 As specified in the Vesting Contract Procedures, "an analytical model, preferably a market gaming model, will be used to derive the overall expected annual market prices for different contract levels".

2.2 In this respect, EMA has consistently used the Cournot Gaming model to simulate non-collusive interactions amongst the Gencos and determine the Vesting Contract level to effectively control Gencos' market power. Specifically, the model estimates the Vesting Contract level required to remove Gencos' incentives to withhold capacity to raise pool prices above a certain target pool price. The Vesting Contract level is set to target the long run marginal cost ("LRMC") of a theoretical new entrant using the most economic generation technology in Singapore contributing more than 25% of total demand. This mimics the outcome of a competitive market and ensures appropriate price signals remain for investors to plant new and efficient generation capacity to meet demand growth. (See Annex for the mechanics of how Vesting Contracts work to control market power)

2.3 Based on the model simulations, PA Consulting recommended increasing the Vesting Contract level from the existing 55% to 62% in 2011. The increase stems from tighter market conditions. Specifically, there has been a sharp increase in demand for electricity driven by the strong economic recovery which is expected to continue in 2011, but without any commensurate increase in generation capacity to meet this demand. Indeed one of the Gencos acknowledged in the feedback to EMA that "there has been an increase in market concentration recently". As there is greater potential for market power to be exercised in a supply-constrained environment, PA Consulting suggested that there was a need for the Vesting Contract level to go up. PA Consulting further recommended that the Vesting Contract level could be subsequently reduced in 2012 to 46% once Senoko Energy's repowered combined cycle gas turbine ("CCGT") unit and Tuas Power Generation's Tembusu cogen are in commercial operation in 2012.

2.4 Based on the feedback received, there is no objection from most of the Gencos on the need for the Vesting Contract level to go up in 2011. However, they have expressed a preference for EMA to set the Vesting Contract level on a firm basis for 2011 and 2012, and not make the Vesting Contract level in 2012 subject to further adjustment upon the commercial operation of Senoko Energy's and Tuas Power Generation's new plants. EMA has carefully considered the industry's suggestion for greater certainty in the Vesting Contract level for 2012. In particular, we have undertaken a sensitivity analysis on the Vesting Contract level required in 2012 to adequately curb the potential exercise of market power in the event of a delay in the new plants. The analysis shows that without the new plants, the Vesting Contract level for 2012 would have to be set at 55% to meet the expected demand growth.

2.5 In light of the above considerations, EMA has decided to set the Vesting Contract level at 60% in 2011 and subsequently reduce it to 55% in 2012 on a firm basis, regardless of when the new plants commence commercial operation.

2.6 In coming up with this determination, EMA has taken into consideration the projected tight market conditions in 2011, and the higher potential for market power to be exercised in such tight market conditions. At the same time, we have taken into consideration feedback from the industry on the need for certainty and stability in the Vesting Contract level. We are also mindful of the longer-term intent to reduce the Vesting Contract level over time as market power diminishes. On balance, therefore, we have moderated PA Consulting's recommendation for the Vesting Contract level in 2011 to 60%, and have set a lower Vesting Contract level of 55% in 2012. In this way, we also keep the annual fluctuations in the Vesting Contract level to a smaller band than what was proposed by PA Consulting, thereby providing greater ease of planning and certainty for the Gencos.

2.7 EMA will also set the peak period weighting factor at 1.10 for 1 January 2011 to 31 December 2012. There is general industry consensus on this.

2.8 Table 1 summarises EMA's determination on the Vesting Contract level and period weighting factors for the next two-year period from 1 January 2011 to 31 December 2012.

Table 1: Vesting Contract Level for 1 January 2011 to 31 December 2012

Year	Vesting Contract Level	Period Weighting factors		
		Peak	Shoulder	Off-Peak
1 January 2011 to 31 December 2011	60%	1.10	1.00	Balancing Factor
1 January 2012 to 31 December 2012	55%	1.10	1.00	Balancing Factor

CONCLUSION

3.1 The generation market in Singapore is highly concentrated, with the three largest Gencos supplying about 80% of electricity demand. EMA has accordingly put in place the current Vesting Contract regime since 2004 to effectively control and curb market power.

3.2 In its various publications and policy statements, EMA has consistently and explicitly made clear that the Vesting Contract level, determined every two years, is set to effectively curb the exercise of market power based on projected electricity supply and demand. While the long-term plan is to reduce the Vesting Contract level over time, EMA has also explicitly said that such reduction is contingent on the dilution of Gencos' market power in the generation market.

3.3 The temporary increase in the Vesting Contract level to 60% in 2011 is therefore in line with EMA's stated objective of effectively curbing the potential exercise of market power by the Gencos in a generation market which has become more concentrated. In 2012, market conditions are expected to improve and hence the Vesting Contract level can revert to 55%. As highlighted earlier, EMA's long term plan is still to reduce the Vesting Contract level over time, if there is a dilution of market power and keener competition in the electricity generation market. We

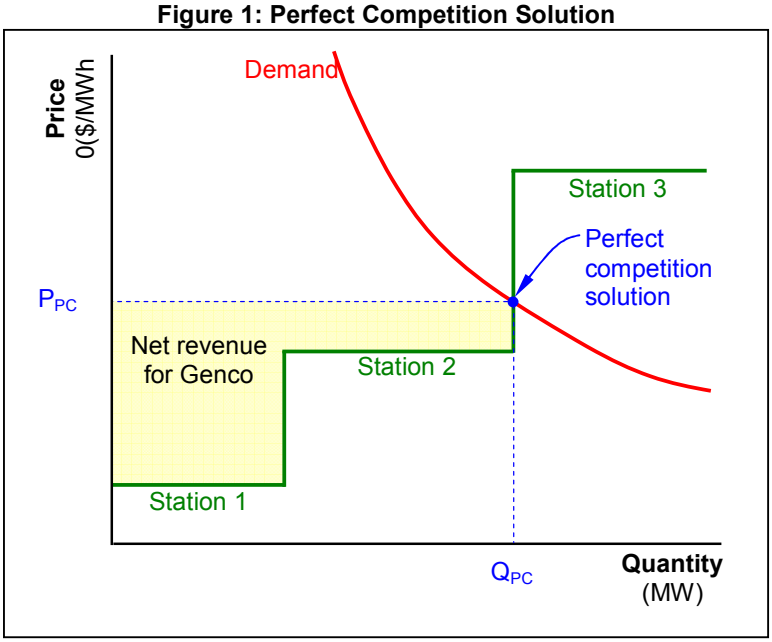
expect this to happen with a healthy pipeline of new generation capacity coming on-stream.

MECHANICS OF VESTING CONTRACTS

1. A Genco has the incentive to withhold some of its capacity to drive up the market price if the loss in revenue due to the reduction in quantity sold is less than the increase in revenue due to the higher market price.[1]

2. To illustrate, Figure 1 shows the perfect competition solution for a Genco facing the residual demand curve. The Genco has three generating units available: Station 1 has a low SRMC, Station 2 has a moderate SRMC, and Station 3 has a high SRMC. Faced with the residual demand curve, the Genco in a perfectly competitive market will operate Stations 1 and 2 at full capacity and not run Station 3. The demand curve intersects a vertical section of the supply curve, implying that a demand bid is effectively marginal. The spot market price will be at the perfectly competitive level P_{PC}. The Genco receives net revenue equal to the shaded area, which represents the difference between its revenue (Q_{PC} x P_{PC}) and its SRMC (the area under the supply curve).

Figure 1: Perfect Competition Solution

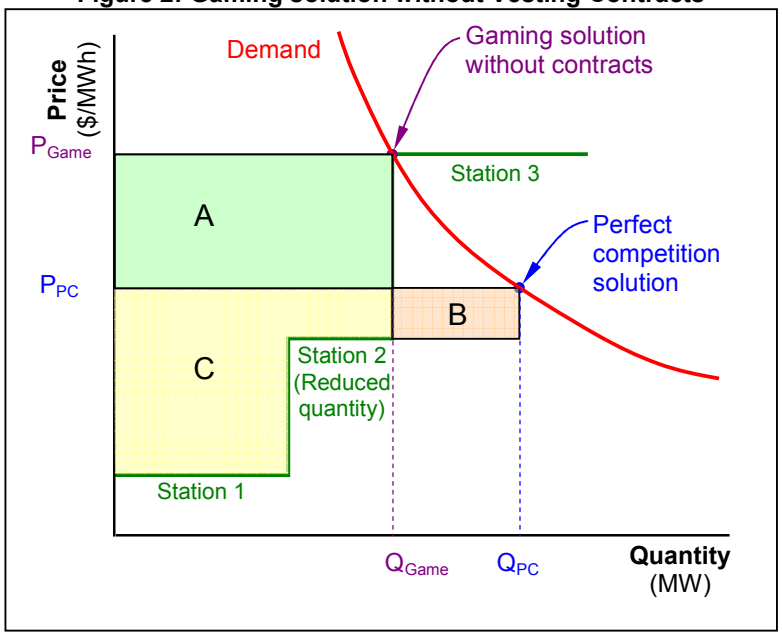


3. Suppose the Genco has some market power such that it can withhold some of Station 2's capacity to make Station 3 marginal and hence receive a higher price. As shown in Figure 2, the offered quantity from Station 2 is reduced, and Station 3 is setting the market price P_{Game}. Overall, the Genco sells less but at a higher spot price. The Genco forgoes net revenue equal to area B, but gains net revenue equal to area A (with area C representing net revenue it was already receiving). In this example, the Genco is receiving higher net revenue in total since area A is larger

[1] A Genco can withhold capacity either physically (by declining to offer capacity) or financially (by offering capacity at an increased price). The two methods of exercising market power are equivalent.

than area B, and therefore has the incentive to reduce its output (Q_{Game}) to increase the spot price (P_{Game}) until area A is equal to area B.

Figure 2: Gaming solution without Vesting Contracts



4. Vesting Contracts can reduce the Genco's incentive to withhold capacity by decreasing its exposure to the spot price. Figure 3 illustrates the situation in which the Genco has quantity Q_K under Vesting Contracts: it receives the Vesting Contract price for this quantity regardless of the spot price. The size of area A is therefore reduced by area D. In this example, the increase in net revenue (area A) is less than the net revenue lost (area B) from withholding capacity. Consequently, the Genco will not withhold so much of Station 2's capacity: it will increase its output Q_{Game} (and hence lower the spot price P_{Game}) until area A is again equal to area B. Clearly, increasing the vested quantity Q_K will result in a spot price P_{Game} closer to the Perfect Competition level.

Figure 3: Gaming solution with Vesting Contracts