REVIEW OF THE LONG RUN MARGINAL COST (LRMC) PARAMETERS FOR SETTING THE VESTING CONTRACT PRICE FOR THE PERIOD 1 JANUARY 2013 TO 31 DECEMBER 2014

FINAL DETERMINATION PAPER

30 SEP 2012

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FINAL DETERMINATION PAPER

1. INTRODUCTION

1.1. The Energy Market Authority ("EMA") implemented vesting contracts on 1 January 2004. The objective of the vesting regime is to control the exercise of market power by the generation companies ("Gencos") and promote efficiency and competition in the electricity market. The 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).

1.2. The vesting contract price is set taking into account both the long run marginal cost ("LRMC") of the most efficient technology that accounts for at least 25% of the system demand in Singapore and the policy objective to promote efficiency and competition in the electricity market for the benefit of consumers. The most efficient technology at present is the "F" class combined cycle gas turbine or CCGT.

1.3. EMA conducts a review of the LRMC parameters used to set the vesting contract price biennially or at other times when it considers necessary. The procedures for determining the vesting price can be found in the document "EMA's Procedures for Calculating the Components of the Vesting Contracts" ("Vesting Contract Procedures"). EMA has appointed KPMG Services Pte Ltd ("KPMG") to assist in the review of the "WACC" parameters and Sinclair Knight Merz Pte Ltd ("SKM") to assist in the review of the remaining "technical" LRMC parameters for setting the vesting contract price for the period 1 January 2013 to 31 December 2014.

1.4. This paper summarises EMA's final determination of the LRMC parameters to be used to set the vesting contract price for the period **1 January 2013 to 31 December 2014**.

2. BASE MONTH

2.1 EMA has adopted May 2012 as the “Base Month” for the determination of the LRMC parameters for setting the vesting contract price for the period 1 January 2013 to 31 December 2014.

2.2 To reduce volatility in computing the LRMC, EMA had determined that data used in the estimation of the following "selected base parameters" would be averaged over a three month period leading up to and including the “Base Month” (i.e. March to May 2012):

a. Exchange rates to convert the costs denominated in foreign currencies into Singapore Dollars;

b. Diesel price to calculate cost of carrying fuel;

c. Debt premium to calculate cost of debt; and

d. MAS Core Inflation Index.

2.3 For the risk free rate, EMA has determined that data averaged over a twelve month period leading up to and including the “Base Month” (i.e. Jun 2011 to May 2012) would be used.

3. REVIEW OF WACC PARAMETERS

3.1 The following formula based on the Capital Asset Pricing Model ("CAPM") is used to determine the post-tax nominal weighted average cost of capital ("WACC") for determining the opportunity cost of investment for a new entrant:

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 level of gearing, i.e. debt as a proportion of total assets
	t	is the corporate tax rate

Risk Free Rate, r_f

3.2 The risk free rate is proxied using the average daily closing yields of a "AAA" rated 20-year Singapore Government Bond. EMA had, in its draft final determination, worked out the risk free rate to be 2.37%, based on the average daily closing yields over the 3 month period Mar to May 2012[1]. The approach of averaging over 3 months is consistent with the methodology adopted in previous reviews.

3.3 For the current review, the Gencos had contended that EMA's use of the yields averaged over a 3 month period is not reflective of long-term risk free rate as the current low yields is an "anomaly". We disagree with this point. The bond market is generally considered efficient and the market expectations of the trend in interest rates would have been reflected in the current yields. We also note that the US Federal Reserve Bank, in a recent statement, stated that they anticipate that the "exceptionally low levels for the federal funds rate are likely to be warranted at least through mid-2015"[2]. Nevertheless, taking into consideration industry feedback that a 3 month averaging period may have a higher risk of being distorted by short term volatility, EMA will revise the methodology henceforth to determine the risk free rate by averaging the yields over a longer period of 12 months instead of 3 months. The risk free rate is **2.41%**, based on the average daily closing yields of a "AAA" rated

[1] Consistent with previous reviews, EMA adopts a "base month" or cut-off date for the data used in the review of the vesting price. For this review, May 2012 is the base month, hence Mar to May 2012 data was used for the computation.

[2] Press release by the Board of Governors of the Federal Reserve System, 13 Sep 2012. http://www.federalreserve.gov/newsevents/press/monetary/20120913a.htm

20-year Singapore Government Bond (NZ10100F)[3] over the 12 month period, Jun 2011 to May 2012.

Debt Premium, DP, and Cost of Debt

3.4 EMA has computed the debt premium based on the average yield to maturity of investment grade rated "Baa" bonds in Moody's Bond Indices for the utility sector for the period Mar to May 2012 less the average yield of US government 30-year bond[4] for the same period.

3.5 The credit rating of Baa is used on the grounds that the new entrant genco would typically require investment grade credit rating in order to secure access to generation financing in today's tight credit environment. Based on the above, the debt premium is computed to be 1.94% (details can be found in Appendix A). This results in a pre-tax cost of debt of **4.35%** (1.94% + risk free rate of 2.41%)**.**

3.6 EMA has also taken into consideration market information provided to EMA by one of the gencos and our consultant, which suggests that the pre-tax cost of debt falls within the range of **4.7% and 6.0%**.

3.7 Taking a balanced view of the range between 4.35% and 6%, EMA has set the cost of debt at **5%.** This implies a revised debt premium of 259 bps above the risk free rate of 2.41%.

Gearing, g

3.8 EMA has derived the gearing of **0.497** based on the 2-year average debt-to-equity ratio of the panel of comparator companies. The derivation of the comparator gearing ratio and equity beta, the selection criteria of the comparator companies and the list of comparator companies can be found in Appendices B, C and D respectively.

Equity Beta, β (equity)

3.9 The derived equity beta of 0.88 is based on the R-squared weighted unlevered beta of 0.48 of the comparator companies. However, it is expected that the return for generation companies in Singapore would be closely correlated with general economic returns. To account for this, EMA has adjusted the equity beta to **1.00**. This adjustment is consistent with the last determination.

[3] The daily closing yields of the SGB can be obtained from MAS via the following link: https://secure.sgs.gov.sg/fdanet/BondPricesAndYields.aspx

[4] US government 30-year yield is applied as Moody's Bond Indices have maturities as close as possible to 30 years. The minimum maturity for the bonds in this index is 20 years.

Market Risk Premium, (r_m-r_f)

3.10 EMA has used similar approaches as previous reviews to estimate the MRP. For this review, the median MRP estimate is 5.5% (details can be found in Appendix E). Taking into consideration the distribution of the MRP estimates and industry feedback, EMA has decided to set the MRP at **6.0%**.

Tax Rate, t

3.11 The tax rate is **17%**, being Singapore's corporate tax rate.

4. REVIEW OF TECHNICAL PARAMETERS

Generating Technology

4.1 Currently, the most efficient technology that accounts for at least 25% of the system demand in Singapore is the "F" class combined cycle gas turbine ("CCGT"). In the determination of the vesting contract price, EMA considers a new entrant to have a plant size of two units of 370 MW CCGTs. The costs of common items such as land, site development and basic infrastructure to support the operation of the CCGTs would be shared between the two units.

Capacity per generating unit

4.2 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 would be **382.1 MW**.

HHV Heat Rate

4.3 The HHV heat rate for the proxy plant is **7103.4** Btu/kWh. This takes into account the effects of degradation, local air temperature and conditions, part load factor, start-up gas usage and adjustments for gas compressor.

Build Duration

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

Economic Lifetime

4.5 The economic lifetime of the proxy plant is **22 years**.

Plant Load Factor

4.6 The plant load factor is set at **67.3%**[5], based on the actual performance of the existing "F" class CCGTs in operation in the system i.e. Senoko Energy's CCGT units 3 to 5, YTL PowerSeraya's CCGT units 1 to 4, and Tuas Power Generation's CCGT units 1 to 4 from the last twelve months leading up to the base month and checked to be achievable for 2013 and 2014. Station load has been subtracted when determining the plant load factor.

[5] The plant load factor of 67.3% is based on the average projected PLF that is achievable for 2013 and 2014.

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.

4.8 The total capital cost is **$479.5 million** for one unit of "F" class CCGT, comprising of:

a. Turnkey Engineering, Procurement and Construction (EPC) cost	$469.7 million
b. Discounted through-life capital cost	$9.8 million

4.9 The EPC costs include the cost for specialized equipment, mechanical and electrical engineering, gas compressors, the jetty and fuel tanks.

Land and Site Preparation Cost

4.10 The total land and site preparation cost for one unit of "F" class CCGT is **$20.3 million**, comprising of:

a. Land lease cost and water front fees	$19.3 million
b. Land preparation cost	$1.0 million

Connection Cost

4.11 The total connection cost for one unit of "F" class CCGT is **$41.4 million**, comprising of:

a. Electrical connection cost *Standard connection charge to SPPG ($50,000 per MW), switchgear GIS and underground cable*	$34.7 million
b. Gas connection costs	$6.7 million

Miscellaneous costs

4.12 The total miscellaneous cost for one unit of "F" class CCGT is **$88.5 million**. This cost consists of:

a. Owner's costs after financial close *owner's engineering; owner's "minor items"; initial spares; start-up costs and construction related insurance*	$57.8 million
b. Owner's costs prior to financial closure *Permits, licences, fees; legal and financial advice and costs; and owner's engineering and in-house costs*	$30.7 million

Non-fuel Operating Costs

Fixed Annual Running Cost

4.13 The fixed annual running cost includes the operating and overhead costs that are incurred in having the plant available for supplying energy and reserves but do not vary with the level of energy output.

4.14 The fixed annual running cost for one unit of "F" class CCGT is **$23.51 million** per annum, comprising of:

a. Manpower and allowance for head office services	$3.88 million
b. Emergency fuel usage	$0.83 million
c. Fixed maintenance and other fixed operations *Fixed maintenance and other fixed operations; start-up impact on turbine maintenance; and distillate usage on turbine maintenance.*	$8.96 million
d. Working Capital[6]	$6.80 million
e. Insurance, property tax and EMA licence fee	$3.04 million

[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 for their exclusive right of use, and an additional 45-day backup fuel stockpile offsite for their first right of use.

Variable Non-Fuel Cost

4.15 The variable non-fuel cost includes any costs, other than fuel costs, that vary with the level of energy output. The variable non-fuel cost is **$6.42/MWh** for one unit of "F" class CCGT, comprising of:

a. LTSA for maintenance of Gas Turbine and Steam Turbine	$5.00/MWh
b. EMC, PSO and EMA license (variable) fees	$0.74/MWh
c. Consumables (chemicals and town water)	$0.68/MWh

Fuel Cost

4.16 The fuel cost included in the vesting price is determined quarterly based on the procedures set out in the Vesting Contract Procedures.

4.17 The fuel cost used in this Final Determination paper is S$22.80/GJ.

LNG Vesting

4.18 The LNG Vesting Scheme will be implemented upon the completion of the LNG Terminal expected in the 2nd quarter of 2013. The LNG Vesting Scheme would be in force for 10 years starting from the first complete quarter after the Commercial Operation Date of the LNG Terminal. Vesting Contract holders who qualify for the LNG Vesting Scheme are allocated a specified amount of LNG Vesting Quantities at the regasified LNG Vesting Price as determined by EMA.

4.19 The regasified LNG Vesting Price for 2013 and 2014 would be determined based on the parameters set out in this Final Determination paper except for the fuel cost component. The fuel cost component of the regasified LNG Vesting Price for each quarter will be determined in accordance with the provisions stated in Section 3.7.2 of the Vesting Contract Procedures.

5. SUMMARY OF LONG RUN MARGINAL COST (LRMC) PARAMETERS FOR SETTING VESTING CONTRACT PRICE FOR THE PERIOD 1 JANUARY 2013 TO 31 DECEMBER 2014

Technical Parameters	2011-2012	2013-2014
Base Month	May 2010	May 2012
Capacity per Generating Unit (MW)	381	382.1
HHV Heat Rate (Btu/kWh)	7010	7103.4
Build Duration (months)	30	30
Economic Lifetime (years)	24	22
Plant factor (%)	74.9	67.3
Capital Cost (S$ million) • Turnkey Engineering, Procurement and Construction (EPC) cost • Discounted through-life capital cost	559.2	479.5
Land, infrastructure and Development Cost (S$ million) • Land and site preparation cost • Connection cost • Miscellaneous cost	152.0	150.2
Fixed Annual Running Cost (S$ million/year)	22.49	23.51
Variable Non-fuel Cost (S$/MWh)	6.55	6.42

WACC Parameters	2011-2012	2013-2014
Risk-free rate, r_f (%)	3.31	2.41
Debt Premium, DP (%)	2.50	2.59
Gearing, g	0.342	0.497
Equity Beta, β_{equity}	1.00	1.00
Market Risk Premium, r_m-r_f (%)	7.0	6.0
Corporate Tax Rate, t (%)	17.0	17.0
Post-Tax Nominal WACC (%)	**8.43**	**6.29**

Vesting Contract Price	2011-2012	2013-2014
Vesting Contract Price (S$/MWh)	225.19	215.95
Non-Fuel Component (S$/MWh)	56.49*	45.09
Fuel Component (S$/MWh)#	168.70	170.86

**Adjusted for Q2 2012 prices. The base non-fuel component at the last reset in Sep 2010 was $50.4/MWh.*

#Based on gas price of S$22.80/GJ for Mar 12 – May 12. The difference in the fuel component is because of changes in the heat rate between the two reviews.

6. REVIEW OF SCALE FACTOR INDICES

6.1. EMA has conducted a review of the LRMC scale factor indices which are set out in Section 3.8 of the Vesting Contract Procedures.

Current Methodology

6.2. Currently, the capital costs are adjusted quarterly using the Domestic Supply Price Index (DSPI) while the overhead costs are adjusted quarterly using the "headline" Consumer Price Index (CPI).

Revised Methodology

6.3. EMA will adjust the capital and overhead costs annually instead of quarterly. EMA notes that an annual adjustment is in line with the practices of regulators in other jurisdictions. For example in Australia, retail electricity, gas and water prices are adjusted annually to reflect both cost changes as well as inflation.

Capital Cost

6.4. EMA will discontinue the use of DSPI to adjust the capital costs[7]. DSPI is not reflective of changes in CCGT costs faced by a potential new entrant. Instead, EMA will conduct a mid-term review in 2013 to re-set the capital costs for 2014, using the same methodology as the biennial reset of the Capital Cost. This would allow the Capital Cost component to more accurately reflect the CCGT cost which a potential new entrant will face.

Overhead Cost

6.5. For the annual adjustment of the Overhead Cost, EMA will use the projected "Core Inflation" rate for the year as published by the Monetary Authority of Singapore (MAS). Compared to headline inflation, the "Core Inflation" rate would more accurately reflect the overhead cost of running a power plant. This is supported by analysis by the Monetary Authority of Singapore (MAS), which indicated that the "MAS Core Inflation is shown to be a better predictor of longer-term inflation in general, compared to the overall CPI inflation"[8].

6.6. EMA will use the mid-point of the latest projected range of the Core Inflation rate for the next year from MAS that is available as at 1st December of the preceding year to adjust the Overhead Cost component for the coming year.

[7] These are defined as the costs set out in items 7 (Capital cost of the plant) and item 8 (Land, infrastructure and development cost of the plant) of Section 2.3 of the Vesting Contract Procedures.
[8] Extracted from MAS Staff Paper No.51: A Review of the Core Inflation Measure for Singapore

Appendix A

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

Date	30 year T-Bill	Baa	Date	30 year T-Bill	Baa
1 Mar 12	3.15	5.05	17 Apr 12	3.14	5.09
2 Mar 12	3.10	5.01	18 Apr 12	3.13	5.07
5 Mar 12	3.15	5.03	19 Apr 12	3.12	5.05
6 Mar 12	3.07	4.95	20 Apr 12	3.12	5.07
7 Mar 12	3.12	4.98	23 Apr 12	3.08	5.03
8 Mar 12	3.17	5.03	24 Apr 12	3.13	5.07
9 Mar 12	3.18	5.04	25 Apr 12	3.15	5.09
12 Mar 12	3.17	5.02	26 Apr 12	3.12	5.08
13 Mar 12	3.27	5.11	27 Apr 12	3.12	5.06
14 Mar 12	3.40	5.25	30 Apr 12	3.11	5.06
15 Mar 12	3.41	5.25	1 May 12	3.15	5.11
16 Mar 12	3.41	5.25	2 May 12	3.12	5.07
19 Mar 12	3.48	5.32	3 May 12	3.12	5.07
20 Mar 12	3.45	5.29	4 May 12	3.07	5.03
21 Mar 12	3.38	5.21	7 May 12	3.06	5.02
22 Mar 12	3.36	5.20	8 May 12	3.03	4.98
23 Mar 12	3.31	5.15	9 May 12	3.02	5.00
26 Mar 12	3.34	5.16	10 May 12	3.04	5.01
27 Mar 12	3.30	5.13	11 May 12	3.01	4.96
28 Mar 12	3.31	5.13	14 May 12	2.92	4.90
29 Mar 12	3.27	5.10	15 May 12	2.92	4.89
30 Mar 12	3.34	5.20	16 May 12	2.90	4.90
2 Apr 12	3.33	5.22	17 May 12	2.79	4.81
3 Apr 12	3.44	5.29	18 May 12	2.81	4.85
4 Apr 12	3.36	5.26	21 May 12	2.81	4.86
5 Apr 12	3.37	5.20	22 May 12	2.87	5.02
6 Apr 12	3.22	5.13	23 May 12	2.82	4.94
9 Apr 12	3.20	5.10	24 May 12	2.87	5.02
10 Apr 12	3.13	5.07	25 May 12	2.84	5.02
11 Apr 12	3.20	5.12	29 May 12	2.85	5.01
12 Apr 12	3.21	5.14	30 May 12	2.71	4.90
13 Apr 12	3.13	5.08	31 May 12	2.64	4.87
16 Apr 12	3.13	5.05			
			Average	3.13	5.07

The average yield to maturity of "Baa" of the Moody's Bond Indices for the utility sector for the period between Mar 2012 and May 2012 is 5.07 %

The Debt Premium = 5.07 – 3.13 = 1.94%

[9] US government 30-year yield is applied as Moody's Bond Indices have maturities as close as possible to 30 years. The minimum maturity for the bonds in this index is 20 years. *Source: Bloomberg*

Appendix B

Derivation of the Comparator Gearing Ratio and Equity Beta

Company	31/12/2010			31/12/2011			Gearing	Beta			
	Net Debt (SGD)	Total Equity (SGD)	D/E Ratio	Net Debt (SGD)	Total Equity (SGD)	D/E Ratio	2-year average D/E Ratio	Company Beta	Tax Rate	Unlevered Beta	R-square
TransAlta Corp	5,186	6,937	74.8%	5,081	7,161	71.0%	72.85%	0.8	31%	0.53	0.27
SSE plc	10,263	22,632	45.3%	12,210	24,181	50.5%	47.92%	0.61	28%	0.45	0.19
Great Plains Energy Incorporated	4,878	3,411	143.0%	5,079	3,879	130.9%	136.95%	0.8	35%	0.42	0.42
American Electric Power Co. Inc	23,503	22,220	105.8%	24,386	25,839	94.4%	100.08%	0.66	35%	0.40	0.29
Iberdola SA	51,333	58,636	87.5%	52,945	48,088	110.1%	98.82%	0.94	30%	0.56	0.59
Median of the 2-year average D/E ratio	98.82%										
Sum of R-squared	1.76										
R-squared weighted unlevered beta	0.48										
Relevered R-squared weighted beta based on median D/E	0.88										

Debt to equity ratio: D/E = 0.9882
D = 0.9882E
D/0.9882 = E

Sub E = D/0.9882 into the Gearing formula

Gearing: D/(D+E) = 0.497

Appendix C

Selection Criteria

The selection process of the comparator companies consists of two stages. In the first stage, the following filtering criteria are considered:

- **Listed companies** – We have required that the comparators have operations in economies that feature risk characteristics similar to that of Singapore and be public-listed companies given the requirement for WACC calculation. Information such as beta and debt-equity ratio are only obtainable from public-listed companies.
- **Financial health** – In order for the comparators to be meaningful, it is imperative that the companies are in good financial health. Taking into consideration the recent global financial crisis, we require the companies to be profitable for at least four out of the last six years of operations.
- **Availability of data** – The companies must have data available for the reporting years 2005 to 2010. Where available, the data for 2011 was included in the analysis as well.

In the second stage, i.e. following this initial "sieve", the resulting set of companies is then assessed against further detailed criteria as follows:

- **Generation Fuel Type** – Given that most of the generation companies in Singapore utilise fossil fuel (majority are gas-fired) for power generation, the power generation portfolio of the comparators must be at least 50% fired by fossil fuel. This is primarily because the business and operational risks of alternative fuel-type plants are considerably different from that of fossil fired plants.
- **Generation capacity** – There are currently 13 generation licensees in Singapore with a total installed capacity of 10,216 MW. To eliminate small players which may not fully reflect the industry risk, the total generation capacity of the power plants owned by the comparators must be at least 3,000 MW.
- **Asset Base –** For the sample of comparators to be appropriate, power generation must be the dominant business of the comparators. Given that power generation is capital intensive, 40% of the assets classified on the balance sheet must be for the use of power generation.

Appendix D

List of comparator companies

	Name	Country	Description	Generation Portfolio Contribution (Fossil Fuel)	Generation Capacity (MW)	Asset Base[10]
1	TransAlta	Canada	TransAlta Corporation operates as a non-regulated electricity generation and energy marketing company. The company engages in the production and sale of electric energy through its diversified portfolio of facilities fuelled by coal, natural gas, hydroelectric, wind, and geothermal resources. It is also involved in the wholesale trading of electricity and other energy-related commodities and derivatives, as well as sale of steam to industrial facilities. As of March 1, 2012, the company has an aggregate net ownership interest of 8,257 megawatts of generating capacity in operation. It operates in Canada, the United States, and Australia. The company was founded in 1911 and is headquartered in Calgary, Canada.	88%	8,174	90%
2	Iberdrola	Spain	Iberdrola, S.A., together with its subsidiaries, engages in producing, switching, distributing, and retailing electricity and gas worldwide. It primarily generates nuclear, fossil-fuel, hydroelectric, and wind power. The company also offers raw materials or primary energies required for electric power generation; energy, engineering, computer, and telecommunications services; and services relating to the Internet. In addition, it is involved in the treatment and distribution of water; provision of urban and gas retailing services, and real estate and other related services; and other gas storage, regasification, transmission, or distribution activities, as well as in the distribution, representation, and marketing of various goods and services, products, articles, merchandise, computer programs, industrial equipment, machinery, machine and hand tools, spare parts, and accessories. Further, the company engages in the research, study, and planning of investment and corporate organization projects, as well as promotion, set up, and development of industrial, commercial, and service companies. Iberdrola, S.A. is headquartered in Bilbao, Spain.	65%	44,991	57%

[10] This refers to the percentage of the companies' total asset base that is used for power generation.

	Name	Country	Description	Generation Portfolio Contribution (Fossil Fuel)	Generation Capacity (MW)	Asset Base[10]
3	SSE plc	UK	SSE plc, through its subsidiaries, engages in the generation, transmission, distribution, and supply of electricity in the United Kingdom and Ireland. It also produces, stores, distributes, and supplies gas; and provides other energy-related services. The company owns approximately 11,290 megawatts of electricity generation capacity; and operates a network of 130,000 kilometers of overhead lines and underground cables, which transmit and distribute electricity to approximately 3.5 million businesses, offices, and homes. It also has an onshore gas storage facility at Hornsea in East Yorkshire with a capacity of approximately 325 million cubic meters of gas; and owns and operates approximately 75,000 kilometers of gas mains delivering gas to approximately 5.7 million industrial, commercial, and domestic customers. In addition, the company provides telecommunication services through a network of 11,200 kilometers of fiber optic cabling; and provides capacity and bandwidth services for companies, public sector organizations, Internet service providers, application service providers, and other license operators. Further, it offers industrial, commercial, and domestic mechanical and electrical contracting; electrical and instrumentation engineering; public and highway lighting; and metering and billing services. Additionally, the company offers licensed gas transportation and water and sewerage services; supplies, installs, and maintains electricity meters; and provides data collection, network capacity, data center, and bandwidth services, as well as produces and processes North Sea gas and oil. In addition, it provides home services, such as gas boiler, central heating, and wiring maintenance; installation products and services; and telephone line rental, and calls and broadband services. 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.	40%	11,290	93%

	Name	Country	Description	Generation Portfolio Contribution (Fossil Fuel)	Generation Capacity (MW)	Asset Base[10]
4	American Electric Power	US	American Electric Power Company, Inc., a public utility holding company, engages in the generation, transmission, and distribution of electric power to retail customers. It generates electricity using coal and lignite, natural gas, nuclear energy, and hydroelectric energy. The company also supplies and markets electric power at wholesale to other electric utility companies, municipalities, and other market participants. As of December 31, 2011, it owned and leased approximately 37,000 megawatts of domestic generation capacity. In addition, the company transports coal and dry bulk commodities primarily on the Ohio, Illinois, and lower Mississippi rivers. It owns and leases approximately 2,600 barges, 45 towboats, and 25 harbor boats. The company operates primarily in the states of Arkansas, Indiana, Kentucky, Louisiana, Michigan, Ohio, Oklahoma, Tennessee, Texas, Virginia, and West Virginia. American Electric Power Company, Inc. was founded in 1906 and is headquartered in Columbus, Ohio.	65%	37,000	48%
5	Great Plains	US	Great Plains Energy Incorporated, through its subsidiaries, engages in the generation, transmission, distribution, and sale of electricity in the United States. The company also provides steam services in the Missouri area. It generates electricity utilizing coal, nuclear, natural gas, oil, and wind resources. The company has approximately 6,600 megawatts of generating capacity. It serves approximately 823,200 customers located in western Missouri and eastern Kansas comprising 724,200 residences and 96,300 commercial firms, as well as 2,700 industrials, municipalities, and other electric utilities. The company was founded in 1919 and is headquartered in Kansas City, Missouri.	85%	6,600	100%

Appendix E

Market Risk Premium (MRP)

The following table shows the average MRP[11] estimated using each of the approaches:

Approach	Average Estimated MRP (%)
Historical Premium ("HRP") Approach[12] (GP)	3.9
Historical Premium ("HRP") Approach (AP)	5.3
Dividend Growth[13] Model	7.8
Overseas benchmark[14]	6.1
Local benchmark[15]	5.5
Volatility Adjusted Approach[16] (GP)	5.5
Volatility Adjusted Approach (AP)	7.6
Median	**5.5**

[11] The estimated MRP for each approach are based on the respective average MRP estimates as shown in the draft final determination paper titled "REVIEW OF THE LONG RUN MARGINAL COST (LRMC) PARAMETERS FOR SETTING THE VESTING CONTRACT PRICE FOR THE PERIOD 1 JANUARY 2013 TO 31 DECEMBER 2014".

[12] For the Historical Premium Approach, the estimated MRP also includes the estimates from the study conducted by Professor Elroy Dimson, Paul Marsh and Mike Staunton.

[13] The estimated MRP for the Dividend Growth Model is based on the average of DGM(L), DGM(H) and DGM(US) as shown in the draft final determination paper titled "REVIEW OF THE LONG RUN MARGINAL COST (LRMC) PARAMETERS FOR SETTING THE VESTING CONTRACT PRICE FOR THE PERIOD 1 JANUARY 2013 TO 31 DECEMBER 2014". DGM(L) and DGM (H) are based on EMA's internal calculation, where DGM (H) assumes a higher GDP growth rate than DGM(L). DGM(US) is calculated by Prof Damadaran – see http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2027211

[14] The estimated MRP for the Overseas benchmark is based on the average MRP set by regulators of Australia, UK and New Zealand, as shown in the draft final determination paper titled "REVIEW OF THE LONG RUN MARGINAL COST (LRMC) PARAMETERS FOR SETTING THE VESTING CONTRACT PRICE FOR THE PERIOD 1 JANUARY 2013 TO 31 DECEMBER 2014".

[15] The estimated MRP for the Local benchmark is based on the average MRP of Keppel, SembCorp, CapitaLand and SMRT as shown in the draft final determination paper titled "REVIEW OF THE LONG RUN MARGINAL COST (LRMC) PARAMETERS FOR SETTING THE VESTING CONTRACT PRICE FOR THE PERIOD 1 JANUARY 2013 TO 31 DECEMBER 2014".

[16] The volatility Adjustment Approach adjusts the MRP, derived using the Historical Premium Approach, to account for the difference in market volatilities in the respective countries as compared to Singapore.