WACC estimates

A REPORT FOR NSW DNSPs

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Table of Contents

List of Tables

1 Introduction

1. My name is Tom Hird. I have a Ph.D. in Economics and 20 years' experience as a professional economist. My curriculum vitae is provided separately.

2. This report has been prepared for the NSW DNSPs (Ausgrid, Endeavour Energy and Essential Energy) to assess the reasonableness of the return on capital range contained in each respective transitional regulatory proposal.

3. This report examines the following subject areas:

   - CAPM estimates of the cost of equity;
   - Non-CAPM estimates of the cost of equity;
   - Estimates of the cost of debt; and
   - The value of imputation credits (gamma).

4. Based on our assessment of the inputs used in deriving the return on capital, we consider that the NSW DNSPs' return of capital range of 8.52% to 9.11% to be reasonable, although, in our opinion, conservative. The remainder of this report is set out as follows.

   - Section 2 provides estimates of the cost of equity for a benchmark regulated distribution network service provider (DNSP) derived from the CAPM;
   - Section 3 provides estimates of the cost of equity for a benchmark DNSP derived from application of the Fama French 3 factor model and the DGM applied to DNSPs and similar firms;
   - Section 4 provides estimates of the cost of debt;
   - Section 5 addresses the best estimate of the value of imputation credits

5. I acknowledge that I have read, understood and complied with the Federal Court of Australia's *Practice Note CM 7, Expert Witnesses in Proceedings in the Federal Court of Australia*

6. I have been assisted in the preparation of this report by Daniel Young and Annabel Wilton from CEG's Sydney office. However, the opinions set out in this report are my own.

Thomas Nicholas Hird

29 January 2014

2 CAPM estimates of the cost of equity

7. The capital asset pricing model (CAPM) is a model of relative risk. The CAPM assumes that investors demand a return equal to the risk free rate plus a risk premium that is equal to the asset's "beta" multiplied by the difference between the expected return on the market portfolio ($E[R_m]$) less the risk free rate $E[R_{\beta=0}]$,.[1] The expected return on the market portfolio $E[R_m]$ is an input into the CAPM, not an output. The output of the models is an estimate of a particular asset's required return *relative to* $E[R_m]$. In the CAPM,[2] the return on each asset is determined as:

$$E[R_i] = E[R_{\beta=0}] + \beta_i \cdot (E[R_m] - E[R_{\beta=0}]), \qquad \text{Equation 1}$$

where $E[R_i]$ is the expected return on the asset, $E[R_{\beta=0}]$ is the expected required return on a zero beta asset, β_i is the beta for the asset and $E[R_m]$ is the expected return on the market portfolio.

8. The inputs into this model are $E[R_{\beta=0}]$, β_i and $E[R_m]$. The above equation could just as easily and correctly be written as:

$$E[R_i] = \beta_i \cdot E[R_m] + E\left[R_{\beta=0}\right] \cdot (1 - \beta_i).$$

9. The expected market risk premium (E[MRP]) is not an input into this model – the E[MRP] is simply the difference between the value of $E[R_m]$ and $E[R_{\beta=0}]$.

2.1 Estimating E[Rm] (and the implied E[MRP])

10. This report considers three different sources of estimate for E[Rm]. These are:

- An estimate of E[Rm] using the dividend growth model to estimate the discount rate that equates the present value of future market dividends with the current capitalisation of the stock market;
- An estimate of E[Rm] based on the historical average realised real return on the stock market; and
- An estimate of E[Rm] based on the assumption that $E[R_m]$ is an invariant value above $E[R_{\beta=0}]$. This involves estimating E[Rm] as the historical average realised MRP plus the prevailing $E[R_{\beta=0}]$. (It should be noted that this approach

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1 Beta is defined as the ratio of the covariance of an asset's return with the return on the market portfolio to the variance of the market return. An asset has zero risk in the CAPM when beta is zero – hence the risk free rate is termed $E[R_{\beta=0}]$.

2 Sharpe, William F. (1964). *Capital asset prices: A theory of market equilibrium under conditions of risk*, Journal of Finance, 19 (3), 425-442.

superimposes an assumption on the asset pricing model that E[MRP] is invariant.[3] This assumption is clearly violated in reality.)

2.1.1 DGM estimates of E[Rm]

11. Following the AER methodology as set out in appendix E.2 of the December 2013 rate of return guidelines, we use the dividend growth model to estimate the following estimates of E[Rm] and E[MRP]. The analysis was performed using data for the 20 days ending 17 December 2013. The 10 year CGS was 4.34% such that E[MRP] reported in the tables below is simply E[Rm] less 4.34%.

Table 1: DGM: estimates of E[Rm] – base case

LR real dividend growth rate=3.75%	**E[Rm]**				**E[MRP]**			
	d=0.0%	d= 0.5%	d= 1.0%	d = 1.5%	4.28%	d= 0.5%	d= 1.0%	d = 1.5%
AER estimate of theta (0.7)	12.65%	12.26%	11.88%	11.50%	8.31%	7.93%	7.54%	7.16%
CEG estimate of theta (0.35)	12.06%	11.66%	11.27%	10.88%	7.72%	7.33%	6.93%	6.54%

Source: Bloomberg, RBA, CEG analysis

Table 2: DGM: estimates of E[Rm] - sensitivity

LR real dividend growth rate=4.28%	**E[Rm]**				**E[MRP]**			
	d=0.0%	d= 0.5%	d= 1.0%	d = 1.5%	4.28%	d= 0.5%	d= 1.0%	d = 1.5%
AER estimate of theta (0.7)	13.07%	12.68%	12.30%	11.91%	8.73%	8.34%	7.96%	7.57%
CEG estimate of theta (0.35)	12.49%	12.09%	11.70%	11.30%	8.15%	7.75%	7.36%	6.97%

Source: Bloomberg, RBA, CEG analysis

12. Table 1 and Table 2 show estimates of E[Rm] and E[MRP] assuming respectively that long run economic growth will be 3.75% pa in real terms (based on average growth in gross domestic income since 1959) or 4.28% pa (based on the average of world and Australian growth rates in GDP for the longest period reported by the Madison project[4]). The first column of figures assumes that nominal dividends will grow in line

[3] The existence of an invariant MRP is in no way an assumption of the CAPM. Indeed, it is entirely inconsistent with modern asset pricing theory that is focussed on explaining the time varying nature of both $E[R_m]$ and E[MRP]. This is explained in more detail in section 3 of Hird and Grundy, Estimating the return on the market, a report for the ENA, June 2013.

[4] See, http://www.ggdc.net/maddison/oriindex.htm

with nominal long run economic activity while subsequent columns assume that dividends will grow at a slower rate (nominal long run economic growth less "d"). It can be seen that, even with the most extreme assumption that dividends grow at 1.5% less than economic activity, the implied E[MRP] is above 6.5% in all scenarios.

13. Our methodology is based on the AER's description of its DGM methodology for estimating the whole market's return on equity and the MRP.[5] Variations to this methodology are also described.

14. We calculated forecast dividend yields for the current and next two financial years by dividing the average of Bloomberg forecast dividends for the ASX200 for each of the current, next and following years into the future ("IDX_EST_DVD_CURR_YR", "IDX_EST_DVD_NXT_YR" and "EST_DVD_FY3_AGGTE") by the value of the ASX200 (sourced from Bloomberg). We calculated the 20 day prevailing average of each dividend yield and then adjusted for the effect of imputation credits by a factor of either 1.1125 (our method, consistent with a 0.35 theta) or 1.225 (AER method, consistent with a 0.7 theta).[6]

15. A series of dividend yields was established by extrapolating the third year forecast dividend yield into the future using an estimate of the long run dividend growth rate. Consistent with the AER methodology, we assume four different long run dividend growth rates equal to nominal long run GDP growth less 0.0%, 0.5%, 1.0% and 1.5%. We differ from the AER on the selection of long run GDP growth. We base this on long run real gross domestic income growth for the longest time series published by the ABS (3.75% real and 6.34% nominal).[7] The AER estimates a long run GDP growth rate of 3.0% based on observations by Lally. [8] The relevant paragraph of Lally states:

> *In respect of the long-run expected GDP growth rate, CEG (2012b, Appendix) favours an estimate of 3.9% based upon the average outcome over the period 1958-2010. However, the result over the considerably longer period from 1900-2000 is 3.3% (Bernstein and Arnott, 2003, Table 1), and the average over the 11 years since 2000 is 3.1% (The Treasury, 2012, Chart 2.2), yielding an average over the period 1900-2011 of 3.3%. This figure of 3.3% suggests that CEG's figure of 3.9% is too high. Furthermore, Bernstein and Arnott*

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5 See, AER, *Explanatory Statement- Rate of Return Guideline*, December 2013, appendix E, pp. 116-119.

6 Uplift = 1+ theta x proportion of franked dividends (0.75) * tax rate/(1-tax rate) where theta is assumed to be 0.7 by the AER and 0.35 in our method, the proportion of franked dividends is 0.75 and the tax rate is 0.3.

7 Series A2304314X, which is published from December 1959 and from which the annual growth rate is 3.75% in real terms. This translates to 6.34% if we assume long run inflation of 2.5% (6.34%=(1+3.75%)*(1+2.5%)-1.

8 The relevant section of the AER December 2013 Final Explanatory Statement is page 117 of Appendix E where it is stated "Associate Professor Lally has recently estimated g using the long–term expected growth rate of real GDP, which he evaluates to be 3 per cent."

provide average real GDP growth rates over 16 countries, and the average over this set of 16 countries is 2.8%, suggesting that even the figure of 3.3% is too high. Furthermore, the Australian Federal Treasury (The Treasury, 2012, Chart 2.2) has forecasted the Australian real GDP growth rate at 3% over the next four years. Taking account of all of this, an estimate for long-run expected real GDP for Australia should be about 3%.[9]

16. In our view this is an entirely unreasonable basis on which to alight on a long run real GDP forecast of 3.0%. In particular:

- The Bernstein and Arnott historical GDP figures are based on a data series developed by Madison and these have been updated.[10] The average GDP growth rate between 1900 and 2008 is actually 3.43% not 3.3%.
- Moreover, the time series extends back to 1820 (i.e., it does not start at 1900). The average real growth in Australian GDP over the entire period 1820 to 2008 reported by Madison is 4.58%;
- Madison has estimates of world GDP going back to 1950. The average world GDP growth rate between 1950 and 2008 is 3.98%.[11]
- A Treasury forecast of 4 year GDP growth (as reported by Lally) is too short term to be of relevance to a long run forecast of GDP growth.

17. Properly analysed, the data referred to by Lally support, rather than undermine, the adoption of an estimate of long-term real GDP growth of around 3.9%. This is less than world GDP growth since 1950 (4.0%) and is less than Australia's long term GDP growth over the longest horizon reported in that data (4.6%).

18. Finally, our estimate of 3.9% real long run growth in dividends was not based on historical average GDP growth since 1959 but, rather, based on historical average real

9 Lally, The Dividend Growth Model, 4 March 2013, p.17.

10 See, http://www.ggdc.net/maddison/oriindex.htm

11 The 16 countries reported by Bernstein and Arnott and referred to by Lally are dominated by Western European countries and the selection of the period 1990 to 2000 is dominated by two "world wars" and a great depression that disproportionately affected Western Europe. The average growth rate for these 16 countries since 1950 has been 3.3% according to Madison

gross domestic income (GDI) growth.[12] Following updates and revisions by the ABS the currently published historical average economic growth figure is 3.75%.[13]

19. For this reason, we use 3.75% (average gross domestic income growth since 1959) as the base-case long run growth rate in Australian company dividends. We also include a sensitivity of 4.28% (the average of the longest time series available for world GDP and Australian GDP available from the Madison data source referenced by Lally).

20. From these base-case dividend growth rates we also report the effects of making a deduction (d) of between 0.5% and 1.5% to allow for new share issues and new companies, as per Lally's recommendation.

21. Since this method moves from the growth rate between the short-term dividend forecasts sourced from Bloomberg to an estimate of long-run dividend growth, we have modelled the linear transition in growth rates as occurring over 8 years (which we understand to be the AER's three-stage model). We do not present the results of moving immediately to the long run growth rate (0 year transition), in line with the AER's two-stage model. This is consistent (although more aggressive than) Lally's advice that "a convergence period of at least 10 years is sensible".[14]

22. Each dividend is assumed to be paid at the middle of the financial year. The forecast dividend for the current financial year is adjusted pro-rata for the remaining period of the financial year, and is assumed to be paid midway between the date of the forecast and the end of that financial year. To be consistent with the AER's terminology, let year 1 be the following year (the first full year, assuming the model is not estimated at the beginning of the financial year). The next dividend yield forecast was assigned to year 1 with the third and final dividend forecast from Bloomberg is assigned to financial year 2.

23. In the three-stage model, the AER transitions the growth rate linearly from the short run to the long run rates such that the long run rate is first applied in the discounted terminal value assigned to year 9. To be clear, the growth rate applied to calculate D_9

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12 As set out in paragraph 189 of CEG, Internal Consistency of the Risk Free Rate and MRP in the CAPM, March 2012 (the precursor to the November 2012 report quoted by Lally – where the November 2012 report was a rebuttal of the AER analysis of the March 2012 report). The source provided there is The Australian Bureau of Statistics (ABS) economic growth figures for "growth in real domestic income of 3.9% (A2304314X of ABS Catalogue 5206.0) rather than nominal growth, since future expectations of inflation are not consistent with the high levels of inflation that were experienced at various times over this period."

13 We note that the equivalent figure for gross domestic product (ABS series A2298668K) is 3.55% which is slightly lower than 3.75%. We note that gross domestic product and gross domestic income attempt to measure the same thing using different data sources. The difference between them is a statistical artefact. 3.75% is more consistent with the long run growth rates for Australia and world GDP from the Madison project.

14 Lally, The Dividend Growth Model, 4 March 2013, p.20.

was still higher (or lower) than the long run growth rate, with the long run growth rate finally applied to calculate the terminal value of D_9 x (1+g)/(k-g).

24. The expected market return on equity was calculated as the discount rate at which the net present value of the series of uplifted dividend yields equals 1. The uplift value depends on the assumed valuation of imputation credits at the time they are distributed to investors ("theta"). The market risk premium is calculated as the expected market return on equity less the 10 day prevailing average of CGS yields.

2.1.2 Historical average estimates of realised E[Rm] (the "Wright approach")

25. An alternative to using the forward looking estimates of E[Rm] from the DGM is to estimate E[Rm] based on the historical average realised real Rm. The AER has termed this approach the "Wright approach". Under this approach, it is assumed that investors' expectations of future Rm are based on the historical average realised Rm. As explained in Hird and Grundy 2013,[15] this approach to estimating E[Rm] is the best approach if you believe that it is not possible to accurately discern movements in E[Rm] using forward looking models such as the DGM.

26. According to NERA's update[16] to the Brailsford et al.[17] data, the average real realised Rm for the Australian market, inclusive of the value of imputation credits, from 1883 to 2011 is 8.84%. Adding currently expected inflation of around 2.50% to the historical average realised real R_m provides an estimate of the current nominal E[R_m] of 11.56%. Given prevailing interest rates in December 2013 reported in the previous section (4.34%), the implied E[MRP] is 7.22%. These estimates are within the range of MRP estimates derived from the DGM analysis of the previous section.

Table 3: Historical average estimate of E[Rm] and implied E[MRP]

	Value
Historical average real realised Rm	8.84%
E[Rm] (historical real realised return with forward looking inflation of 2.5%)	11.56%
E[MRP] = E[Rm] – 4.34%	7.22%

Source: NERA, RBA, CEG analysis.

15 Hird and Grundy, CEG, Estimating the return on the market, a report for the ENA, June 2013.

16 NERA, *The market, size and value premiums*, 2013.

17 Brailsford, T., J. Handley and K. Maheswaran, *Re-examination of the historical equity risk premium in Australia*, Accounting and Finance 48, 2008.

2.1.3 Historical average estimates of realised excess returns plus the risk free rate

27. An alternative approach to estimating E[Rm] is to estimate the historical average realised excess return above the risk free rate on the market portfolio and to assume that this is the best estimate of the E[MRP]. However, in order to arrive at an estimate of E[Rm] this must be added to an estimate of the risk free rate. There are two candidates for an estimate of the risk free rate:

- The historical average risk free rate; or
- The prevailing risk free rate.

28. For the reasons set out in Hird and Grundy 2013, adding the prevailing risk free rate to the historical average excess return will lead to a biased estimate of the E[Rm].[18] Moreover, doing so involves a combination of an historical average estimate of MRP (historical average Rm less the historical average risk free rate) with a prevailing estimate of the risk free rate. For the reasons set out in section 2 of Hird 2012,[19] this is internally inconsistent and a violation of the CAPM.

29. To see this consider the CAPM formula below.

Equation (1)

$$Exp.Yield\ Eq^{i} = RFR + \beta^{i} \times (\ Exp.Yield\ Eq^{market} - RFR)$$

Where $Exp.Yield\ Eq^{i}$= the expected yield on an individual asset, $Exp.Yield\ Eq^{market}$= the expected yield on the market portfolio, β^{i}= the beta for asset i measured against the market portfolio and RFR= the risk free rate.

30. Note that the risk free rate enters into this equation twice – once on its own and once in the definition of the MRP. These two definitions of the risk free rate need to be the same for the CAPM formula to be valid. This further means that the MRP (and therefore the risk free rate embodied in the MRP) needs to be estimated on the same basis as the risk free rate that enters separately to the MRP.

31. Consider the case of an equity that has the same risk as the market ($\beta^{i} = 1$). Obviously, the expected yield on this equity has to be the same as the expected yield on the market. However, this will not be the case if different definitions of the risk free rate are used in the two places that the risk free rate enters the equation.

32. By way of example, consider the following scenario. Let the prevailing spot risk free rate be 3% and the prevailing expected yield on the market be 12%. Let the 10 year

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18 Hird and Grundy, CEG, Estimating the return on the market, a report for the ENA, June 2013.

19 See section 2 of Hird, CEG, Response to AER Vic gas draft decisions, Internal Consistency Of MRP And Risk Free Rate, November 2012.

forecast of the average expected yield on the market also be 12% but the 10 year forecast for the average risk free rate be 6%. It follows from this that the spot MRP (the difference between the spot expected yield on the market and the spot risk free rate) is 9% while the forecast 10 year average MRP is 6%.

Table 4: Illustration of using mismatched parameter definitions

Parameter	Spot level	Forecast of 10 year average
β^i	1	1
Spot risk free rate	3%	6%
Expected yield on the market	12%	12%
MRP	9%	6%

Source: CEG

33. Populating the CAPM entirely with spot estimates of parameters will give an estimate of the spot cost of equity. Similarly, populating the CAPM with long term forecasts of parameters will give a long term forecast of the cost of equity. (In this example the two are the same but they need not be.)

34. Populating the CAPM with two different definitions of the risk free rate will not give a meaningful answer. The AER's reasoning would lead, in this example, to the following implementation of the CAPM.

$$Exp.Yield\ Eq^i = RFR_{Spot} + \beta^i \times (Exp.Yield\ Eq^{Market}_{10\ yr\ forecast} - RFR_{10\ yr\ forecast})$$

$$Exp.Yield\ Eq^i = 3\% + 1 \times (12\% - 6\%) = 9\%$$

35. This approach clearly arrives at an estimate that is neither the spot return on equity nor the long term forecast return on equity – and is below both. The reason is that the two risk free rates do not cancel out as they should if the risk free rate and the MRP were both consistently defined. This error is similar in nature to the error found by the Australian Competition Tribunal in its 2003 GasNet decision.[20]

[20] In that decision, (available at http://www.austlii.edu.au/au/cases/cth/ACompT/2003/6.html), the Tribunal found that the ACCC had erred by using a 5 year CGS yield as the proxy for the prevailing risk free rate and the 10 year CGS yield through history as the basis of the proxy for then prevailing risk free rate when estimating the historical average realised market excess return relative to CGS. Clearly a 5 year CGS bond is not the same as a 10 year CGS bond and using different bonds creates a potential for mismatch. Somewhat more subtly, but equally importantly, a 10 year CGS bond today is not the same (does not have the same risk characteristics) as a 10 year CGS bond at other times through history.

46 … While it is no doubt true that the CAPM permits some flexibility in the choice of the inputs required by the model, it nevertheless requires that one remain true to the mathematical logic underlying the CAPM formula. In the present case, that requires a consistent use of the value of rf in

36. For this reason we consider that, if an estimate of the historical average realised excess return is to be used as the E[MRP] in the CAPM formula then it should be combined with an internally consistent estimate of the historical average risk free rate.

37. According to NERA's update[21] to the Brailsford et al.[22] data, the average realised excess return for the Australian market, inclusive of the value of imputation credits, from 1883 to 2011 is 6.5%. The historical average yield on the 10 year government debt over the same period and from the same source is 5.64% and the historical average inflation rate is 3.34%. This implies a historical average real bond yield of 2.22% which, when combined with an inflation forecast of 2.5% implies a nominal risk free rate of 4.78%. This compares with the more recent historical average, over ten years, of 5.17% (from 19 November 2003 to 18 November 2013). Over this period it is reasonable to assume that inflation expectations were centered around the RBA's target rate of 2.5%. This would imply an average real expected return of 2.60%.

2.2 Estimating beta

38. Consistent with recent work performed by CEG[23], SFG[24] and NERA[25], we consider that the appropriate range for beta is between 0.82 and 1.00. A beta of 0.82 is based solely

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both parts of the CAPM equation where it occurs so that the choice was either a five year bond rate or a ten year bond rate in both situations.

47 The ACCC erred in concluding that it was open to it to apply the CAPM in other than the conventional way to produce an outcome which it believed better achieved the objectives of s 8.1. In truth and reality, the use of different values for a risk free rate in the working out of a Rate of Return by the CAPM formula is neither true to the formula nor a conventional use of the CAPM. It is the use of another model based on the CAPM with adjustments made on a pragmatic basis to achieve an outcome which reflects an attempt to modify the model to one which operates by reference to the regulatory period of five years. The CAPM is not a model which is intended to operate in this way. The timescales are dictated by the relevant underlying facts in each case and for present purposes those include the life of the assets and the term of the investment.

48 The Tribunal is satisfied that the use by GasNet of a ten year Commonwealth bond rate to determine a Rate of Return on equity under s 8.30 of the Code was a correct use of the CAPM and was in accordance with the conventional use of a ten year bond rate by economists and regulators where the life of the assets and length of the investment approximated thirty years in the MRP calculation and the risk-free rate. …

21 NERA, *The market, size and value premiums*, 2013.

22 Brailsford, T., J. Handley and K. Maheswaran, *Re-examination of the historical equity risk premium in Australia*, Accounting and Finance 48, 2008.

23 Information on equity beta from US companies, a report for the ENA, June 2013, CEG report - International comparators, a report for the ENA, October 2013, Precision of beta estimates, a report for APIA, October 2013.

24 Regression-based estimates of risk parameters for the benchmark firm, a report for the ENA, June 2013, The Vasicek adjustment to beta estimates in the CAPM, a report for the ENA, June 2013, Comparison of OLS and LAD regression techniques for estimating bet, a report for the ENA, June 2013

on a regression-based estimates of beta. This estimate gives more weight to beta estimates where they exist for the small number of Australian comparables but does give weight to the large number US comparables.[26]

39. A beta of 1.0 takes into account the empirical regularity, both in Australia and in other markets, which suggests that econometric measures of beta do not explain required market returns.[27] This may be because beta itself is not the only determinant of risk (in which case a model other than the CAPM should be used) or because the true risk free rate is above the proxy for the government bond rate used or simply because econometric estimates of beta do not accurately reflect true beta risk (e.g., because the true market portfolio is dominated by illiquid ill-measured assets such as real-estate and human capital). Whatever the explanation, the empirical fact is that assuming a beta of 1.0 will, in general, result in a more accurate estimate of total risk than adopting an econometrically estimated beta.

2.3 Estimating CAPM return on equity

40. The inputs into the CAPM are the E[Rm], risk free rate and the beta (the E[MRP] can be calculated from the chosen E[Rm] and risk free rate inputs). The table below summarises the various estimates of the CAPM cost of equity found by combining the various parameter estimates set out above (where such combinations can be made in an internally consistent manner).

Table 5: Estimates of the CAPM cost of equity

	E[Rm] estimated with DGM		**E[Rm] estimated based on historical average realised**	
	(Theta 0.7)	(Theta 0.35)	Return on the market	Excess return on the market
Risk free rate	4.34%	4.34%	4.34%	4.78%
E[MRP]	8.31%-7.16%	7.72%-6.54%	7.22%	6.50%
Beta	0.82 -1.0	0.82 -1.0	0.82 -1.0	0.82 -1.0
Cost of equity (high)	12.65%	12.06%	11.56%	11.28%
Cost of equity (low)	10.21%	9.70%	10.26%	10.11%

Source: Bloomberg, RBA, CEG analysis

25 Estimates of the Black CAPM zero beta premium, a report for the ENA, June 2013, Review of cost of equity models, a report for the ENA, June 2013

26 As set out on page 16 of SFG, Regression-based estimates of risk parameters for the benchmark firm, June 2013.

27 As documented in NERA, Estimates of the Black CAPM zero beta premium, a report for the ENA, June 2013, and NERA Review of cost of equity models, a report for the ENA, June 2013.

41. The NSW DNSPs have adopted a range for the cost of equity of 9.98% to 11.02%. The bottom of the NSW DNSPs' range is at the low end of the 'low' range of estimates set out above. The top of the Network NSW range is well below the top end of the range reported above.

3 Non-CAPM estimates of the cost of equity

42. It is commonplace for academics and market practitioners to estimate the cost of equity for a company/industry using non-CAPM models – such as the Fama French three factor model or the DGM. This section provides estimates of the cost of equity for a benchmark DNSP using these approaches.

3.1 Fama French model

43. The Fama-French model predicts the required return on equity for the benchmark firm using the following equation:

$$r_e = r_f + \beta_e \times (r_m - r_f) + s \times SMB + h \times HML$$

where r_e is the required return on equity for the benchmark firm, r_f is the risk-free rate of interest, r_m is the required return on the market portfolio and β_e (beta) is an estimate of systematic/market risk of equity in the benchmark firm, SMB is the expected return to a portfolio of small market capitalisation stocks minus the expected return to a portfolio of large market capitalisation stocks, HML is the expected return to a portfolio of high book-to-market stocks minus the expected return to a portfolio of low book-to-market stocks, and s and h represent the sensitivities of expected returns to the SMB and HML factors.

44. Eugene Fama, after whom the Fama French Model is named, was awarded the 2013 Nobel Prize in Economics in part for the development and empirical testing of this asset pricing model.[28] This strongly suggests that the Fama French Model is a well accepted in economic literature and the results of the model should be considered "relevant' information for the purposes of assessing the cost of equity.

45. SFG have estimated the cost of equity of the benchmark Australian regulated utility using the Fama French model.[29] They estimated that the cost of equity under long term average market conditions was 11.5%. They also estimated the prevailing cost of equity at the time of writing, associated with a risk free rate of 3.2%, to be 11.4%. Updating the risk free rate to reflect higher current levels (4.34% in December 2013)

28 http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2013/advanced-economicsciences2013.pdf

29 SFG (2013), Regression-based estimates of risk parameters for the benchmark firm.

but holding the SFG estimate of the market cost of equity (12.2%) constant[30] results in an updated estimate of 11.61%.

46. I note that all of these Fama French Models are above 11.0% - which we understand is the top end of the range adopted by the NSW DNSPs in their transitional proposals.

3.2 DGM estimates

47. The DGM has already been used in this report to estimate the cost of equity for the market as a whole. However, the DGM can also be used to estimate the discount rate that sets the present value of all expected future dividends for a specific firm (industry) equal to the current stock price(s) of that specific firm (industry). This discount rate will be determined by investors' required return for bearing risk, but there is no disaggregation of the expected return associated with separately-identified risk factors.

48. SFG[31] has estimated the DGM cost of equity in the following manner. For all Australian-listed firms for which data is available there is an estimate of the required return on equity performed over every six month period from 2002 to 2012. Applying market capitalisation weights to these required return on equity estimates results in a market cost of equity estimate for every six month period. This is compared to the risk-free rate every six months to form an estimate of the implied market risk premium every six months.

49. SFG then compares cost of equity estimates for regulated to the risk-free rate to form estimates of the equity risk premium for these comparable firms. The risk premium associated with these individual firm estimates is compared to the market risk premium in the corresponding six month period to provide a set of risk premium ratios. Across the 85 individual firm observations the average ratio is 0.96, implying that the average listed network has an equity risk premium which is 96% of the market risk premium.

50. This average risk premium is then applied to the implied market risk premium at any point in time, which is then added to the risk-free rate to estimate the cost of equity for the benchmark firm.

51. SFG estimate that the DGM estimates of the required return on equity for the benchmark efficient firm are as follows:

- Under current market conditions the dividend growth model-based estimate is 11.8%.

30 This 12.2% estimate of the market cost of equity is within the range of DGM estimates derived by us for December in Table 1 and Table 2.

31 SFG (2013), Dividend discount model estimates of the cost of equity, June.

- Under long-term average market conditions the dividend growth model-based estimate is 11.5%.

52. The prevailing DGM estimates of MRP (associated with a risk free rate of 4.34%) in Table 1 average at 7.13%.[32] Applying the 0.96 DGM factor as estimated by SFG, this is associated with a cost of equity for the benchmark utility of 11.18%.[33]

53. I note that all of these DGM estimates are above 11.0% - which we understand is the top end of the range adopted by the NSW DNSPs in their transitional proposals.

54. In summary, when assessing CAPM and non-CAPM approaches to the cost of equity, and based on our assessment of the inputs used by the NSW DNSPs, we consider that the NSW DNSPs' cost of equity range of 9.98% to 11.02% to be reasonable, although, in our opinion, conservative.

32 The simple average of the base case MRP estimates reported in Table 1 assuming a theta of 0.35.

33 11.18%= 4.34%+0.96*7.13%.

4 Estimates of the cost of debt

55. For the reasons set out in our previous two reports on the merits of a trailing average benchmark for the cost of debt[34] and the merits of imposing a transition to that benchmark[35] we consider that immediate adoption of a long-term trailing average is appropriate for NSW DNSPs.

56. Those reports should be read in full for an explanation of both the efficiency of the trailing average benchmark and why it is not appropriate to impose a single transition to that benchmark on all firms. However, the first report established criteria by which to assess the relative efficiency of the 'on the day' versus the 'trailing average' benchmark cost of debt.[36] The second report applies the same criteria to assess, in the context of a firm that already funds itself using a staggered debt portfolio, the relative efficiency of the AER's proposed transition versus immediate adoption of the trailing average benchmark. The high level conclusions are repeated below.[37]

i. *The AER trailing average transition retains the unhedgeable characteristics of the 'on the day' approach and causes the same exposure to unnecessary risks for a business that already finances in this way. The AER transition approach 'locks in' a component of the 'on the day' approach for the next N years. The longer an unhedgeable benchmark is used (including in transition) the greater the level of unnecessary risks that investors are exposed to.*

ii. *The above risks can, at best, be partially hedged against. Moreover, any attempt by a business to partially reduce such risks will c reate transaction costs for the business. These transaction costs would be avoided if no transition was put in place.*

iii. *The AER transition increases the risks associated with measurement error. The AER transition approach gives, in the first year of the next regulatory period, 100% weight to the estimate of the 'on the day' cost of debt at the beginning of that year and this continues to have (declining) weight in the cost of debt allowance for the next N years (where N is the term of the trailing average). An immediate adoption of the trailing average gives 1/N weight to each of N year's. It therefore dramatically reduces the potential for estimation error in a single year to affect the accuracy of the cost of debt allowance over the next N years.*

iv. *Unexpected price volatility can create costs to customers in managing and smoothing their budgets (i.e., above and beyond the costs of paying higher/lower*

34 CEG, *Efficiency of staggered debt issuance, a report for the NSW DNSPs, February 2013.*

35 CEG, Transition to a trailing average approach, *a report for the NSW DNSPs*, October 2013.

36 CEG, *Efficiency of staggered debt issuance, a report for the NSW DNSPs, February 2013.*

37 CEG, Transition to a trailing average approach, *a report for the NSW DNSPs*, October 2013, pp. 3-4.

prices). The effective incorporation of an 'on the day' approach at the beginning of the transition significantly increases the level of uncertainty faced by customers and businesses about the level of compensation that will actually be provided.

v. *Finally, imposing a transition delays the time until the benchmark cost of debt allowance reflects the standard practice of businesses operating in similar environments to network energy businesses. The fact that other businesses generally fund using a trailing average approach provides a strong indication that this practice is efficient. Delaying the implementation of a trailing average where a business already funds itself in this way delays the time at which its cost of debt allowance will reflect efficient costs.*

57. In short, the AER's decision in its final guideline to impose a single transition path, irrespective of a business's actual financing strategy (a transition path that retains the 'on the day' approach for the first year of the next regulatory period)[38], is inconsistent with "benchmark efficient" debt management strategy for the purpose of modelling the rate of return consistent with clause 6.5.2(c) of the NER.

> *The allowed rate of return objective is that the rate of return for a Distribution Network Service Provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the Distribution Network Service Provider in respect of the provision of standard control services (the allowed rate of return objective).*

58. For a business that is already funding itself using a staggered portfolio approach (giving rise to a trailing average cost of debt), the AER's transition significantly delays the realisation of the benefits of moving to the AER's benchmark efficient cost of debt which is the trailing average estimate. Similarly, it may prevent a business from having an opportunity to recover its efficient costs.

59. In order to arrive at an estimate of the 10 year trailing average cost of debt it is necessary to construct a time series for the cost of debt that has the relevant characteristics (e.g., term to maturity at time of issue and credit rating). The AER final Guideline proposes a benchmark term to maturity of 10 years and a credit rating of BBB+. The ENA submissions to the AER Guidelines process proposed a 10 year term and a credit rating of BBB (or even BBB-).

60. In Australia there are only three potential sources of independent 3rd party estimates of the cost of debt for BBB rated corporate debt. These are produced by Bloomberg, CBASpectrum and, most recently, the Reserve Bank of Australia (RBA). The RBA series, starting in January 2005, has the longest uninterrupted time series over the last 10 years (i.e., over the agreed benchmark term). CBASpectrum ceased publication

[38] Followed by a gradually transition to a trailing average for all businesses

after the 2009 financial crisis and Bloomberg has only intermittently published a 10 year BBB estimate over the relevant period.

61. We understand that the NSW DNSPs only require a preliminary estimate for the 10 year cost of debt for the purpose of their transitional proposals and we have not been asked to arrive at a definitive estimate. In this context, we consider that reliance on the RBA times series is appropriate – given that this time series requires no extrapolation to 10 years (unlike Bloomberg) and is available for 9.5 continuous years. The table below shows the RBA estimates of the average cost of debt from January 2005 to November 2013 (noting that more data will become available from this source overtime).

Table 6: 10 year trailing average estimates

	Jan 05 to Nov 13
RBA estimate of yield on BBB debt	7.96%
RBA estimate of yield on A debt	7.14%
Average of RBA estimates of BBB and A rated debt	7.55%

Source: RBA publication: Aggregate measures of Australian corporate bond spreads. These values have been converted to annual yields by CEG.

62. We note that there is some possibility that the RBA BBB series overestimates the cost of debt for a BBB+ benchmark. This is because the RBA BBB data sample includes bonds rated from BBB- to BBB+. There is a possibility that the inclusion of BBB and BBB- bonds in the sample tends to lower the estimated yield below that for a 'pure' BBB+. We have not investigated this possibility in this report but have included the midpoint between the RBA BBB and A rated estimates in order to provide a simplistic, although likely conservative,[39] possible basis for arriving at a BBB+ estimate from the RBA's BBB and A series. We note that in order to assess the need for any such adjustment and to accurately make such an adjustment it would be necessary to understand and analyse the bonds included in the RBA samples – a task that is outside the scope of this report.

63. It is relevant to note that the 10 year average of cost of 10 year BBB debt ending November 2013 and sourced from Bloomberg (and generally accepted as a proxy for the BBB+ cost of debt) is 7.84%. This is based on extrapolation of the Bloomberg fair value curve using regulatory precedent for the method of extrapolation (e.g., in periods when the AER was extrapolating using the AAA curve this method is followed, in periods when the AER is using bond pair analysis this method is followed). This is

[39] If the RBA A curve (which is based on A+ to A- bond yields) was interpreted strictly as a pure "A" curve and the BBB curve (which is based on BBB+ to BBB- bond yields) was interpreted as a pure "BBB" curve and if there was a constant linear relationship between yields and each 'notch' of a credit rating then the simple average of the A and BBB curves would be associated with an implied credit rating that was exactly midway between the border of A- and BBB+.

consistent with the preliminary range for the RBA estimates for the historical average cost of debt reported above.

64. We also note that the primary difference between the AER and the ENA analysis of the cost of the benchmark credit rating is that the ENA arrives at an estimate of a BBB benchmark by focusing on prevailing conditions and credit ratings for regulated businesses. By contrast, the AER acknowledges current credit ratings below BBB+ but relies heavily on a historical average credits to arrive at a BBB+ estimate.

65. In particular, see Table 8.3 on page 229 of the AER December 2013 explanatory statement. That table shows the median prevailing credit rating of BBB but the AER's analysis focuses on the fact that the median credit rating over the period 2002 to 2012 (2013) was BBB+ (BBB+ Negative watch).

66. In our view, the correct approach is to have regard to the historical average credit rating (BBB+) in the context of estimating a trailing average cost of debt. In the above table this is proxied by the 7.55% yield. However, in the context of estimating a prevailing cost of debt (such as in the first year of the AER's proposed transition) it is appropriate to have regard to the prevailing credit rating (BBB). In this regard, I note that the RBA estimate of the prevailing BBB cost of debt is 7.58% for November 2013 – which is slightly higher than the historical average of the BBB and A curves.

67. In summary, when considering publicly available data sources for the cost of debt, the use of an average of RBA estimates for BBB and A rated debt from January 2005 to November 2013, we consider that the NSW DNSPs approach of using a trailing average cost of debt of 7.55% to be appropriate (albeit likely conservative).

5 Gamma

68. The AER Guideline has proposed a value of imputation credits (gamma) parameter of 0.5 based on a payout ratio of 0.7 and a value of distributed imputation credits (theta) of 0.7. By contrast, in our view the best estimate of the value of gamma is 0.25 based on a payout ratio 0.7 (consistent with the AER Guideline) and a theta value of 0.35 (half the AER Guideline estimate).

69. The point of difference between our estimate and that of the AER relates to the estimate of theta. This difference arises fundamentally because the AER believes that the value of imputation credits distributed can be estimated using accounting techniques – in essence asking what proportion of imputation credits are 'used' in Australian resident tax returns to offset personal income tax assessments. By contrast, we consider that the value of imputation credits must be estimated using economic techniques – in essence asking what value (price) does the market as a whole place on imputation credits when they are distributed.

70. In our view, the market value of imputation credits is the only valuation that is consistent with arriving at an estimate of efficient financing costs. This follows from the fact that businesses must compete in the market for equity funding. The way they do this is by promising investors a combination of cash dividends and imputation credits in return for the investors providing equity funding.

71. The level of cash dividends that must be provided depends on the market value of imputation credits. If the market places a low value on imputation credits then, other things equal, higher cash dividends must be promised in order to attract equity funding. Similarly, if the market places a high value on imputation credits then, other things equal, lower cash dividends must be promised in order to attract equity funding. This is true irrespective of the rate at which resident taxpayers "use" imputation credits (noting that resident taxpayers are only a fraction of the total market providing equity funding to Australian businesses).

72. Once it is accepted that businesses must pay the market rate for equity funding it follows inexorably that the correct value to place on imputation credits when estimating the cost of equity funding is the market value. The question of the market value of imputation credits has been the subject of Australian Competition Tribunal review. [40] In that case the value of imputation credits was set at 0.35 based on dividend drop off studies. As noted by the ENA[41] the basis for this finding remains unchanged:

40 Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011)

41 ENA, Response to the AER Consultation Paper, June 2013, pp 86-87.

Dividend drop-off analysis can be used to estimate the value of distributed credits by observing the stock price change around the ex-dividend date, when the dividend and associated imputation credit separate from the share.

In the Gamma Case, the Tribunal directed that SFG should be retained to perform a "state of the art" dividend drop-off study. That study ultimately concluded that the appropriate estimate of theta was 0.35, paired with an estimate of the value of cash dividends of 0.85 to 0.90.

The Tribunal strongly endorsed the estimates from the SFG state-of-the-art study:

> *In respect of the model specification and estimation procedure, the Tribunal is persuaded by SFG's reasoning in reaching its conclusions. Indeed, the careful scrutiny to which SFG's report has been subjected, and SFG's comprehensive response, gives the Tribunal confidence in those conclusions.* [42]

The Tribunal went on to conclude that:

> *The Tribunal is satisfied that SFG's March 2011 report is the best dividend drop-off study currently available for the purpose of estimating gamma in terms of the Rules.* [43]

and

> *The Tribunal finds itself in a position where it has one estimate of theta before it (the SFG's March 2011 report value of 0.35) in which it has confidence, given the dividend drop-off methodology. No other dividend drop-off study estimate has any claims to be given weight vis-à-vis the SFG report value.* [44]

The ENA has retained SFG to update the dividend drop-off study that was prepared for the Tribunal. SFG (2013a) uses the same econometric specifications, estimation methods and data sources as in the study prepared for the Tribunal. The updated study also includes a wide range of sensitivity analyses, robustness checks and stability analyses. SFG concludes that:

> *In our view, the conclusions from our earlier study remain valid when tested against the updated data set.* [45]

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42 Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraph 22.

43 Ibid, Paragraph 29.

44 Ibid, Paragraph 38.

45 SFG (2013a), p. 27.

73. We consider, based on the above, that the NSW DNSPs' proposed 0.25 value of gamma is reasonable.