KPMG

Goldfields Gas Transmission Pty Ltd

Weighted Average Cost of Capital

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Contents

1 Executive summary

The Goldfields Gas Transmission Joint Venture ("GGTJV") owns and operates the gas transmission system in Western Australia known as the Goldfields Gas Pipeline ("GGP"). The GGP transports gas from Yarraloola in the north west of Western Australia to Kalgoorlie, and services the East Pilbara and Goldfields regions.

In accordance with the requirements of the *National Third Party Access Code for Natural Gas Pipeline Systems* ("Code"), the GGTJV submitted an access arrangement to the relevant regulator - the Western Australian Independent Gas Pipelines Access Regulator, now the Economic Regulation Authority ("Regulator" or "ERA") - on 15 December 1999. The Regulator issued a draft decision in April 2001. However, in order to address certain issues relating to the interaction of the Code and the Goldfields Gas Pipeline Agreement, an agreement between the State of Western Australia and the GGTJV that provided for construction of the pipeline and for third party access ("State Agreement"), the draft decision was amended and reissued on 29 July 2004 ("Amended Draft Decision").

KPMG has been asked to provide advice on the upper limit of the range of values for the rate of return for the GGP for the purpose of determining a reference tariff under the Code, assuming that:

- the Code is interpreted in such a way that the previous rate of return applying under the State Agreement (and the parameters used to determine that rate of return) are to be disregarded;
- the rate of return is to be determined afresh in accordance with current prevailing conditions in the market for funds; and
- the models referred to by way of example in section 8.31 of the Code are applied consistently with the conventional use of those models.

In this report we review the conventional determination of a rate of return as weighted average of costs of equity and debt, and the use of the Capital Asset Pricing Model ("CAPM") for estimation of the cost of equity, recognising the requirements for internal consistency in the use of that model.

When values at the upper or, as appropriate, lower limits of the ranges of values for the parameters used in applying the CAPM, and in determining a weighted average of costs of equity and debt are used, the rate of return is 13.7% pre-tax nominal, or 10.8% pre-tax real.

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2 Code requirements and the GasNet decision

Section 8.30 of the Code sets out requirements for the rate of return that should be used in determining a reference tariff for a covered pipeline:

> *"The Rate of Return used in determining a Reference Tariff should provide a return which is commensurate with prevailing conditions in the market for funds and the risk involved in delivering the Reference Service (as reflected in the terms and conditions on which the Reference Service is offered and any other risk associated with delivering the Reference Service)."*

Guidance on the methods which might be used to determine the rate of return required by section 8.30 is provided in section 8.31:

> *"By way of example, the Rate of Return may be set on the basis of a weighted average of the return applicable to each source of funds (equity, debt and any other relevant source of funds). Such returns may be determined on the basis of a well accepted financial model, such as the Capital Asset Pricing Model. In general, the weighted average of the return on funds should be calculated by reference to a financing structure that reflects standard industry structures for a going concern and best practice. However, other approaches may be adopted where the Relevant Regulator is satisfied that to do so would be consistent with the objectives contained in section 8.1."*

In its GasNet decision, the Australian Competition Tribunal ("ACT"), responding to an application for review of a decision by the Australian Competition and Consumer Commission ("ACCC") on revisions to the access arrangement for the gas transmission system owned and operated by GasNet Australia (Operations) Pty Ltd, gave explicit consideration to:

- the application of sections 8.30 and 8.31 of the Code; and
- the role of the regulator in establishing the method to be used for the setting of the rate of return, and in assigning values to the parameters to be used in applying that method.[1]

In developing its response, the ACT noted the findings of the Full Court of Supreme Court of Western Australia in *Epic Energy*, and concluded:

> *"It is clear in the reasoning in Michael that there is no single correct figure involved in determining the values of the parameters to be applied in developing an applicable Reference Tariff. The application of the Reference Tariff Principles involves issues of judgement and degree. Different minds, acting reasonably, can be expected to make different choices within a range of possible choices which nonetheless remain consistent with the Reference Tariff Principles. Where the Reference Tariff Principles produce tension, the relevant regulator has an overriding discretion to resolve the tensions in a way which best reflects the statutory objectives of the Law. However, where there are no conflicts or tensions in the application of the Reference Tariff Principles, and where the AA proposed by the Service Provider falls within the range of choice reasonably open and consistent with Reference Tariff Principles, it is beyond the power of the Relevant Regulator not to approve the proposed AA simply because it prefers a different AA which it*

[1] *Application by GasNet Australia (Operations) Pty Ltd* [2003] ACompT 6.

> *believes would better achieve the Relevant Regulator's understanding of the statutory objectives of the Law."*[2]

In the specific context of determination of the rate of return, the ACT observed that:

> *"Contrary to the submission of the ACCC, it is not the task of the Relevant Regulator under s 8.30 and s 8.31 of the Code to determine a 'return which is commensurate with prevailing conditions in the market for funds and the risk involved in delivering the Reference Service'. The task of the ACCC is to determine whether the proposed AA in its treatment of Rate of Return is consistent with the provisions of s 8.30 and s 8.31 and that the rate determined falls within the range of rates commensurate with the prevailing market conditions and the relevant risk.*
>
> *As a matter of construction, s 8.30 involves issues of judgement and degree as stated in par [29] above as to whether the Rate of Return is commensurate with the prevailing conditions in the market for funds and the risk involved in delivering the Reference Service. Nevertheless, it involves making decisions as to the existence or otherwise of the underlying facts which are relevant to the statutory task and to the choice of a method of utilising those facts to produce a Rate of Return. The right to choose a methodology is found in s 8.31."*[3]

Having found that the regulator's role was not to set the rate of return, but to assess whether the rate determined by the service provider fell within the range of acceptable rates obtained by applying sections 8.30 and 8.31 of the Code, the ACT concluded:

> *"When the proposed AA was delivered by GasNet to the ACCC, insofar as it contained a Rate of Return which was used to determine the Reference Tariff established by the use of the CAPM, the only issue for the ACCC to determine in respect of the Rate of Return was whether GasNet had used the model correctly. That is, whether it had used the CAPM to produce a Rate of Return which was consistent with the conventional use of the model. If GasNet had done so, then there was no occasion to refuse to approve the proposed AA on the basis that the Rate of Return had not been determined on a basis which was consistent with the objectives contained in s 8.1."*[4]

Finally, in assessing the approach the regulator had taken to the particular parameter value in question (the risk free rate), the ACT noted:

> *"The position of the ACCC was that it was required to make an evaluative judgement for the purposes of s 8.30 as to what the appropriate rate of return should be. Its position was that although consistency was desirable, best estimates have to be used when perfect information is not available, and that at various stages of the CAPM, approximations and estimates are required. The ACCC contends that such a use of estimates and approximations does not invalidate the use of CAPM. 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."*[5]

In summary, the GasNet decision:

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[2] *GasNet*, paragraph 29.
[3] *GasNet*, paragraphs 42 and 43.
[4] *GasNet*, paragraph 45.
[5] *GasNet*, paragraph 46.

- reiterated the Court's view in *Epic Energy* that there was no single correct figure for each of the parameter values which must be determined for the purpose of developing a reference tariff, and noted that issues of degree and judgement were involved which may lead to tensions which should be resolved by reference to the statutory objectives;

- identified the task of the regulator as being one of assessing whether the service provider's treatment of rate of return was consistent with the provisions of sections 8.30 and 8.31 of the Code, and assessing whether the service provider's rate of return falls within the range of rates commensurate with prevailing market conditions and the relevant risk;

- indicated that choice of the method by which the rate of return was determined was a matter for the service provider;

- limited the regulator to ensuring that the service provider applied its chosen method in a way which was consistent with the conventional use of that method; and

- acknowledged that, where the service provider's method made use of the CAPM, there was flexibility in the choice of inputs, but insisted that this did not preclude remaining true to the mathematical logic underlying the model.

3 Conventional and consistent use of "the model"

Key principles from the GasNet decision are that, subject to the requirements of sections 8.30 and 8.31 of the Code, a service provider's chosen method for determination of the rate of return is be applied in a way which:

- is the conventional use of that method; and
- maintains the consistency of the method's internal logic.

Determination of a rate of return as a weighted average cost capital – a weighted average of the cost of funds from each source used to finance a business ("WACC") – is well established, and has a clearly defined internal logic. It is described in many textbooks on corporate finance, and has been carefully articulated by Officer.[6]

In this section of our report, we set out the conventional method for determination of a WACC, and indicate requirements for internal consistency in the application of that method. The specific parameter values which might be used in applying the conventional method of determining the WACC are discussed in the following section.

3.1 Weighted average cost of capital

The rate of return that a business – regulated, or unregulated – expects to earn represents the minimum return required to retain the existing financing of the capital invested, and to attract new financing for new investment. It is typically measured by reference to the current cost of financing the business. As most businesses are funded by a combination of equity and debt, the rate of return is typically measured as an average of the cost of equity and the cost of debt, each cost being weighted, as appropriate, by the contribution of equity or debt to total financing. The rate of return is measured as a WACC.

The cost of equity used to finance a business is usually expressed as a nominal rate after allowance for tax. The cost of debt is usually expressed as a before-tax nominal rate. In consequence, provided the proper adjustments are made, the WACC can be expressed in either post-tax or pre-tax terms.

Observed costs of equity and debt are nominal costs. They incorporate current expectations of inflation. In some applications of the rate of return measured as a WACC, actual financial outcomes are important, and nominal costs are appropriate. In other applications, the focus is on change in the value of real goods and services, abstracting from changes in the general level of prices. In these applications, real costs of equity and debt must be used. A WACC may therefore be expressed in either nominal or real terms.

The post-tax nominal form of the WACC is:

[6] R R Officer (1981), "The Measurement of a Firm's Cost of Capital", Accounting and Finance, 21(2): 31 – 61. Textbook presentations include Thomas E Copeland and J Fred Weston (1988), *Financial Theory and Corporate Policy*, 3rd ed., Addison-Wesley, Reading, Massachusetts.

$$\mathbf{WACC_{post\text{-}tax\ nominal} = K_e \times E/V + K_d \times (1 - t) \times D/V},$$

where:

- K_e is the post-tax nominal cost of equity;
- E/V is the proportion of equity in the total financing of the business;
- K_d is the pre-tax nominal cost of debt;
- t is the tax rate; and
- D/V is the proportion of debt in the total financing of the business.

This form of the WACC is applicable only if the taxation system does not provide for dividend imputation. If the taxation system recognises payment of tax at the corporate level, and shareholder payment of tax on dividends, as involving double taxation of the same income stream, and provides credits to shareholders for tax already paid at the corporate level, the calculation of the WACC should be modified to properly represent the additional element of shareholder return. The post-tax nominal WACC must, in these circumstances, be determined as:

$$\mathbf{WACC_{post\text{-}tax\ nominal} = K_e \times (1 - t)/[1 - t \times (1 - \gamma)] \times E/V + K_d \times (1 - t) \times D/V},$$

where γ is the proportion of tax collected at the corporate level which is to be credited against personal tax payments.[7]

Conversion from the post-tax nominal form of the WACC to the pre-tax real form has been the subject of some debate because tax is assessed only on a nominal net income stream. In this report, we use, for this conversion, the forward transformation method. (In this respect, our approach is the same as that of the ERA for the Amended Draft Decision for the GGP.)

First, the equivalent pre-tax nominal WACC is obtained by dividing by (1 – t):

$$\mathbf{WACC_{pre\text{-}tax\ nominal} = K_e \times 1/[1 - t \times (1 - \gamma)] \times E/V + K_d \times D/V}.$$

This pre-tax nominal WACC is then adjusted for expected inflation, using the Fisher equation, to yield a pre-tax real WACC:

$$\mathbf{WACC_{pre\text{-}tax\ real} = (1 + WACC_{pre\text{-}tax\ nominal})/(1 + \pi^e) - 1},$$

where π^e is expected inflation.

[7] See R R Officer (1994), "The Cost of Capital of a Company Under an Imputation Tax System", Accounting and Finance, 34(1): 1 – 17.

3.2 Determining the cost of equity

Despite continuing concern over aspects of the way in which it is derived, and doubt about its empirical validity, the CAPM remains the most widely used method of estimating the cost of equity.[8] The CAPM is a formalization of the notion that an investor in a risky asset requires additional return as compensation for bearing additional risk. In simple terms, the CAPM asserts that the expected rate of return on a risky asset is the sum of the risk free rate of return (R_f), and a risk premium measured as the product of the excess return on a well-diversified portfolio of risky assets (R_m - R_f) and the "beta" of the risky asset. That is, the required rate of return for equity securities (K_e) is determined as:

$$\mathbf{K_e = \text{risk free rate} + \text{risk premium}}$$

$$\mathbf{= R_f + \beta_e \times (R_m - R_f)}$$

Beta (denoted by β_e) is a normalized measure of the covariance of the return on the risky asset with the return on a portfolio of all risky assets. It is a measure of relative risk which captures only risk which cannot be eliminated by an investor holding a diversified portfolio of assets. This risk which cannot be eliminated by portfolio diversification is referred to as market or systematic risk. It derives from economy-wide influences that affect all assets. Portfolio diversification is assumed to eliminate all other risks (referred to as non systematic, specific or idiosyncratic risks).

The CAPM postulates that the expected rate of return on a risky asset is related only to the market risk of that asset. An asset with a higher market risk (higher beta) should have a higher expected rate of return than an asset with a lower market risk (lower beta). Furthermore, a risky asset with a high total risk (market risk plus non systematic risk), but with a low beta, should have a lower expected rate of return than another risky asset with a higher beta but with a lower total risk. Non systematic risk is irrelevant because it can be eliminated by portfolio diversification.

In practice, portfolio diversification to the extent required by the CAPM appears to be uncommon.[9] For this reason, at least some investors are likely to require compensation for non systematic risks. That compensation would not be included in estimates of the expected rates of return on risky assets estimated using the CAPM in the way theory requires that it be applied.

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[8] See André F Perold (2004), "The Capital Asset Pricing Model", Journal of Economic Perspectives, 18(3): 3 – 24; and Eugene F Fama and Kenneth R French (2004), "The Capital Asset Pricing Model: Theory and Evidence", Journal of Economic Perspectives, 18(3): 25 – 46.

[9] Goeztman and Kumar have recently obtained results from a study of 60,000 individual investors, over a six year period (1991-1996), indicating that the majority of those investors were under-diversified. (W Goetzman and A Kumar (2004), "Diversification Decisions of Individual Investors and Asset Prices", working paper, Yale School of Management.) Goeztman and Kumar suggest that if investors systematically hold less than fully diversified portfolios, they are likely to demand compensation for non systematic risk, and the diversification decisions of these investors is reflected in asset prices. Campbell, Lettau, Malkiel and Xu have found that firm-level non systematic risk has increased over time and, as a result, the number of risky assets which must be held in a portfolio to achieve a given level of diversification has increased. (J Campbell, M Lettau, B Malkiel and Y Xu (2001), "Have Individual Stocks Become More Volatile? An Empirical Exploration of Idiosyncratic Risk", Journal of Finance, 56(1): 1 - 43). Furthermore, Malkiel and Xu argue that if there are investors who cannot hold the market portfolio for exogenous reasons (that is, they cannot diversify to the extent required by the CAPM), other investors will also be unable to hold the market portfolio. In these circumstances, investors will care about total risk, not just market risk. (B Malkiel and Y Xu (2002), "Idiosyncratic risk and security returns", unpublished working paper.)

3.3 Determining the cost of debt

The risk-return relationship in the CAPM is applicable to any risky asset. Therefore, the expected rate of return for risky debt securities can be similarly estimated:

K_d = risk free rate + risk premium

= $R_f + \beta_d$ x ($R_m - R_f$)

In practice, estimation of the individual components of the debt risk premium – in particular, estimation of the debt beta (β_d) – is uncommon. Instead, the observed yields on issued debt securities are used to directly estimate the risk premium β_d x ($R_m - R_f$). That is, the expected rate of return on debt is usually determined as:

$K_d = R_f$ + debt risk premium

We take this approach in the next section of our report.

3.4 Applying "the model"

The estimation of a WACC is, in practice, complicated by a range of theoretical considerations and measurement issues:

- in theory, the WACC is a weighted average of the expected rates of return on equity and debt, but expectations are not directly observable, and historical data must be used to estimate all of the parameters;
- even if all of the necessary historical data are available, estimation still requires careful judgment and a degree of pragmatism about estimation methods, and about the values obtained; and
- although empirical testing has lent support to the concept of risk that underpins the model, that testing has also shown that the CAPM does not fully explain expected returns on risky assets.[10]

Estimation issues are considered further in the next section of this report.

[10] See, for example, Eugene F Fama and Kenneth R French (2004), "The Capital Asset Pricing Model: Theory and Evidence", Journal of Economic Perspectives, 18(3): 25 – 46.

4 Parameter estimates

The values of the parameters to be used in determining a WACC for the GGP are considered in this section of the report. In the next section, parameter values at the upper or lower limits of the ranges are, as appropriate, used to estimate a WACC.

The WACC that we estimate is a weighted average of the costs of the equity and debt that would be used to finance the pipeline, assuming a capital structure that reflects standard industry structures for a going concern and best practice.

Following the method described in the previous section, we determine the cost of equity using the CAPM. This requires estimates of:

- the risk free rate of return;
- the equity beta; and
- the market risk premium.

The cost of debt is estimated as the sum of the risk free rate of return and a debt risk premium.

The (post-tax nominal) WACC is calculated by averaging the cost of equity weighted by the proportion of equity in the total financing of the business, and the cost of debt weighted by the proportion of debt. This requires estimation of the capital structure, or gearing.

Finally, we examine possible values for the valuation of imputation credits, and give consideration to the "average Australian investor" argument, and to consistency issues, before concluding on the range of values for γ.

4.1 Risk free rate of return and expected inflation

The risk free rate of return is a theoretical construct, and cannot be measured directly. In consequence, in applying the CAPM, consideration must be given to:

- choice of a proxy for the (theoretical) asset which yields a risk free rate of return; and
- the period over which the return on the proxy – the estimate of the risk free rate of return – is to be measured.

4.1.1 Choice of a proxy

Since the introduction of access regulation in Australia in the mid-1990s, there has been a vigorous debate on the appropriate proxy for the risk free asset. This debate had its origins in the ACCC's continued use of proxies which delivered returns over periods that matched the periods for which it was setting regulated access prices.

This practice by the ACCC was questioned in the GasNet decision. Through that decision the Tribunal contributed to resolution of the debate by finding in favour of GasNet. GasNet had argued (as had other Australian regulators), that a government bond with a term to maturity of five years was not the appropriate proxy for the risk free asset required for application of the CAPM in the context of gas pipelines. Where the life of the pipeline approximated 30 years, the use of a bond with 10 years to maturity was appropriate and accorded with conventional use of CAPM.

In the absence of government bonds with longer terms to maturity, the appropriate proxy for the risk free asset is a Commonwealth Government Treasury Bond with term to maturity of 10 years. Currently, the 10 years bond is best represented by the April 2015 Treasury Bond.

There is, however, no equivalent Commonwealth Government Indexed Treasury Bond maturing in April 2015 which can provide a corresponding estimate of the real risk free rate return. In the absence of an indexed bond maturing in 2015, KPMG has used the Commonwealth Government Indexed Treasury Bonds maturing in August 2010 and August 2015 as the appropriate proxies. We have estimated the real risk free rate of return by interpolating between the yields on the 2010 and 2015 indexed bonds.

4.1.2 Sampling period over which returns on the proxies are to be measured

In an ideal world, the nominal and real risk free rates would be determined from the most recent available bond yields. Yields reported today incorporate the latest market expectations and information about future interest rates. Averaging today's yields with past yields, as some have proposed, does not improve the estimate obtained. Instead, it inappropriately gives weight to superseded prior expectations.

The world is not, however, ideal, and today's reported bond yields (like yesterday's) will contain a random component ("noise"). Some averaging of yields should reduce the effect of this noise on the estimate of the risk free rate of return, with longer-term averages achieving better noise reduction. However, longer term averaging introduces a bias because greater weight is given to superseded prior expectations.

Standard practice in the application of the CAPM is to average bond yields for the purpose of estimating risk free rates over 10 to 20 trading days.

Regulators in New South Wales and Victoria, and the ERA in Western Australia, average yields over 20 days. The ACCC previously averaged over 20 days, but has adopted shorter sampling periods (for example, 10 days) in some of its recent access pricing decisions.

In the absence of strong arguments to the contrary, KPMG considers the sampling of bond yields over a 20-day period to be appropriate for estimating the risk free rate of return.

4.1.3 Inflation

An estimate of expected inflation (π^e) can be obtained from estimates of the nominal and real risk free rates of return using the Fisher equation:

$$\pi^e = (1 + R_{f,\,nominal})/(1 + R_{f,\,real}) - 1$$

Estimates made in this way have limitations, but also have the advantage of consistency. The inflation estimate obtained incorporates the same market information and expectations as the estimates of the nominal and real risk free rates of return.

4.1.4 Estimated risk free rates and expected inflation

To obtain an estimate of the nominal risk free rate of return, KPMG has averaged the yields on 10 years Commonwealth Government Treasury Bonds, as represented by the April 2015 bond, over the 20 trading days to 30 September 2004.

The estimate of the nominal risk free rate of return obtained in this way is **5.42%**.

To obtain an estimate of the real risk free rate of return, we have interpolated between the yields on August 2010 and April 2015 Commonwealth Government Indexed Treasury Bonds, on each of the 20 trading days to 30 September 2004, and averaged the results.

The estimate of the real risk free rate of return obtained in this way is **2.79%**.

Applying the Fisher equation yields expected inflation of **2.56%**.

4.2 Equity beta

If the shares in a company are traded on a stock exchange, beta can usually be estimated by regressing observed share market returns against a market index. Betas estimated in this way are commercially available from a number of financial services organizations.

If, however, a company's shares are not traded, or if the shares are traded but estimation error is so high that the resulting estimates cannot be relied upon, beta must be estimated by reference to the betas of comparable entities with traded shares. In these circumstances, estimation clearly involves issues of judgement and degree.

Those issues of judgement and degree are not eliminated when beta is estimated statistically from share market returns:

- estimation error is usually high;
- specification error arises because, in theory, the market index required by the CAPM is an index of returns on all assets – not just equity – and no such index exists; in practice an index of share market returns must be adopted as a proxy for the index of returns on all assets;
- estimates can be made over different periods – daily, weekly (including weekly ending or starting on specific days) or monthly – and different values may be obtained;

- historical data must be used even though the CAPM is forward looking; and
- betas are usually assumed to be stable over time, but this is not be the case, and the selection of an estimation period involves a trade-off between:
  - a period long enough to obtain sufficient observations to minimise the standard error of the estimate; and
  - a period sufficiently short to minimise the error in the estimate due to changes in the underlying determinants of beta.

4.2.1 De-levering and re-levering betas

One of the determinants of beta is business capital structure, or gearing. Gearing varies across countries, industries and firms. In consequence, when the betas of comparable entities are used to estimate the beta of a business for which a WACC is required, adjustments must be made for differences in gearing. The effect of the gearing of a comparable entity is removed by de-levering, and the effect of the gearing of the business for which a WACC is required is introduced by re-levering the de-levered beta. The de-levered beta is often referred to as an asset beta (β_a), and the re-levered beta is referred to as an equity beta (β_e).

Table 1: de-levering and re-levering formulae

Description	Formula
Simple (Brealey and Myers)[1] Assumes active debt management policy	$\beta_e = \beta_a + (\beta_a - \beta_d) \times D/E$
Hamada Assumes passive debt management policy	$\beta_e = \beta_a + (\beta_a - \beta_d) \times (1 - t) \times D/E$
Appleyard and Strong Assumes active debt management policy	$\beta_e = \beta_a + (\beta_a - \beta_d) \times \{1 - t \times [K_d/(1+K_d)]\} \times D/E$
Monkhouse Assumes active debt management policy	$\beta_e = \beta_a + (\beta_a - \beta_d) \times \{1 - (1 - \gamma) \times t \times K_d/(1+K_d)]\} \times D/E$

Source:

1. Richard A Brealey and Stewart C Myers (1996). *Principles of Corporate Finance*. International edition. McGraw-Hill: New York.
2. R S Hamada (1972). "The Effect of the Firm's Capital Structure on the Systematic Risk of Common Stocks." Journal of Finance, 27(2): 435-452.
3. T R Appleyard and N C Strong (1989). "Beta Geared and Ungeared: The Case of Active Debt Management." Accounting and Business Research, 19: 170 – 174.
4. Monkhouse, Peter H.L. (1997). "Adapting the APV valuation methodology and the beta gearing formula to the dividend imputation tax system." Accounting and Finance, 37: 69 – 88.

Determination of the effects of de-levering and re-levering beta requires careful consideration of business financial policy. Different results are obtained for passive and active debt management policies. If a business adopts a passive debt management policy, the amount of debt changes in accordance with a predetermined schedule, regardless of future cash flows. Active debt

management refers to a policy whereby the business maintains a predetermined ratio of debt to total financing.

The main results of analyses of the effects of de-levering and re-levering reported in the literature on financial economics are summarised in Table 1.

The calculation of WACC in this report uses the most recent of the de-levering/re-levering formula: that proposed by Monkhouse in 1997. A number of Australian regulators – the ACCC, the Essential Services Commission in Victoria, and the Queensland Competition Authority – also use the Monkhouse formula. The ERA's Amended Draft Decision for the GGP does not reveal the de-levering formula which has been used. The simple formula was used in estimating the WACC of the Regulator's April 2001 Draft Decision.

4.2.2 Debt beta

Use of the Monkhouse de-levering/re-levering formula requires estimation of the debt beta (β_d). β_d can, in theory, be estimated by "reverse-engineering" the CAPM:

$$\beta_d = (K_d - R_f)/(R_m - R_f).$$

We note that in the Draft Decision for its 2003 gas access arrangements review, the Essential Services Commission in Victoria estimated a debt beta using the following variation of the above formula:

$$\beta_d = [(K_d - R_f) - \text{default premium}]/(R_m - R_f).$$

The rationale for this approach is essentially that it is the expected return on debt (which is equal to the cost of debt less default risk) that drives the debt beta. In the application of this formula, the default premium was established using the statistics for debt with 10 years to maturity reported by Elton, Gruber, Agrawal and Mann.[11]

Estimates of β_d are usually small and, in practice, a value of zero is sometimes used.

"Reverse engineering", using the ranges of values for K_d, R_f and $(R_m - R_f)$ used in this report, produces a range of 0.23 – 0.27 for the debt beta.

Applying the method of the Victorian Essential Services Commission, yields a range of 0.19 – 0.25 for β_d.

Use of a lower value of the debt beta in the Monkhouse de-levering/re-levering formula produces a higher equity beta. We are unable to justify a value for β_d as low as zero, and use **0.19** as a lower limit for the rate of return calculation presented in this report.

[11] E Elton, M Gruber, D Agrawal, and C Mann (2001), "Explaining the Rate Spread on Corporate Bonds", Journal of Finance, 56(1).

4.2.3 Comparable entities

Australian Graduate School of Management estimates of the equity betas for a number of Australian companies which are commonly taken as being comparable to other gas utilities are set out in Table 2.

Table 2: AGSM equity betas

Company	Equity beta measured over 48 months ended					
	Sep 2002	**Dec 2002**	**Mar 2003**	**Jun 2003**	**Sep 2003**	**Dec 2003**
AGL	0.09 (-0.21 - 0.40)	0.08 (-0.24 - 0.40)	0.06 (-0.24 - 0.36)	-0.01 (-0.31 - -0.29)	-0.07 (-0.36 - 0.22)	-0.06 (-0.35 - 0.23)
APT	0.94 (0.28 - 1.61)	0.79 (0.08 - 1.50)	0.77 (0.16 - 1.37)	0.39 (0.15 - 0.62)	0.35 (0.11 - 0.59)	0.36 (0.12 - 0.59)
Alinta	0.13 -(0.27 - 0.53)	0.15 (-0.23 - 0.54)	0.20 (-0.14 - 0.54)	0.29 (-0.06 - 0.65)	0.33 (0.01 - 0.66)	0.37 (0.06 - 0.68)
GasNet	n.a.	n.a.	n.a.	n.a.	n.a.	0.05 (-0.21 - 0.31)
Envestra	0.31 (0.04 - 0.57)	0.33 (0.05 - 0.60)	0.34 (0.10 - 0.58)	0.39 (0.13 - 0.64)	0.28 (0.03 - 0.53)	0.30 (0.05 - 0.54)

Source: AGSM Risk Measurement Service, Sep 2002, Dec 2002, March 2003, June 2003, Sep 2003, and Dec 2003.

Notes:

Betas quoted for APT up to and including March 2003 are thin-trading adjusted betas. Betas for APT are based on less than 48 months of data in all quarters.
GasNet estimate for December 2003 is based on only 24 observations.
Alinta estimates based on less than 48 months of data.

The estimates in Table 2 appear to be much lower than the equity betas currently being used in calculating the rates of return to be used in determining the reference tariffs of Australian gas transmission businesses. A part of the difference will, however, be attributable to gearing differences. In Table 3, we present the betas de-levered and re-levered to common gearings of 55% and 65%.

Table 3: AGSM equity betas de-levered and re-levered

Company	Dec 2003 AGSM equity beta	Gearing used to de-lever equity beta	Asset beta	Equity beta re-levered - 55% gearing	Equity beta re-levered – 65% gearing
AGL	-0.06	38%	0.04	-0.16	-0.26
APT	0.37	36%	0.31	0.44	0.51
Alinta	0.05	65%	0.15	0.08	0.05
GasNet	0.30	77%	0.22	0.25	0.27
Envestra	0.36	54%	0.27	0.36	0.41
Average			**0.20**	**0.20**	**0.20**

Note: asset betas calculated using a debt beta of 0.20 and the simple de-levering/re-levering formula.

The de-levered/re-levered betas remain low relative to the equity betas which have been adopted in recent decisions concerning regulated access prices. These betas have been close to 1.0, and in some cases they have exceeded 1.0.

For its Amended Draft Decision for the GGP, the ERA adopted an equity beta of 1.33. This beta is at the high end of the range of values for Australian gas transmission pipelines. The ERA noted that, in adopting 1.33, it considered the potentially greater systematic risk of pipelines that supply gas to mining and minerals processing activities. The corresponding asset beta, obtained by de-levering using the Monkhouse formula, is 0.65.

An **asset beta** of **0.65** is used as an upper limit of the range of values for beta for the rate of return calculation presented in this report.

4.3 Market risk premium

The market risk premium is the return in excess of the return on a risk free asset that an investor requires as compensation for risk when investing in a diversified portfolio.

Measurement of the market risk premium is a contentious issue. In theory, the market risk premium is a measure of the premium that investors, on average, *require* over the risk-free rate of return to invest in a portfolio of risky assets. In effect, the market risk premium is the *forward-looking* price that investors place on risk. Unfortunately, this forward-looking price is not directly observable.

There are, now, a large number of studies which report measures of the market risk premium for Australia. The results of these studies are summarised in Tables 4 and 5.

Table 4: Officer's estimates of the Australia market risk premium

Period	Risk premium	Standard deviation	Standard error
1882 - 2001	7.19%	16.97%	1.55%
Different ending point:			
1882 - 1950	8.00%	11.11%	1.34%
1882 - 1970	8.16%	13.70%	1.45%
1882 - 1990	7.40%	17.33%	1.66%
Different starting point:			
1900 - 2001	7.14%	17.94%	1.78%
1950 - 2001	6.51%	22.60%	3.13%
1970 - 2001	3.37%	24.38%	4.31%

Source: Essential Services Commission, Victoria, 2003 Review of Gas Access Arrangements, Final Decision, page 324.

Table 5: Estimates of market risk premium, Australia

Source of estimate	Period	Market risk premium
Australian Graduate School of Management:		
Arithmetic mean including October 1987	1974 - 1995	6.2%
Arithmetic mean excluding October 1987	1974 - 1995	8.1%
Arithmetic mean[1]	1974 - 1995	4.8%
Arithmetic mean including October 1987[2]	1974 – Sep 2000	6.2
Arithmetic mean excluding October 1987	1974 – Sep 2000	7.7
Officer (1989): arithmetic mean	1882 – 1987	7.9
Officer (1989 updated): arithmetic mean[3]	1882 - 2001	7.2
Officer: arithmetic mean[4]	1946 - 1991	6.0 to 6.5
Hathaway (1996)[5]:		
Arithmetic mean	1882-1991	7.7
Arithmetic mean	1947-1991	6.6
Gray (2001)[6]	1883 – 2000	7.3
Dimson, Marsh and Staunton (2000)[7]	1900 – 2000	7.6

Sources:

1. Referred to in independent expert report by Deloitte Touche Tohmatsu dated 19 December 2000 to Woodside Petroleum shareholders in relation to a takeover offer by Shell Investments.
2. ABN AMRO (1999), "Submission to the Office of the Regulator General Victoria Regarding 2001 Electricity Distribution Price Review; the Cost of Capital Financing", (Consultation Paper No. 4), page 12. Available at http://archive.esc.vic.gov.au/1999/electric_ConsPap4Resp_abnamro.pdf
3. ABN AMRO (1999), page 12.
4. Officer, R.R. (1992), Rates of Return to Shares, Bond Yields and Inflation Rates: An Historical Perspective, as updated for a 1993 Seminar at the University of Melbourne.
5. ABN AMRO (1999), page 12.
6. S Gray, "Issues in Cost of Capital Estimation", 19 October 2001 downloadable at http://www.esc.vic.gov.au/PDF/2001/SubUQBS_GasPosPapOct01.pdf
7. E Dimson, P Marsh and M Staunton (2000), "Twelve Centuries of Capital Market Returns", Business Strategy Review, 11(2).

In interpreting the evidence in Tables 4 and 5, we note that the estimates of the market risk premium show a degree of variation but remain largely within the range 6% to 8%.

The view has been advanced by regulators (including the ERA) and by others, that estimates for more recent periods indicate a decline in the market risk premium. This may appear to be the case from the data presented in Tables 4 and 5, but we note that the more recent estimates have significantly larger standard errors. They are less reliable, and the conclusion that the market risk premium has fallen is more difficult to sustain.

This point was been made by Professor Stephen Gray in a submission to the Victorian Essential Services Commission. Table 6 shows that for the period 1883 to 2000, the Australian market risk premium was 7.3%, with a standard error of 1.56%. The estimate from 1971 to 2000 is 4.8%, but is much less reliable with a standard error of 4.4%. As Gray pointed out, the 4.8%

average obtained for the more recent period is not statistically different from the longer term historical average.

Table 6: Estimates of market risk premium, varying start and end dates

Start	End	Risk premium	Standard error
1883	2000	7.3	1.56
1883	1970	8.2	1.5
1971	2000	4.8	4.4
Source: S Gray (2001), "Issues in Cost of Capital Estimation". Available at http://www.esc.vic.gov.au/PDF/2001/SubUQBS_GasPosPapOct01.pdf			

We also note that post-1987 data are biased downwards because the market index used to measure the market risk premium does not capture the average value of franking tax credits. In its Final Decision from its 2003 gas access arrangements review, the Victorian Essential Services Commission estimated that allowing for the average value of franking credits since 1987 would add about 0.2 percentage points to the market risk premium. Professor Robert Officer is of the view that the effect could be much larger:

> "… *if you assume that franking credits represent about 20% of total stock returns, the historic ERP could be biased downward by as much as 1%.*"[12]

On the basis of the evidence presented above, an upper limit for the range of values for the Australian market risk premium is **8.0%**.

4.4 Cost of debt

The cost of debt is estimated as:

$$\mathbf{K_d = R_f + \delta},$$

where δ is the debt margin. The debt margin has two components:

- the debt risk premium referred to earlier, in section 3.3; and
- the cost of establishing the debt facility.

Estimation of each of these components of the debt margin is discussed below.

4.4.1 Estimating the debt risk premium

A critical determinant of the debt risk premium is the current credit rating of the business for which a WACC is being estimated.

[12] Jardine Fleming Capital Partners Limited, The Equity Risk Premium – An Australian Perspective, Trinity Best Practice Committee, September 2001.

Only a limited amount of credit-rating data are available for gas transmission businesses like GGT and, in the absence of direct measurements, reference is usually made to the credit-ratings of a somewhat wider set of businesses for the purpose of making an estimate.

In Table 7, we set out published credit ratings for a number of Australian energy businesses which have interests in gas pipeline systems.

Table 7: Credit ratings of energy businesses

Business	Long term credit rating
AGL	A
Alinta Ltd	BBB
Envestra	BBB
GasNet Australia	BBB
Source: *Standard & Poor's, Industry Report Card, Australian Utilities, 18 October 2004*	

We note that in its Amended Draft Decision for the GGP, the ERA adopted a debt risk premium which reflected a credit rating of BBB+ for the GGP, but gave no reasons for why that rating was appropriate.

We note that, in a decision on the Moomba to Sydney Pipeline, the ACT considered the evidence presented in Table 7 above, and found that it supported a credit rating of BBB.[13] In particular, the ACT found that AGL was not within the class of pipeline companies, and should be ignored for the purpose of assessing a credit rating for the Moomba to Sydney Pipeline.

In these circumstances, an appropriate credit rating for the GGP, for the purpose of establishing the debt risk premium to be used in estimating a WACC, is BBB.

Data available from the Commonwealth Bank of Australia's Spectrum service ("CBA Spectrum") may be used to estimate the risk premium for debt issued by a business with a given credit rating. However, as the ERA and others have noted, the CBA Spectrum data may not be as reliable as was initially thought. NERA has recently raised the issue of understatement in the CBA Spectrum data in a report prepared for ActewAGL:

> *"One source of market data that Australian regulators, such as the ACCC, IPART and ESCOSA, have recently relied on is CBA Spectrum data. On the 25th of February 2004, CBA Spectrum was reporting estimated debt margins of 101bp for 10 year maturity BBB+ bonds. However, CBA Spectrum's database only includes three BBB+ bonds. Moreover, two out of these three bonds have maturity dates of less than 3 years with only one having a maturity date of 9 years.*
>
> *… for BBB+ bonds, CBA Spectrum is on average 27 basis points below the actual observations of debt margins on BBB+ rated debt. For the only observation of long dated debt (Snowy Hydro), CBA Spectrum is 37 basis points below the equivalent actual observation. …*

[13] *Application by East Australian Pipeline Limited* [2004] ACompT 8, paragraphs 54 – 67.

> *The explanation for this lies in the fact that CBA Spectrum simultaneously estimates the 'fair' relationship between debt margins and maturity for all 10 investment credit ratings from Government to BBB. In doing so, CBA Spectrum constrains these estimated curves to follow similar shapes to one another and never to cross (e.g. 'fair' debt margin on a BBB+ bond must always be below that on a BBB bond). This effectively means that the estimates of 'fair' debt margins for BBB+ bonds, for which there are only three observations and for which there are even fewer long dated observations, are largely driven by observations for higher rated bonds …"*[14]

We understand that CBA Spectrum has not yet responded to NERA's view of its data.

NERA's analysis suggests that CBA Spectrum data may be understated by as much as 20 to 30 basis points at the BBB+ level. In the absence of an alternative source of data, we use the CBA Spectrum premiums in estimating the debt risk premium for the GGP. We have assumed the same degree of understatement at the BBB credit rating level as at BBB+, and have added a further 25 basis points contingency. The average of the CBA Spectrum debt risk premiums for BBB rated bonds over the 20 days to 30 September 2004 was 111 basis points. Allowing a contingency of 25 basis points raises the debt risk premium to 136 basis points.

4.4.2 Debt establishment costs

To establish a debt facility, a business must typically pay a margin above the base rate it will pay on the debt. These debt establishment costs may add as much as 50 basis points to the base rate.

A submission made by NECG in response to the ACCC's decision on the proposed access arrangement for the Moomba to Sydney Pipeline referred to evidence from the United States indicating that debt establishment costs could be as high as 50 basis points.[15] More recently, the ACT found that a margin of 25 basis points was appropriate for debt establishment costs for Gas Net.

On the basis of this limited evidence, debt establishment costs for the GGP are likely to be in the range of 25 to 50 basis points.

4.4.3 Estimated debt margin and cost of debt

The conclusions in the two preceding subsections, lead to a value of 186 basis points as the upper limit of the range of values for the debt margin for the rate of return calculation presented in this report.

With a nominal risk free rate of return of 5.42% (see section 4.1 above), this implies a nominal cost of debt as high as **7.28%**.

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[14] *ActewAGL Supplementary Submission, Estimating the Debt Margin for ActewAGL, A Report for ActewAGL prepared by NERA*, February 2004, pages 4 and 5.

[15] *Key contentions on WACC components of ACCC MSP decision, A report to East Australian Pipeline Limited from the Network Economics Consulting Group*, October 2003, pages 17 - 18.

4.5 Gearing

In determining the gearing to be used in estimating a WACC, it is standard practice to examine the observed gearing levels of other businesses in the same industry. There are, however, very few "pure" gas transmission businesses in Australia which can be used as comparators for the GGP.

The gearing of Australian energy businesses which have interests in gas pipeline systems (not necessarily transmission systems) are set out in Table 8.

Table 8: Observed gearing of gas pipeline businesses

Company	2001	2002	2004	Average
AGL	46%	40%	29%	**38%**
APT	54%	56%	51%	**54%**
Alinta	39%	32%	36%	**36%**
GasNet	67%	66%	64%	**65%**
Envestra	81%	78%	72%	**77%**
Average	**57%**	**54%**	**50%**	**54%**
Source: Bloomberg				

Of the companies listed in Table 8, only two can be considered "pure" gas transmission businesses. These two are Australian Pipeline Trust ("APT") and GasNet. The other companies listed in the table either have interests in gas distribution pipeline systems, or are significantly more diversified into business activities regarded as being of higher risk than the provision of gas transmission services.

The averages of the observed gearings of Australian Pipeline Trust and GasNet are 54% and 65%, respectively. The midpoint of this range is, approximately, 60%; it is the gearing that has emerged as the regulatory benchmark for regulated gas pipeline businesses.

A lower gearing implies a lower proportion of lower cost debt, and a higher proportion of higher cost equity, in the total financing of the business, and a higher WACC. A value of **55%** is therefore used as the lower limit of the range of values for gearing for the rate of return calculation presented in this report.

4.6 Tax issues: valuation of imputation credits

Under the dividend imputation provisions of the Australian taxation system, domestic equity investors receive a credit - a franking credit - which is attached to any dividends paid out of after-tax company profits. This credit is a component of the return to equity investors, and should be taken into account in determining the cost of equity for the purpose of establishing a WACC.

The proportion of tax collected at the corporate level which is to be credited against personal tax payments is denoted by γ.

4.6.1 Estimating gamma (γ)

Gamma is the product of two components:

- the rate at which franking credits are distributed by the business – the distribution rate; and
- the rate at which franking credits are utilised by shareholders – the utilisation rate.[16]

Hathaway and Officer (1999):

- estimated an average distribution rate of approximately 82% from an examination of the average rate of access to franking credits determined from aggregate taxation data; and
- estimated the utilisation rate using two methods:
  - examination of the rate at which franking credits are redeemed by investors (using aggregate taxation data); and
  - ex-dividend drop-off analysis, in which the utilisation rate is obtained by comparing the cum-dividend share price of a dividend-paying company with its ex-dividend share price.[17]

Hathaway and Officer explained the ex-dividend drop-off analysis as follows:

> *"Ex-dividend drop-off statistics can only address the second factor, **distribution**, associated with company tax and imputation credits. Drop-off analyses (and any other valuation based on dividend events) can only value the tax credit attached to a dividend when it (the franked dividend) is paid. This happens after the company makes its decision about how much of the profit, after-company tax, to distribute as a franked dividend. The value of credits derived from drop-off analyses indicates the market value of credits, not the redemption value. In theory, we would expect the drop-off valuations to be less then the redemption valuations in order to allow for the time value of money between the payment of the franked dividend and the redemption of the franking credit. In practice, the "noise" in the data may mask any such finessing of the results."*[18]

Other than the work by Hathaway and Officer, there has been little discussion or analysis about the merits of the different approaches that have been used to estimate γ.

Most of the debate on the estimation of γ has revolved around the utilisation rate.

[16] See H Hathaway and R R Officer (1999), "The Value of Imputation Tax Credits", unpublished manuscript, Graduate School of Management, University of Melbourne.
[17] Ibid.
[18] Ibid, pages 4 - 5.

4.6.2 Utilisation rate

Results of empirical work to determine the utilisation rate are summarised in Table 9. (All of the studies use Australian data to create samples that are representative of the Australian capital market.)

Table 9: Estimates of utilisation rate

Study	Method	Utilisation rate
Bruckner, Dews and White (1994)	Dividend drop-off	33.5% - 68.5%
Hathaway and Officer (1999)	Analysis of tax data	60%
	Dividend drop-off	49% (large companies) 44% (all companies)
Walker and Partington (1999)	Dividend drop-off	88% or 96%
Cannavan, Finn and Gray (2004)	Inference from value of individual share futures and low exercise price options	0%
Chu and Partington (2001)	Rights issues	Close to 100%
Twite and Wood (2002)	Inference from analysis of trading in derivatives	45%

Sources:

K Bruckner, N. Dews and D. White (1994), "Capturing value from dividend imputation", McKinsey and Company.

N Hathaway and R R Officer (1999), "The Value of Imputation Tax Credits", unpublished manuscript, Graduate School of Management, University of Melbourne.

S Walker and G Partington (1999), "The Value of Dividends: Evidence from Cum-dividend Trading in the Ex-dividend Period", Accounting and Finance, 39: page 293.

D Cannavan, F Finn and S Gray (2004), "The value of imputation tax credits", Journal of Financial Economics, 73(1).

H Chu and G Partington (2001), "The market value of dividends: theory and evidence from a new method", working paper, University of Technology, Sydney, page 39.

G Twite and J Wood (2002), "The Pricing of Australian Imputation Tax Credits: Evidence From Individual Share Futures Contracts, working paper.

Three of the studies listed in Table 9 use the dividend drop-off method to estimate the utilisation rate. Dividend drop-off studies, however, suffer from the statistical problem of multicollinearity. Cash dividend and the imputation credit variables are highly correlated, and obtaining reliable estimates of their individual regression coefficients is impossible.

The presence of some degree of multicollinearity can be observed in Hathaway's and Officer's Table 1. In that table, the sum of the regression coefficients which represent the drop-off due to the cash dividend ("a"), and the extra drop-off due to the franking credit ("b"), centres around 1.00. One interpretation of this result is that a $1 dividend, and an accompanying 64 cent franking credit, are associated with a drop of around $1.00 in the stock price. In other words, the franking credit component is effectively worthless.

In view of the multicollinearity problem, considerably lesser weight should be placed on the results from the dividend drop-off studies in establishing a range of values for γ.

Chu and Partington (2001) have inferred the value of franking credits from the prices of traded securities. The method they used compared the prices of shares with different dividend entitlements consequent to rights issues. "Old" shares were entitled to receive the dividend, but "new" shares were not, thereby providing a means of estimating the value of the franking credits attached to the dividends. The study found that the mean value of imputation credits was 150%, implying that franking credits were almost fully valued. However, the standard error of the estimate was 97%, making the results somewhat inconclusive.

Cannavan, Finn and Gray, in a study now published in a refereed journal, estimated the utilisation rate by comparing the prices of certain derivative securities (individual share futures and low exercise price options) and the underlying shares. They concluded:

> *"We find that: (i) cash dividends are fully valued relative to futures payoffs, (ii) prior to the 45-day rule, imputation credits were valued at up to 50% of face value for high-yielding firms, and (iii) since the 45-day rule, imputation credits are effectively worthless to the marginal investor of ISFs and LEPOs."*[19]

Cannavan, Finn and Gray argued that the method they used provided a better estimate of the value of imputation credits for large companies than dividend drop-off analyses:

- the analysis of value can be undertaken, each time an ISF or LEPO trades, within one minute of a trade in the underlying share, and hence accommodates a larger sample size that improves the reliability of estimates and enables calculation company-by-company rather than on an aggregate basis;

- the analysis is not confined to ex-dividend dates, when share price data are often confounded by the activities of short-term arbitrage traders; and

- the method does not have the multicollinearity problems of the dividend drop-off studies.

We are of the view that the evidence from Cannavan, Finn and Gray supports a utilisation rate of zero, while Hathaway's and Officer's analysis of tax data indicates a higher value, around 0.60.

Combined with the distribution rate of 82%, this indicates that γ is in the range 0 to 0.50 (rounded).

[19] D Cannavan, F Finn and S Gray (2004), "The value of imputation tax credits", Journal of Financial Economics, 73(1): page 26.

4.6.3 The benchmark investor assumption

Those arguing for values of γ at the high end of the range – principally Australian access regulators – make the assumption that the relevant benchmark is the "average Australian investor". In our view, this assumption is:

- inconsistent with basic CAPM concepts; and
- inconsistent with the basis upon which other underlying WACC parameters are estimated.

Accordingly, the arguments which have been made for values of γ at the high end of the range are of doubtful validity.

4.6.4 The "average Australian investor"

The use of the "average Australian investor" benchmark has been argued most strongly by the Essential Services Commission in Victoria.[20] The Commission indicated that "… *a number of the other inputs used to estimate the cost of capital could be affected by the assumption made about the identity of the investor – such as the risk free rate, equity premium, company tax regime and asset beta*"[21], and advised that the values for these inputs which it had adopted were consistent with the assumption of Australian ownership. In particular:

- in determining proxy betas, most weight was placed upon empirical beta estimates for comparable Australian firms (albeit, the estimates were adjusted upward to take account of previous regulatory decisions);
- the benchmark gearing assumption was consistent with firms listed on the Australian stock exchange (and with majority Australian ownership);
- the market risk premium was consistent with Australian market data; and
- the debt margin reflected the cost of debt raising for an efficiently financed Australian electricity distributor.[22]

In stark contradiction, the Essential Services Commission noted in the Final Decision from its 2003 gas access arrangements review that:

> *"The systematic risk associated with the Victorian gas distributors (under the CAPM) is the same for any person who may own the asset – systematic risk depends upon the relationship between the returns to the businesses and the market as a whole, and is independent of ownership. Similarly, the gearing levels that can be maintained and debt*

[20] See, for example, Essential Services Commission's 2001-2005 Electricity Distribution Price Determination, page 313.
[21] Ibid, page 313.
[22] Ibid, page 316.

> *margin charged would depend upon the characteristics of the firm's cash flow and not the national identity of its owners."*[23]

We are of the view that, if the cost of capital parameters referred to in the paragraph above, are indeed independent of ownership, then there is no reason to hold the view that an Australian ownership assumption is superior to, say, an assumption of foreign ownership.

We do not agree that placing weight on Australian company data for beta estimates leads to the conclusion that the relevant investors are necessarily Australian. Beta estimates are derived by examining the share prices movements of Australian stocks. As foreign investors exist in the Australian stock market, it does not automatically follow that beta estimates based on Australian company proxies reflect the positions of Australian investors. It would be more accurate to argue that a beta estimate reflects the position of the "marginal investor". It is the marginal investor that sets the share price.

Nor do we concur with the view that, because the market risk premium is based on Australian market data, it reflects the position of Australian investors. Foreign investors invest in Australian stocks, and the returns on those stocks, from which the market risk premium is derived, are the returns required by foreign investors. Again, a more accurate view is that the Australian market risk premium reflects the premium required by the "marginal investor" in the Australian stock market.

In order for the benchmark investor assumption made in estimating γ to be consistent with the assumptions for the CAPM parameters, it would be necessary to, among other things, adopt an equity beta estimate of 1.0, reflecting the market average beta of the overall Australian market (rather than an estimate from comparable company data), and to adopt a gearing consistent with that of the average company listed on the Australian Stock Exchange (and which would be reflected in the equity beta of 1.0).

4.6.5 Conceptual inconsistencies

There are strong conceptual reasons why an "average Australian investor" benchmark is not an acceptable benchmark for the purpose of measuring the cost of capital. This is because the CAPM measures the marginal cost of capital or the required rate of return from the perspective of the marginal investor. The marginal investor is the one who implicitly sets the share price, the value of γ, and the cost of capital at the margin.

The broader question of what value to attribute to γ should, therefore, be restated as: *what proportion of taxes paid at the corporate level is really a pre-collection of the personal tax of the **marginal** investor*. The definition is simple; however, ascertaining the identity of the marginal investor can be difficult.

One view, advanced by Officer, is that the marginal investor – the investor who sets the price of Australian stocks – is the foreign investor:

[23] Essential Services Commission, Victoria, Final Decision, 2003 Gas Access Arrangements Review, page 399.

> *"In an open capital market, such as Australia, where the size of the market relative to offshore markets implies it is a price taker, we would not expect the cost of capital to change – the arguments to support this proposition have been made in Officer (1988)."*[24]

Cannavan, Finn and Gray (2004) support this view:

> *"Officer (1988) points out that since Australia is a small open economy, the cost of capital for Australian companies will be determined by supply and demand conditions in world capital markets. That is, large companies are unlikely to be financed solely by resident investors – at least some non-resident investment is likely to be required. Also, participants in world capital markets are free to invest anywhere, so they will only invest in a small open economy such as Australia if they receive a return that is fair by world standards. If imputation credits are worthless to these investors, they will only invest if they are provided a sufficient return by way of cash dividends and capital gains.*
>
> *In this case, resident investors will receive capital gains, cash dividends and imputation credits and non-resident investors will receive capital gains and cash dividends only. Since resident investors receive a higher return (via the imputation credits granted by the local tax system), they will the first to invest. The marginal investor will then be a non-resident, who will receive a return in the form of capital gains and cash dividends that just meets their required return. This means that in a small open economy such as Australia, the company's cost of capital is not affected by the introduction of a dividend imputation system."*[25]

The important consequence of the marginal investor being a non-resident foreign investor is that the value of γ is likely to be closer to zero than it is to 100% – or even to 50%.

The use of a marginal investor assumption in determining an appropriate value for γ is not only underscored by consistency with the assumptions underlying the CAPM. It is also dictated to a large extent by the evidence that is available on the likely value of γ. Other than the evidence from national taxation statistics, the empirical evidence supporting current estimates of γ implicitly makes use of the foreign marginal investor assumption because:

- share price data used to estimate γ is from Australian companies in general (none of the relevant studies focuses on companies with purely Australian-resident shareholders); and
- it is accepted that share prices are set by the marginal investor.

In our opinion, it is therefore not possible to maintain the assumption that the marginal investor is the "average Australian investor". If γ is a measure of the pre-collection of personal for the marginal investor, it is a measure reflecting the fact that the marginal investor is most likely a foreign investor.

[24] R R Officer (1994), "The Cost of Capital of a Company Under an Imputation Tax System", Accounting and Finance, 34(1): 1 – 17.
[25] Cannavan, Finn and Gray (2004), op cit, page 27.

4.6.6 Consistency with the form of the CAPM used

In its April 2001 Draft Decision for the GGP, the ERA noted that there were emerging concerns that it was not appropriate to adopt a value for γ less than 1.0 because this was inconsistent with the CAPM model being employed.[26] In particular, there was a view that because the CAPM employed by Australian regulators was a domestic (and not an international) CAPM, consistency required an assumption that all investors were Australian and could fully utilise franking credits. Reference was to Lally (2000).[27]

The argument over inconsistency arising from use a domestic version of the CAPM (which assumes that capital markets are segregated), and parameter values (such as the value of imputation credits) that are influenced by the presence of foreign investors, was originally raised by Lally in a submission to the Victorian Essential Services Commission. Lally had argued that:

- the Essential Services Commission's adoption of "*… an assumption for gamma as high as 0.5 was inconsistent with the assumptions made elsewhere in the estimation of the costs of capital for the distributors' regulated activities*"[28];

- this inconsistency arose because "*… a value less than 1 … is a reflection of the fact that a significant portion of investors in the Australian equity market are foreigners, who are unable to benefit (or benefit fully) from imputation credits*", while "*… the Draft Decision also elects to use a version of CAPM that assumes that national equity markets are completely segregated*"[29]; and

- a more theoretically valid approach consistent with the assumption of complete segregation of markets would be "*… to use the CAPM proposed, but ignoring foreigners in the calculation of gamma – which would imply an assumption that almost 100 per cent of franking credits distributed could be utilised.*"

Lally advocated the following changes to the Essential Services Commission's application of the CAPM, which he suggested may have the net effect of lowering the cost of capital:

- *"a utilisation coefficient for franking credits (and hence gamma) of zero should be assumed;*

- *the equity (market) risk premium would need to reflect that of the world market portfolio, rather than the Australian market. As the world market portfolio would have lower variance, the equity premium would be lower; and*

- *betas would need to be defined against the world market (rather than against the Australian market).*[30]

[26] Draft Decision, Part B, page 147.
[27] Lally, M (2000), *The Cost of Equity Capital and its Estimation*, McGraw-Hill Series in Advanced Finance, Vol. 3, pages 10 – 11.
[28] Essential Services Commission, September 2002, 2001-2005 Electricity Distribution Price Determination, page 314.
[29] Ibid, page 315.
[30] Ibid, page 315.

While, a priori, the impact on the equity betas of Australian firms of moving from an Australian portfolio an international portfolio was unclear, Lally noted that there was evidence that Australian stocks have, on average, lower betas against the international market, and this would be true of utilities.

The arguments put forward by Lally have been extensively analysed by Professor Stephen Gray.[31]. Gray acknowledged that, in theory, it may be more appropriate to use an international CAPM ("ICAPM"), and that existing empirical research suggests that the performance of ICAPM models is superior to the performance of the domestic CAPM. However, due to their greater complexity, adoption of an ICAPM would lead to significantly more debate among stakeholders about methodologies and interpretation.

As a compromise position, Gray suggested retention of the domestic CAPM notwithstanding that it was theoretically incorrect, and adjustment for the error that was induced by use of the wrong model.

4.6.7 Market practice

We note that (outside the application of WACC and CAPM in the determination of regulated access prices) it remains common market practice to assume that imputation credits are not fully valued, or are not valued at all. A recent examination of expert reports, by Lonergan (2001), showed that, of 122 reports prepared in support of takeover activity, only 48 (or 39%) indicated how the WACC they had used was determined.[32] Of these, 42 (or 88%) used the classical CAPM model and made no adjustment for dividend imputation. Only six reports made an adjustment to reflect dividend imputation. Furthermore, of those that attributed a value to imputation credits, five attributed little or zero net effect on the value of the company being assessed.

Lonergan provided a list of reasons cited in the reports for not adjusting for imputation credits. These included:

- the value of franking credits is dependent on the tax position of each individual shareholder;
- there is no evidence that acquirers of businesses will pay additional value for surplus franking credits;
- there is little evidence that the value effects of dividend imputation are being included in valuations being undertaken by companies, by investors, or by the broader market;
- foreign shareholders are the marginal price-setters of the Australian market yet many such shareholders cannot avail themselves of the benefit of franking credits; and

[31] S Gray (2001), "Issues in Cost of Capital Estimation", a paper which accompanied TXU's submission in response to the Victorian Essential Services Commission's position paper on its 2003 gas access arrangements review. Available at http://www.esc.vic.gov.au/PDF/2001/SubUQBS_GasPosPapOct01.pdf

[32] W Lonergan (2001), "The disappearing returns: why dividend imputation has not reduced the cost of capital", JASSA, Autumn, page 13.

- there is a lack of certainty about future dividend policies, about the timing of taxation, and about dividend payments and, in consequence there is uncertainty about the value of franking credits.

4.6.8 Conclusions on γ

Despite further research in the area, there remains considerable uncertainty around the estimation of γ.

We note that more recent research indicating a value close to zero may be more valid than earlier estimates above 50%.

Moreover, although the continued use of a domestic CAPM arguably involves assumptions inconsistent with the assumptions on which γ is estimated, the potential errors arising from this inconsistency are not expected to be reduced by adopting an ICAPM.

We expect that a more definitive view on the value of γ will only be formed as more research is undertaken.

A lower value of γ implies a higher WACC, and this report therefore uses a value of **zero** as the lower limit of the range of values for the rate of return calculation.

5 Calculation of the rate of return

The calculation of a rate of return for the GGP applying:

- the conventional method of determination of that rate as a weighted average of the costs of equity and debt, using the CAPM for estimation of the cost of equity, as explained in section 3; and

- the upper or, as appropriate, lower limit of the range of values for each of the parameters required for consistent application of "the model" as discussed in section 4,

is set out in Table 10.

Table 10: Upper limit of range of values of WACC for GGP

Parameter	Calculation	Value
Nominal risk free rate of return	$R_{f,\ nominal}$	5.42%
Real risk free rate of return	$R_{f,\ real}$	2.79%
Market risk premium	$R_m - R_f$	8.00%
Asset beta	β_a	0.65
Debt beta	β_d	0.19
Debt margin	δ	1.86
Ratio of debt to total assets	D/V	55.00%
Corporate tax rate	t	30.00%
Valuation of imputation credits	γ	0.00%
Calculated values		
Ratio of equity to total assets	$E/V = 1 - D/V$	45.00%
Equity beta	$\beta_e = \beta_a + (\beta_a - \beta_d) \times \{1 - (1 - \gamma) \times t \times K_d/(1+K_d)]\} \times D/E$	1.20
Cost of equity	$K_e = R_{f,\ nominal} + \beta_e \times (R_m - R_f)$	15.03%
Cost of debt	$K_d = R_{f,\ nominal} + \delta$	7.28%
Expected inflation	$\pi_e = (1 + R_{f,\ nominal})/(1 + R_{f,\ real}) - 1$	2.56%
WACC		
Post-tax nominal	$WACC_{post\text{-}tax\ nominal}$	9.56%
Post-tax real	$WACC_{post\text{-}tax\ real}$	6.83%
Pre-tax nominal	$WACC_{pre\text{-}tax\ nominal}$	13.66%
Pre-tax real	$WACC_{pre\text{-}tax\ real}$	10.83%

When values at the upper or, as appropriate, the lower limits of the ranges of values for the parameters are used, the rate of return for the GGP is 13.7% pre-tax nominal, or 10.8% pre-tax real.

6 A final note

The estimate of the of rate of return for the GGP made using the upper or, as appropriate, lower limits of the ranges of values for the parameters is consistent with the conventional use of the CAPM and the determination of a WACC. This means that no allowance is included in the cost of equity for any risks not captured in beta. It also implies that no allowance for asymmetric risk, and no allowance for non systematic risk, or risk specifically involved in delivering the reference service, is included in the rate of return.

The inclusion of asymmetric risks in the estimation of the rate of return is inconsistent with the principles underpinning the CAPM model. To that extent, the approach used in this report is consistent with the conventional use of "the model". It is less obvious, however, that the exclusion of asymmetric risks is inconsistent with the practical application of "the model". This is because, as a number of regulators have noted, including an allowance in the expected rate of return for risks or uncertainties that are difficult to capture in the cash flows is a common approach in commercial practice. It also provides one rationale for the discrepancy observed between estimates of the cost of capital and the hurdle rates used in investment evaluation.

Furthermore, there is accumulating evidence that at least some investors require compensation for non systematic risk, and that that compensation is not included in estimates of rates of return determined using the CAPM.

Although the method of estimating the rate of return in this report is consistent with conventional use of "the model", and with the approach taken by Australian regulators, the rate of return it delivers may understate the rate of return sought by investors.