THE RATE OF RETURN

FOR

ELECTRICITY DISTRIBUTION NETWORKS

DISCUSSION PAPER

INDEPENDENT PRICING AND REGULATORY TRIBUNAL
OF NEW SOUTH WALES

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Discussion Paper DP-26 **November 1998**

Submissions

Public involvement is an important element of the Tribunal's processes. The Tribunal therefore invites submissions from interested parties to all of its investigations.

Submissions should have regard to the specific issues that have been raised. There is no standard format for preparation of submissions, but reference should be made to relevant issues papers and interim reports. Submissions should be made in writing and if they exceed 15 pages in length, should also be provided in computer disk in word processor, PDF or spreadsheet format.

The closing date for submissions is 22 January 1999.

Confidentiality

The results of the Tribunal's investigations are enhanced if information is generally available for public comment and scrutiny. With this in mind, the Tribunal would wish that submissions are made publicly available whenever reasonably possible. However, if a person making a submission does not want that submission to be made available to the public, that person should claim confidentiality in respect of the document, or any part thereof.

Such a claim for confidentiality should be clearly noted in a prominent position on the front page of the submission.

While the Tribunal will take steps to identify and protect from public access both exempt documents (within the meaning of the *Freedom of Information (FOI) Act, 198)* and material claimed as confidential, it cannot be guaranteed that submissions will not be released to the public. Section 22A of the *Independent Pricing and Regulatory Tribunal Act, 1992*, provides that, on request by any person, the Tribunal must release documents that are not exempt under the *FOI Act*. There are also provisions for the Tribunal, at its discretion, to release otherwise exempt documents after consultation with the parties concerned.

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Information about the role and current activities of the Tribunal, including copies of latest reports and submissions can be found on the Tribunal's web site at *www.ipart.nsw.gov.au*

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1 INTRODUCTION

The Tribunal is conducting a review of pricing for the electricity distribution network services of New South Wales. The review was referred to IPART by the Premier, under section 12A of the *Independent Pricing and Regulatory Tribunal Act 1992* ("the IPART Act").

As part of the review process, the Tribunal is distributing this discussion paper. Its purpose is to identify significant issues relating to the rate of return used in determining maximum allowable revenue for the network businesses covered by the review and to indicate Tribunal's preliminary views on some of these issues.

Interested parties are invited to make **written submissions** to IPART on the issues addressed in this paper **by close of business on Friday, 22 January 1999**.

The terms of reference provided to IPART under s12A of the IPART Act also require IPART to report on the appropriate pricing of government monopoly electricity transmission network services for the five-year period from 1 July 1999. At the same time, the Australian Competition and Consumer Commission (ACCC) is also conducting an inquiry into the appropriate revenue cap to be applied to the non-contestable elements of the TransGrid's transmission network services from 1 July 1999. The National Electricity Code ("the Code") provides that the ACCC shall be responsible for the economic regulation of the NSW transmission network from 1 July 1999.

Since the terms of reference for the two reviews to be undertaken are similar, IPART and the ACCC have agreed to closely coordinate their work programs and consultation processes.

The views expressed in this discussion paper are those of the Secretariat of IPART. They do not reflect the views of ACCC. The ACCC is currently developing a Statement of Regulatory Intent (SRI) that will outline the ACCC's regulatory approach and deal with issues such as the cost of capital for transmission networks. The ACCC released an issues paper in May 1998 in relation to the issues to be addressed in the SRI and has received submissions from a number of parties, including TransGrid.

2 REQUIREMENTS OF THE NATIONAL ELECTRICITY CODE

The Terms of Reference of IPART's current review of transmission and distribution networks pricing under s12A of the IPART Act require IPART to base its recommendations on the National Electricity Law and the National Electricity Code.

Chapter 6 of the National Electricity Code ("the Code") deals with the regulation of transmission and distribution network pricing. It requires the jurisdictional regulators to consider the regulated entity's need for a fair and reasonable rate of return when determining the appropriate annual aggregate revenue requirement (AARR).

The Code requires that the distribution network pricing regulatory regime seek to achieve several outcomes, including:

> *Clause 6.10.2(b) Distribution network service pricing – fair and reasonable rate of return*
> "an incentive-based regulatory regime which:

> (1) provides for, on a prospective basis, a sustainable commercial revenue stream which includes a **fair and reasonable rate of return** to Distribution Network Owners on efficient investment …;" [emphasis added]

The Code requires that the regime for regulating the revenues of distribution network owners and distribution network service providers be administered according to the following principle:

> *Clause 6.10.3(e) – Distribution network service pricing – asset valuation*
> "The regulatory regime to be administered by the Jurisdictional Regulator … must have regard to the need to:
> (5) provide **a fair and reasonable risk-adjusted cash flow rate of return** to Distribution Network Owners on efficient investment given efficient operating and maintenance practices on the part of the Distribution Network Owners where [assets are valued according to certain principles]

In setting the revenue or price cap to be applied to each network owner, the jurisdictional regulator must take into account each distribution network owner's revenue requirements during the regulatory control period, including:

> *Clause 6.10.5(d)(5) – Distribution network service pricing – WACC*
> "the Distribution Network Owner's **weighted average cost of capital** applicable to the relevant network service, having regard to the **risk adjusted cash flow rate of return** required by investors in commercial enterprises facing similar business risks to those faced by the Distribution Network Owner in the provision of that network service;" [emphasis added]

> *Clause 6.10.5(d)(6) – Distribution network service pricing – rate of return*
> "the provision of a **fair and reasonable risk-adjusted cash flow rate of return** on efficient investment including sunk investments subject to the provisions of clause 6.10.3(e)(5);" [emphasis added]

As noted above, the Code requires that the jurisdicational regulators consider the weighted average cost of capital (WACC) for the distribution networks respectively. A method of calculating WACC is outlined in Schedule 6.1 of the Code.

In summary, the Code requires the jurisdictional regulators to estimate the rate of return from the perspective of the market. The rate of return must be consistent with the returns currently being sought by investors from investments bearing similar business risks.

3 IMPORTANCE OF THE RATE OF RETURN

To establish an acceptable level of return on capital for the network business owner the National Electricity Code combines a rate of return with a regulatory asset value. Given the capital-intensive nature of electricity network business, the return on capital component of the regulated revenue could account for 30 to 35 percent of the annual aggregate revenue. Therefore, relatively small changes to the rate of return can have a significant impact on the total revenue requirement and ultimately, the end-user prices.

It is important that the rate of return be set at an appropriate level which reflects a commercial return for the regulated businesses. Setting a rate of return below the cost of funds in the market could make continued investment in developing the network difficult or unattractive for the owners. This might create pressure for the regulated businesses to

reduce maintenance and capital expenditure below optimum levels, thus degrading the quality of service.

Conversely, if the rate of return were set at too high a level by the regulator, the regulated businesses would earn a return in excess of their cost of capital in the market place. This would distort pricing signals to consumers and investors, resulting in misallocation of resources and sub-optimal economic outcomes. Prices which are unduly high could adversely affect the competitiveness of downstream business end-users, to the detriment of the community. Unduly high distribution charges could distort the apparent economics of network by-pass options and the incentives for demand side management, energy efficiency, or use of alternative energy sources.

4 THE TRIBUNAL'S APPROACH TO ASSESSING RATE OF RETURN

The Tribunal considers that a key objective in setting an appropriate rate of return is the promotion of certainty and predictability in the regulatory environment. Unfortunately, there is no perfect theoretical answer to the problem of setting a rate of return, and there are other factors that impact on end users and investors / utility owners.

At present, the capital asset pricing model (CAPM) is the most widely accepted procedure for estimating the cost of capital. This view is supported by the industry and market participants. CAPM has been applied by regulatory agencies to estimate the cost of capital for regulated industries in the USA and UK.

While the tool is widely used, many aspects of its application remain contentious. This was illustrated recently in the submissions and debate on the draft decisions of the Australian Competition and Consumer Commission (ACCC) and the Office of Regulator General (ORG) decisions on the access arrangements for gas networks in Victoria. Concerns were raised about the treatment of asymmetric risks and sensitivity to current interest rates. These problems related to using WACC / CAPM as a tool of analysis. Neither concern can be easily factored into the WACC / CAPM model, but both are relevant to a regulator's judgement about an appropriate rate of return.

There are other complex and contentious issues surrounding the application of the model. These involve determining:

- An appropriate risk free rate. This involves an assessment of the appropriate term for the risk free rate and whether a spot rate or some estimate of a long term average rate should be used.
- A valuation of the tax imputation credits.
- How to treat taxation in estimating the cost of capital.
- The methodology to be used to convert conventional post-tax measures of return into pre-tax measures of return and the effective tax rate to be used in that conversion.

These are discussed later in this paper.

In its submission on the ACCC's Issues Paper on the Statement of Regulatory Intent for transmission networks, NSW Treasury acknowledges the important role played by the Regulator's judgement:

> The estimation of cost of capital is a subjective judgement rather than a scientific calculation. It should be remembered that WACC and CAPM are only methods of trying to ascertain the return that the market requires. In this regard, there is no substitute for market and investor input. The ACCC should be cognisant of the views of the investment community, rather than solely relying on narrow technical considerations when determining a "fair and reasonable rate of return".[1]

While recognising that CAPM is just one approach to assessing the cost of equity and the weighted average cost of capital, the Tribunal has used it as a guide for assessing the rate of return for a utility. This requires careful consideration of the input values to the model. It is recognised that there is no single, 'precise' value for the component parameters. Consideration of the input parameters will help establish a reasonable range for the cost of capital within the CAPM approach. However, the choice of a rate of return within this range is a matter of regulatory judgement. This judgement may be informed by the results of alternative models for assessing the cost of capital, assessment of risks specific to the utility, and evidence of market expectations.

The Tribunal's recent draft determination on access arrangements for Great Southern Energy's Gas Distribution system in Wagga Wagga illustrates this approach. In that determination the Tribunal concludes:

> From the evidence currently available on the cost of equity, use of CAPM suggests that the **nominal post tax return on equity should be within the range of 11.0-13.4 percent**. Using this approach, the weighted average cost of capital for the regulated gas distribution network should be within the range of **5.8-8.6 percent (real, pre tax).**
>
> In addition to CAPM, the Tribunal considered other factors including an assessment of the risks faced by GSN, other evidence on market expectations of the rate of return and other economic considerations. The Tribunal concludes that a rate of return within the range of 7-8 percent which is towards the higher end of the range under the CAPM framework is appropriate for GSN for the purposes of this draft decision. It is considered appropriate for GSN, given the size of its network and the associated risk. Although GSN has a mature network, the potential volatility of its earnings is considered to be above the average that may be faced by a service provider, since a small number of major customers provides most of the revenue.
>
> Within this range for the real pre tax rate of return (ie 7-8 percent), the Tribunal must decide on the most appropriate point as the rate of return for GSN. This decision has been made after examining the initial capital base, the implications for prices, new investments and competition, and GSN's cashflow positions and financial projections over the next ten years.
>
> The Tribunal concludes that a **real pre tax rate of 7.5 percent** is appropriate for GSN for this access arrangement. This conclusion is consistent with a **nominal post tax return on equity of 12-13 percent.**[2]

The above conclusions are not quoted on the assumption that such results are translatable directly to electricity. Indeed, the Tribunal's report makes it clear that these conclusions are specific to GSN's gas network in Wagga Wagga. Each sector / utility must be considered on a case-by-case basis and the decisions in this case need not necessarily apply to other utilities. However, the broad approach adopted and outlined above may have more general applications.

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1 NSW Treasury, submission to ACCC in response to the Issues Paper on the Statement of Regulatory Intent for transmission networks, pp 5-6.

2 IPART, *Draft Decision: Access Arrangement Great Southern Energy Gas Networks Pty Ltd*, September 1998, pp 29-30.

Comments are invited on:

- ***the Tribunal's approach to determining the rate of return for a utility with guidance from analysis using the CAPM framework.***

5 WEIGHTED AVERAGE COST OF CAPITAL

The Code requires that the rate of return used to determine the network prices should provide for a return which is commensurate with the prevailing cost of funds available in the market, and with the risk involved in delivering the network's services. The rate of return may be set on the basis of a weighted average cost[3] applicable to each source of funds, equity and debt.

The cost of debt is estimated by considering the premium to the risk free rate at which the network businesses are likely to raise debt in current market conditions. The cost of equity is estimated with reference to CAPM. This necessitates establishing an appropriate risk premium to a risk free rate applicable to the equity investment in a business of similar nature.

From an investor's perspective, an estimate of weighted average cost of capital (WACC) is used to value risky *future* cash flow streams. The WACC applied by an investor will reflect that particular investor's opportunity cost of capital, having regard for a range of factors including that investor's marginal tax rate.

The required return for equity and debt is weighted in proportion to the relative amount of equity and debt used in the financing mix. The WACC formula[4] is as follows:

$$WACC = R_e * \frac{(1 - T)}{1 - T(1 - \gamma)} * \frac{E}{(E + D)} + R_d * (1 - T) * \frac{D}{(E + D)}$$

Where:

R_e	=	required rate of return on equity after company tax
R_d	=	pre tax average cost of debt
D	=	market value of debt
E	=	market value of equity
T	=	effective corporate tax rate
γ	=	franking credit utilisation

To apply this formula to determine the required rate of return, it is necessary to estimate future expectation of:

- the risk free rate
- the cost of debt
- the tax rate
- gearing (financing mix)

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[3] Refer Schedule 6.1 of the National Electricity Code.

[4] This formula was developed by Officer (1994), *The Cost of Capital of a company under an imputation tax system*, Journal of Accounting and Finance, 34. This formula is widely accepted as a tool of business valuation.

- the risk premium on equity including the estimate of beta.

The most subjective of these parameters is the estimation of risk premium and beta which are discussed in more detail in 8.3 and 8.4.

Comments are invited on:

- ***the Tribunal's approach in using WACC to determine the rate of return on the regulated asset base of the distribution network business.***

6 CAPITAL STRUCTURE ASSUMED IN CALCULATING WACC

A gearing (debt / assets) ratio needs to be established for the distribution network businesses to identify:

- a beta factor to be used in estimating the cost of equity
- the appropriate weighted average cost of debt and cost of equity in the WACC.

The gearing level needs to be estimated to adjust observed comparable beta factors for the difference in financial risk between the comparative utilities and the distribution businesses. The higher the assumed level of gearing for the distribution businesses, the higher the adjusted comparative betas and the higher the cost of equity.

To determine the WACC, the gearing level of the distribution businesses needs to be estimated. The *optimum* gearing level is that which minimises the WACC. Risk premium demanded by debt is invariably lower than that demanded by equity. However, at high debt levels, the costs of debt and equity increase significantly, reflecting the increased likelihood of insolvency and associated costs.

Businesses tend to gear up as much as possible to a level where agency costs, penalties and risk premium imposed by the capital markets constrain further borrowing. Relatively high levels of gearing are typically associated with lower risk projects such as regulated monopolies.

International differences in tax systems may have some bearing on the gearing levels of utilities in different countries. In the UK, where a taxation system with imputation characteristics operates, comparable entities have very low gearing levels. The imputation system has the effect of lowering the cost of equity. On the other hand, US companies operating under a classical tax system which gives incentives to increase leverage have higher gearing levels. Therefore, gearing levels observed in overseas utilities are not necessarily directly transferable to Australia.

Shown below are the gearing levels[5] of several UK utility sectors from 1993 / 94 to 1996 / 97:

[5] Gearing is measured as the ratio of book value of debt to book value of debt and book value of equity.

Table 1 Gearing of UK utility sectors

	1993/94 (%)	1994/95 (%)	1995/96 (%)	1996/97 (%)
Multi-utilities average	34	34	54	59
British Telecom	40	41	42	45
Water and sewerage companies average	30	30	33	40
Regional electricity companies average	31	38	56	54

Source: *The Importance of Capital Structure*, The Utilities Journal, May 1998.

As indicated above, the level of gearing of UK utilities has been increasing over time. This is particularly true of the electricity companies, with an average gearing of 54 percent.

The current gearing level of some large Australian companies is around 34 percent based on book equity, and 24 percent based on market capitalisation (see Appendix 1). Acquisition statistics for the Victorian electricity distributors indicate debt levels of the low risk electricity utilities are significantly higher than those of the listed companies. Presently, observable gearing levels in utility companies are as follows:

Table 2 Gearing of Australian utility companies

Utilities	Debt/Assets(%)	Rating
United Energy	62	A-
CitiPower (owned by Entergy Corp)	78	--
Solaris Power (now wholly owned by by AGL)	68	BBB+
PacifiCorp Australia (holding company for Powercor Australia)	55	BBB+
Eastern Energy	56	A-
AGL	40	A
Envestra	64	BBB

Source: Standard & Poors: April 1998, Rating Memorandum.

The current capital markets appear to regard a gearing level as high as 60 percent debt to total assets as acceptable, and are prepared to provide debt to a 60 percent geared business at a price commensurate with an investment grade rating.

The NSW Treasury paper *Capital Structure for NSW Government Trading Enterprises,* states that a notional grade of at least "A" as per the Standard and Poors ("S&P") is required for NSW Government Trading Enterprises[6]. The level of debt of the government trading enterprises (GTEs) needs to satisfy the following conditions:

- maintain a good investment grade rating over the next five years
- finance an approved capital expenditure program
- be capable of repaying debt within a reasonable period
- maintain sufficient flexibility for reasonable contingencies
- maintain satisfactory levels of liquidity
- sustain levels of required financial distributions.

[6] The level of debt of NSW Government Trading Enterprises including the six NSW distributors and TransGrid need to satisfy specific conditions as set out in the NSW Treasury paper, *Capital Structure for NSW Government Trading Enterprises,* (1994).

A 1996 study of the capital structure of the NSW electricity distributors recommended a gearing level of 50 percent for the electricity distributors. This appears conservative in the light of the current gearing of the Victorian electricity distributors and other Australian utilities.

The 1997/98 regulatory financial statements returned by the NSW electricity distributors show the gearing levels of the six network businesses average 44 percent with a range of zero to 56 percent.

The gearing levels of the consolidated (regulated and non-regulated businesses combined) NSW electricity distributors are as follows:

Table 3 Gearing of NSW distributors

	Debt/Debt+Equity (%)
Energy Australia	45
Integral	55
North Power	21
Great Southern Energy	20
Advance Energy	15
Australian Inland Energy	(debt negotiable)
Overall	41

Source: 1997/98 Audited financial statements of the NSW Distributors.

The gearing levels of the NSW network businesses are lower than recommended by the capital structure study and significantly below the Victorian distributors. In the recent gas access determinations, IPART, ORG and ACCC used a benchmark gearing of 60 percent to assess the regulatory rate of return for the regulated entities.

Comments are invited on:

- ***the appropriate gearing assumption for determining a benchmark rate of return for the distribution network businesses, given that the Tribunal assumed a gearing of 60 percent in determining the rate of return for Great Southern Gas Networks' access arrangement.***

7 EFFECTIVE TAX RATE

In estimating the cost of equity and WACC, an assumption of the effective tax rate[7] (ETR) is required at two levels:

- The ETR is used in conjunction with the estimate of the value of franking credits to adjust the cost of equity[8]. In this instance, the **higher** the assumed tax rate, the **lower** the post tax cost of equity.
- The assumed ETR is also used to transform the post tax WACC to a pre tax WACC[9]. In this instance, the **higher** the assumed ETR, the **higher** the estimated pre tax WACC.

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7 Effective tax rate is calculated as: $\frac{\text{NPV Actual tax paid}}{\text{NPV(pre tax net cashflows)}}$

8 Refer section 8.4 Equity beta.

9 Refer Section 11: WACC Transformation.

Opinions differ as to whether the statutory tax rate or the effective tax rate of the regulated business should be used to convert a nominal post tax WACC to a pre tax WACC.

Although the statutory tax rate is currently 36 percent, most distribution businesses are geared sufficiently to have the effective tax rate below 36 percent. These businesses also receive substantial tax breaks in the form of accelerated depreciation on their network infrastructure assets. When the time value of the money is taken into account, this further lowers the effective tax paid.

Thus, grossing up post tax WACC using the full statutory rate will provide the network owner with a higher after-tax rate of return than is implicit in the calculation of the target revenue. This results in high network prices to the end users.

Given the capital intensive nature of electricity utilities, it is unlikely that the effective tax rate will be as high as the statutory tax rate. The average effective tax paid by the NSW distributors amounted to 25 percent in 1996/97. The effective tax rate for the distribution network businesses in the next ten years averages 27 percent, as shown below:

Table 4 Effective tax rate of the NSW distribution network businesses

	NPV of pre tax net cashflow	NPV of tax charge	Effective tax rate(%)
Energy Australia	2,084	564	27
Integral	1,322	374	28
North Power	397	105	31
Great Southern Energy	273	53	21
Advance Energy	212	49	25
Australian Inland Energy	17	1	6
Combined NSW network businesses	4,350	1,146	27

IPART calculation (see appendix 4).

It can be argued that the effective tax shield on debt is at the marginal tax rate. The exception to this is when the entity is in a tax loss position and the utilisation of tax deductibility of interest is deferred. Thus, a distinction may be drawn between the effective tax rate on debt and on equity in the WACC calculation.

The recent draft decision by the Office of the Regulator General suggests an effective tax rate of 15 percent to 25 percent for the proposed Victorian gas distribution access arrangements. However, the final decision applies the statutory rate of 36 percent, noting that this assumption provides a cash flow benefit to the utility.

In practice, most practitioners use marginal or statutory tax rate. It can be argued that use of the effective rate other than the statutory rate conflicts with public policy initiatives of promoting investment. Furthermore, given that effective tax rates are continually changing over time and are largely specific to individual companies, this makes it extremely difficult to derive a generally applicable effective tax rate.

Furthermore, as accelerated depreciation, which generates most of the tax benefits, is essentially a timing rather than permanent difference, the average effective tax rate approximates the corporate tax rate over the longer term.

The real pre tax WACC is relatively insensitive to reasonably large changes in the effective tax rate. For instance, keeping the other parameter values constant, increasing the value of the ETR from 25 percent to 36 percent results in an increase in the real pre tax WACC of only 40 basis points.

Alternatively, some argue for the introduction of a tax pass through mechanism, whereby any future taxation changes would be automatically fed into the cost of capital calculations and revenue caps.

The Tribunal's draft determination on the access arrangement for Great Southern Energy Gas Networks Pty Limited applies a range of assumptions from an effective tax rate of 25 percent to the statutory rate of 36 percent.

Comments are invited on:

- ***whether the effective tax rate or the statutory tax rate should be used to determine the pre tax weighted average cost of capital***
- ***if the effective tax rate is to be used, how this should be estimated***
- ***whether the actual tax paid should be recovered as part of the operating costs of the distribution business.***

8 COST OF EQUITY

The Capital Asset Pricing Model (CAPM) approach is a generally accepted methodology for determining the cost of equity for input to the calculation of the weighted average cost of capital. CAPM is based on the portfolio theory of finance in which risks are classified into:

- *systematic risk* - risk applicable to the market as a whole, such as inflation, tax rises, interest rates etc
- *specific risk* - residual risk unique to an individual firm or a small group of companies that forms a subset of the market.

The basis of CAPM is the relationship between risk and return[10]. Whilst there has been considerable debate on the strength of the risk/return relationship, evidence indicates there is a strong linear and positive relationship over the very long term. The theory stipulates that specific risks that can be eliminated through diversification are not to be compensated. Consistency with the WACC/CAPM framework requires that specific risks be factored into projected cash flows.

The essential elements in establishing a required return for a specific stock are:

1. Estimation of the risk free rate.
2. Estimation of the risk premium for the market as a whole.
3. Estimation of the stock's risk relative to that of the whole market.

[10] For further discussion on the risk/return relationship, see chapter 8 of Brealey and Myers, *Principles of Corporate Finance*, 1972.

The general formula for CAPM is:

$$Re = Rf + [\beta e (Rm-Rf)]$$

Where:

Re	=	return on equity, being the return after corporate tax but before personal tax
Rf	=	risk free rate of return
Rm-Rf	=	market risk premium
βe	=	levered beta, ie the relative volatility of the specific stock to the market, a measure of systematic risk.

8.1 Alternative methodologies for estimating the cost of equity

Other methods which can be applied to estimate the cost of equity. These include:

- price/earnings ratio (P/E)
- comparable earnings
- dividend growth model (DGM)
- arbitrage pricing theory (APT).

All these models are based on the same underlying assumptions of discounted cashflow.

The price/earnings ratio methodology involves capitalising the estimated future maintainable earnings of the business at a price/earning multiple appropriate to the risks and prospects of the business. This method is commonly used in practice and is generally used for established businesses with a financial track record and smooth earnings flows.

The comparable earnings methodology involves deriving a company's cost of equity capital based on the return on equity for a sample of 'comparable companies'. For each company in the sample, return on equity is calculated as the accounting return on the company's book value of equity. This method marred by the defficiency that the use of book values of income and equity is not consistent with market related concept of cost of capital.

The DGM is based on the premise that the value of a stock is equal to the present value of the dividend stream from that stock. The cost of equity is assumed to be the discount rate which equates the stock's current market value with the present value of the stock's dividend stream. The general formula for DGM is:

$$R_e = \frac{D_1}{P_0} + g$$

where

R_e	=	cost of equity
D_1	=	expected dividend
P_o	=	current share price
g	=	rate of growth in dividends

Assumptions inherent in DGM include dividend growth at a constant rate forever and expected dividend growth can be estimated accurately. These are major weaknesses of DGM.

Use of APT requires:

- identification of the macroeconomic factors affecting the stock
- measurement of the risk premium for each of these factors
- measurement of the sensitivity of the stock to each of those factors.

APT has rarely been used in mainstream valuation exercises because the number and specification of the factors to be priced vary from model to model, and individual factor loadings must be estimated.

CAPM is relatively simple to apply, at least in theory. It has widespread support. Whilst these may be good reasons for regulators to use it, CAPM has its critics too. Problems with CAPM include:

- It is doubtful whether CAPM provides a good description of actual equity returns over time. It is argued that if market risk is not identical to systematic risk, beta cannot adequately reflect market risk.
- Some of the economic assumptions underlying CAPM may be questionable, eg riskless returns, mean variance analysis, fully informed investors.
- Measuring the market portfolio is difficult.
- Estimating difficulties are varied and complex, particularly the estimation of expected return on equity. In applying CAPM in the Australian environment, relevant comparators are generally not available in the stock market. Overseas estimates are not necessarily comparable.

The controversy surrounding nearly every parameter in the CAPM formula is highlighted in recent debate about the ACCC/ORG draft decision on the Victorian gas access arrangement.

However, it should not be assumed that the application of alternative approaches would be any less controversial. Despite its drawbacks, CAPM is frequently used by practitioners because of its relative simplicity in defining and measuring risk factors. Its supporters argue that there is extensive empirical evidence that the model provides a reasonably accurate estimate of returns required by the market.

Comments are invited on:

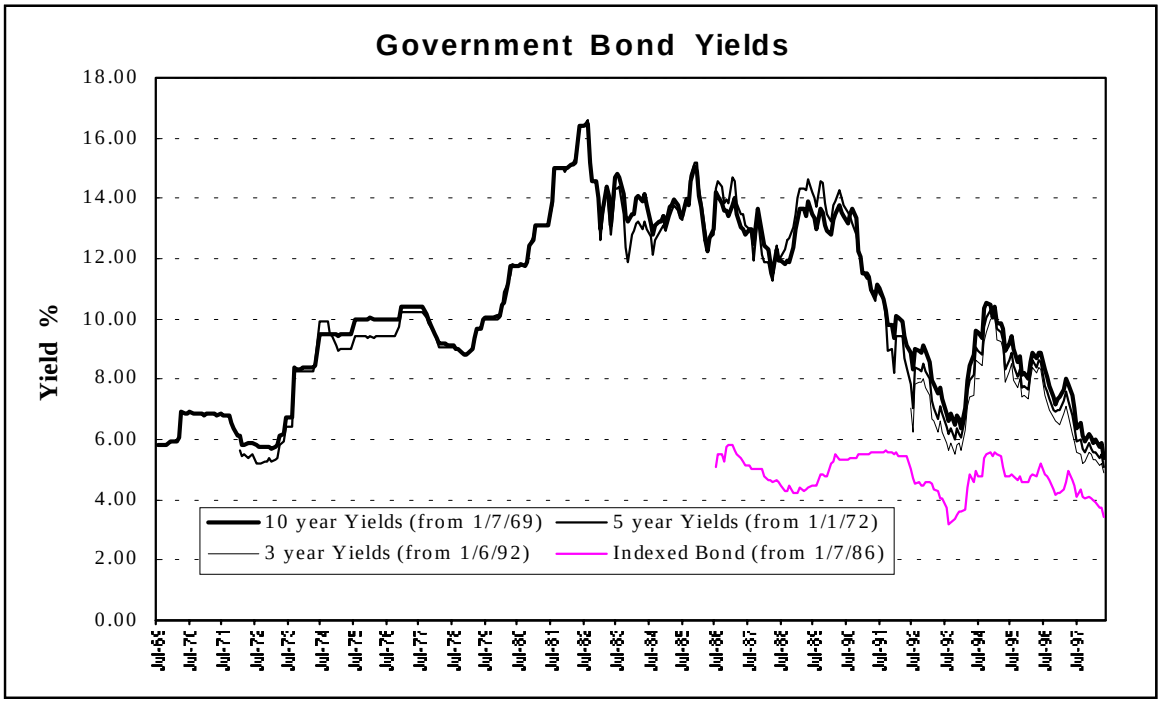
- ***the Tribunal's approach to determining after tax return required by equity holders with guidance from CAPM analysis***
- ***the feasibility and appropriateness of using an alternative to CAPM such as DGM to determine the equity risk premium***
- ***the use of historical data to determine the equity risk premium.***

8.2 Risk free rate

Application of the CAPM theory requires the use of a benchmark risk free rate in place of the theoretical risk free rate. The most commonly used proxy is the 10 year Australian Commonwealth bonds yield due to its market depth. The 10 year bond yield gives a better picture of the true market rate than the less liquid bonds with longer duration.

Shown below are the nominal yields of 10 year Commonwealth bonds in the past 20 years.

Figure 1 Government bond yields



Source: Based on bond rates published by the Reserve Bank of Australia

Monthly averages for the 10 year Commonwealth bond rates in comparison to the 3 year and 5 year bond rates are:

Table 5 Comparison of 3 Year, 5 Year, 10 Year and 10 Year Indexed Commonwealth Bond Rates

	3 Year	5 Year	10 Year	10 Year Indexed[11]	Implicit inflation 10 year bond[12]
past 20 years	7.15	11.13	11.25	4.77	6.18
past 10 years	7.15	9.38	9.55	4.70	4.63
past 5 years	7.18	7.54	7.88	4.46	3.27
past 2 years	6.25	6.60	6.91	4.25	2.55
past 1 Year	5.29	5.60	5.91	3.86	1.98

Source: Calculation based on bond rates published by the Reserve Bank of Australia.

CAPM is based on current estimates of future returns. Since the market risk premium (as discussed in 9.3 below) applied in CAPM reflects a margin over the ***contemporaneous*** 10

[11] The 10 Year Indexed bond came into existent in 1986.

[12] Calculated using 1+n=(1+r)(1+I).

year bond rate, it would seem reasonable to adopt the ***current*** 10 year government bond rate as the risk free rate. It is inconsistent to use a historic average for the risk free rate in one part of CAPM while using a market risk premium over the contemporaneous risk free rate in another part of the model.

The benefit of using a contemporaneous measure of the risk free rate is that the value is readily measurable and the resulting revenue requirements and network prices tend to reflect current costs. This reduces the possibility of inefficient pricing.

However, the use of a single rate is likely to lead to more volatility in the risk free rate than using an average rate, causing volatility in network prices from one regulatory period to the next. Use of a longer term rate, such as 10 year bond rate, would be less volatile.

The Financial Appraisal Guidelines[13] issued by the New South Wales Treasury specify use of 10 year Commonwealth Bond rate as a proxy for the risk free rate for the purpose of calculating the WACC of GTEs and SOCs. The risk free rate must be established by taking the average of this rate for the 20 business days immediately prior to the valuation date. This method captures the most recent information and views on inflation, while minimising the distortion that can be caused by any one day's deviation in the rate. The Tribunal's draft decision on the access arrangement for the Great Southern Gas Network applies an average of the 10 year bond rate over the 20 business days preceding the date of the decision.

Another factor that may influence the selection of the risk-free rate is the frequency of regulatory determinations for which WACC is applied. Arguably, if the allowable WACC is revised periodically, then it is not necessarily appropriate to use the long term cost of capital as a benchmark. Some argue that an appropriate term for calculating the risk free interest rate for CAPM is the term between pricing reviews.

The interest rate risk associated with holding a fixed interest security increases with the time remaining to maturity. Accordingly, the interest rate associated with a 10 year bond rate is higher than for a 5 year bond rate. It may be argued that to use a long term bond rate such as a 20 or 30 year bond rate as a proxy for the risk free rate would over-compensate network owners/investors for an interest rate risk which they do not bear. As returns are reset every 3-5 years, the use of shorter term bond rates eliminates interest rate risk and provides a better estimate of a risk free rate benchmark for the regulatory period. In this way, network owners/investors are better protected against movements in interest rates.

It is a widely accepted financial management principle that amortisation of relevant assets must be over their full economic life and assets life as matched to the maturities of liabilities. This implies that investors generally have an expectation that they will be compensated for making long term investments. Thus, it is argued that when determining expected returns, consideration needs to be given to the investors' planning horizons.

It is important to distinguish between the *investment decision* and the *financing decision*. Given that WACC is used primarily to value projected cash flows arsing in the regulatory period, the length of the regulatory period appears to be an appropriate time frame to benchmark the risk free rate. The regulator is not primarily concerned with determining a WACC to

[13] These Guidelines were released by the NSW Treasury in 1996. The use of risk free rate is detailed in 5.2 of Part 5, *Calculating Cash Flows and Weighted Average Cost of Capital for NSW Agencies.*

value cashflows arising from the full economic life of the assets. It is noted that there is some support amongst academics and practitioners for a risk free rate as short as 90 days[14].

Concern has been expressed about the possible price shock at the subsequent price review if there is an upward movement in the interest rate. The presumption underlying this concern is that current interest rates are historically low and it is highly probable that at the next review interest rate will be higher.

Unfortunately, it is very difficult to forecast future interest rates. It is arguably inappropriate for the regulator to do so. Variations in nominal interest rates are due to changes in inflation expectations and real interest rates. It can be argued that the major source of volatility in interest rates is inflation. This has been incorporated in the incentive based regulation through CPI-X based price or revenue caps.

8.2.1 Current risk free rate and expected inflation

The current risk free rate can be estimated in both real and nominal terms:

- The yield on 10 year Commonwealth bonds is around 5 percent nominal[15]. Assuming an average inflation rate of 2 percent over the next 10 years, this nominal yield equates to a real rate of around 3 percent[16].
- The yield on long-dated indexed securities issued by the Commonwealth is in the range of 3.5 percent real. The yield on these indexed securities may include a liquidity risk premium. Thus, it could be argued that these yields indicate the upper limit of the underlying real risk free rate.

The rate of return determined for the Access Arrangement for Great Southern Energy Gas Network is based on a risk free rate of 5.67 percent, representing the average rate over the 20 business day period preceding the determination date.

Comments are invited on:

- ***whether to apply a risk free bond rate consistent with the regulatory period, or to apply one consistent with the expected useful life of the asset***
- ***the Tribunal's use of the 20 day average of the current market bond rate as the risk free rate.***

8.3 Market risk premium

The risk premium represents the return that investors expect, in addition to the risk free return, for investing in the securities market as a whole. The premium is an ex ante premium, which should be based on a forward view. However, for practical reasons, the premium earned historically is used as a proxy. The market risk premium (MRP) is also measured historically from a benchmark risk free rate which is normally taken to be the yield to maturity on 10 year Commonwealth bonds.

The premium is generally calculated over a number of years. Opinions differ as to whether the geometrical mean or the arithmetic mean is the appropriate measure. Arithmetic mean[17]

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[14] Inter alia, Brealey and Myers and the Office of Gas Supply in the UK have favoured this approach.

[15] As of 26 October 1998.

[16] As of 26 October 1998.

is often preferred because estimates of discount rate are closer to the arithmetic mean than the geometrical mean.

A study undertaken by the Centre for Research in Finance at the Australian Graduate School of Management (AGSM) shows a wide range of premium:

Table 6 Average equity risk premium

Method	Period	Risk Premium (%)
Including October 1987		
Arithmetic average	1964-1995	6.2
Geometric average	1964-1995	4.1
Excluding October 1987		
Arithmetic average	1964-1995	8.1
Geometric average	1964-1995	6.6

As shown above, there are significant fluctuations in the measure of market premium. It may be negative in certain years. Thus, measures of risk premium are influenced by the measurement period. The risk premium measured by AGSM from 1991 to 1995 amounted to 8.6 percent, whereas from 1990 to 1995 the risk premium was just 1.9 percent, which is significantly smaller.

Research undertaken by Officer suggests that the mean market risk premium was in the range of 6 percent to 6.5 percent for the period 1946 to 1991, depending on the specific period over which the premium is measured.

Davis uses an alternative approach, which involves applying the dividend growth model to the market as a whole to derive the implied required rate of return. This approach gives an ex ante market risk premium of between 4.5 percent and 6 percent[18]. This differs with the long term average of the actual MRP in the range of 6 percent to 8 percent.

It has been suggested by some finance studies that the equity risk premium has reduced quite dramatically in recent years due to the effects of dividend imputation. In this view, a market risk premium calculated largely using data under a classical tax system [ie no imputation] of around 6 to 8 percent may be too high. Following the introduction of imputation, the risk premium could have fallen to reflect the additional value of franking credits received on an investment.

However, it is argued by finance academia that whilst the mix of the components of expected returns may have altered, the aggregate expected return has not. The aggregate expected return is a function of the risk of the equity and it does not appear that the imputation tax system has changed this underlying risk. The impact of dividend imputation is accounted for in WACC by the inclusion of gamma (γ) term in the WACC calculation, rather than through a downward adjustment to the market risk premium.

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[17] Richard Brealey and Stewart Myers advocate the use of arithmetic averages because geometrical means average down returns in a project. This could have several different outcomes.

[18] The study was commissioned by the Office of the Regulator General of Victoria for the pricing determination for the Victorian Gas Distribution Access Arrangements, 1998. This approach however is criticised by Officer as not a suitable empirical model although theoretically sound as the alternative. The problem is that it is extremely difficult to get appropriate measures of real growth.

A study based on historical data on the relative return performance of Australian equities and bonds over the period 1928-1996[19], has found that the Australian equity premium fluctuated between peaks in excess of 8 percent to levels as low as 1 percent. Currently, the equity premium is estimated to be around 3 percent, with an average of 3.9 percent over the period 1928-1996. The study notes that the equity premium has exhibited a trend decline in the most recent decades due to the decline in inflation[20]. It is argued that if a low-inflation environment is maintained in the Australian economy in future years, Australian equity premium will remain relatively low.

The Tribunal's draft determination on the access arrangement proposed by Great Southern Energy Gas Networks Pty Limited uses a range of market risk premium of 5.5 to 7.0 to estimate the return on equity.

Comments are invited on:

- ***the appropriate range of risk premium that should apply to the capital asset pricing model.***

8.4 Equity beta

8.4.1 Beta

Beta is the measure of the expected volatility of a particular stock relative to the market as a whole. It measures the systematic risk of a stock, ie the risk that cannot be eliminated in a well-balanced, diversified portfolio.

Generally, application of CAPM in Australia is based on the Australia Stock Exchange (ASX) as a proxy for the whole market. If returns are not sensitive to the market against which they are measured, beta will be low. When risk is low, the excess return relative to the market as a whole is low hence the return to shareholders.

8.4.2 Measurement of beta

Because the expected beta cannot be observed, past price data is used to calculate a historical beta. Changes in the economic and regulatory environment, and in the financial and operating structure of the entity mean that historical beta needs to be adjusted.

Where a company is not listed, conventional practice is to use other companies or sector averages as proxies. This requires a subjective adjustment to account for differences between the reference stocks and the stock in question.

A reference beta can be applied when:

- reference companies have the same characteristics as the regulated businesses and operating in similar regulatory environment
- the risk profile of the reference stock during the measurement period is the same as the regulated businesses.

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[19] Kortian, T (1998), *Australian Sharemarket Valuation and the Equity Premium*, Department of Finance, University of Sydney.

[20] As well as the decline in inflation and the increasing importance of institutional investors which have exerted downward pressure on the Australian equity premium, Kortian T. (1998) argues that demographic changes in the form of increases in younger savers in Australia's population is important in underpinning the decline of the Australian equity premium.

Although this latter point applies in theory, there is practically no direct Australian reference stock (listed) for the electricity distribution business. Using overseas proxies which operate under different regulatory regimes, economic environments and markets from that faced by the NSW distribution businesses would give rise to estimation errors. Also, since beta is measured with reference to a specific stock exchange, measured correlation coefficients are not necessarily appropriate for other environment. Deriving beta proxies from stock not listed on ASX may cause estimation errors.

In this regard, Officer makes the following comment[21]:

> … using a US based beta runs into the problem that the US, whose share market index is used to estimate the beta, is not like the Australian market, which is a resource based market. On these grounds, I believe it would be unwise to use US betas for an Australian based asset without adjusting for or taking account of the different nature of the markets (economies).

This view is shared by Associate Professor Neville Hathaway. Whilst an electricity grid or distribution business might be a relatively high risk business relative to the market index of an industrial economy, in a high risk resource economy like Australia, these businesses could appear relatively low risk in comparison to the economy's market index.

8.4.3 Gearing effect

The risk premium sought by equity investors will be a function of:

- the underlying market risk of the pre-financing cash flows of the asset
- the level of financial risk, which is, in turn, dependent on the capital structure of the entity.

In theory, the debt equity mix assumed in calculating the WACC must be consistent with the debt equity mix applicable to the reference stocks. Debt equity mix is likely to vary from one reference stock to another. Similarly, a debt equity mix of a particular reference stock varies during the measurement period.

To ensure consistency between the capital structure and equity beta, the beta of the reference stock needs to be adjusted from a geared beta to an asset (ungeared) beta, using the formula:

$$B_a = \frac{B_e + B_d * \frac{D}{D+E}}{1 + (1 - t_c(1-\gamma)) * \frac{D}{E}}$$

where

β_a	=	asset beta
β_e	=	equity beta
γ	=	the value of imputation credits
β_d	=	debt beta
t_c	=	corporate tax rate
D	=	debt
E	=	equity

[21] Comment made in a supplementary paper submitted to the Office of Regulator General (Victoria) in relation to the Gas Access Arrangement (8 April 1998).

The asset beta is then regeared to produce an estimated equity beta for a given level of financial leverage, using the following formula[22]:

$$Be = Ba \times (1 + (1 - tc(1 - \gamma)) \times \frac{D}{E} - Bd \times \frac{D}{V}$$

Various criticisms are made of this approach. It is argued that the technique is subject to considerable estimation error in that:

- the gearing is calculated at a point in time when solving the equation
- adjusting equity beta for financial risk merely compounds the original estimation errors in the original beta
- using asset betas of similar companies and then 'regearing' these betas to obtain an equity beta is potentially misleading as there is not a linear relationship between gearing levels and the risk/return required by equity investors.

The significant variations in the gearing levels of the reference stocks makes it necessary to make adjustments to obtain a better approximation of the appropriate beta range.

8.4.4 Estimated value of equity beta

Morin (1994) provides data relating to higher risk electricity utilities. This data is summarised in the table below.

Table 7 Equity beta and gearing of US utilities

Data Set	Equity Beta	Debt/Equity (%)
Arithmetic mean of 31 US high beta utilities	0.72	55
Arithmetic means of 11 US nuclear Baa-rated electric utilities	0.70	60
Average of US gas distribution sector	0.58	50

Source: Regulatory Finance: Utilities Cost of Capital, Morin R A (1994).

The data set out in Appendix 3 gives levered and unlevered betas for US Electric utilities. The equity beta for US electricity distribution averaged 0.69, while the corresponding asset betas for these companies averaged 0.45.

Given the different characteristics of the US and Australian market economies (see earlier discussion), the US observations may overstate the beta values which might apply to comparable entities in the Australian economy.

By way of comparison, the betas of the Australian low risk industrials, including utilities and infrastructure and gas utilities (AGL and Allgas) are as follows:

[22] In the ACCC final decision on the Victorian Gas Transmission Access Arrangements, the Monkhouse formula is used:Be=Ba+(Ba-Bd)(1-rd/(1+rd)T)D/E since it reflects an assumption of an active debt policy aimed at maintaining a specific gearing ratio as assumed in the regulatory model.

Table 8 Geared and ungeared betas of ASX industry groups and utility companies

Industry Group	Geared Beta[23]	Debt/Equity (%)	Ungeared Beta[24]
Retail	0.50	75	0.36
Telecommunications	0.70	134	0.41
Food & household goods	0.73	108	0.46
Infrastructure & utilities	0.61	59	0.46
Property trusts	0.49	10	0.47
AGL	0.66	38	0.53
Allgas	0.56	39	0.45

Note: Geared betas and calculated ungeared betas of the ASX industry groups are detailed in Appendix 5.

The beta range applicable to the network business should not exceed the range indicated above, given that the electricity network businesses:

- operate in a natural monopoly environment and within a transparent and consistent regulatory framework
- the demand for the service is relatively resistant to changes in the overall economic growth.

The Tribunal's draft determination on the Great Southern Energy Gas Networks Pty Limited's access arrangement used an asset beta of 0.40 - 0.50 to estimate the return on equity.

Recently, ORG/ACCC used an asset beta of 0.55 to estimate the equity return required for the Victorian Gas Access Arrangements. This was deliberately biased towards the upper limit of the range 0.45 – 0.60, as applied by regulators in the UK to similar gas transportation utilities. ORG/ACCC concluded that the high asset beta used would overcompensate investors for diversifiable risks that cannot be readily quantified or included in the cashflow[25].

Comments are invited on:

- ***the appropriate range of asset and equity betas applied to the estimation of the cost of equity for the NSW distribution network businesses.***

8.5 The effects of dividend imputation

The introduction of dividend imputation has complicated the calculation of the cost of capital in Australia. Under an imputation tax system, a proportion of the tax paid at the company level is, in effect, personal tax withheld at the company level. However, the proportion of company tax paid which may be claimed as a tax credit against personal tax varies, depending on whether the recipient is an Australian taxpayer.

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[23] Observed equity betas of the industry groups are based on the Risk Management Service published by the Centre for Research in Finance of AGSM, University of New South Wales (March 1998).

[24] The ungeared beta is calculated using the formula: $Ba = \frac{Be + Bd(1-(1-\gamma)tc) * \frac{D}{E+D}}{1+(1-tc(1-\gamma)) * \frac{D}{E}}$ where gamma=0.5, corporate tax rate=36% and Bd=0.06.

[25] See *Access Arrangements for Multinet, Westar and Stratus*, Office of the Regulator General, Victoria October, 1998, page 213.

Officer (1994) has developed a way of accounting for the effects of dividend imputation on the WACC. The term γ is included in the WACC calculation to represent the proportion of franking credits which can, *on average*, be used by shareholders of the company to offset tax payable on other income. The higher the gamma factor, the lower will be the required return to equity holders and therefore, the lower the estimated WACC.

The above approach is widely accepted as a means of adjusting for the effects of dividend imputation on the WACC used to set target revenues in view of the relative simplicity of the methodology.

Alternatively, cash flow can be adjusted by a factor reflecting imputation credits and after effective tax cashflows be discounted at an unadjusted cost of capital. This has the benefit of a more accurate net present value of the cashflow. Hathaway[26] supports this approach, arguing that "prices for capital are set at the competitive world rates" and to accommodate local tax changes by adjusting the cost of capital is not appropriate.

Imputation credits are unlikely to be capitalised into share prices at their full value because:

- not all investors can use tax credits
- effective tax rates on dividend and capital gains can differ for investors
- not all tax credits are distributed by the companies immediately.

Empirical evidence indicates average values for Australian imputation credits may be 68 to 82 percent of their face value[27]. Market studies undertaken by the Melbourne Business School indicate that the imputation credit value (γ) is of the order of 50 percent.

The utilisation of franking credits depends on:

- the tax paying position of the company
- the dividend payout ratio
- the tax position of the equity investor.

8.5.1 Tax paying position of utilities

Some utilities, by virtue of their high gearing levels and availability of accelerated depreciation, may not be in a tax paying position for a substantial period. If these businesses do not pay tax, the dividends paid will not be franked and therefore imputation credits will not be available to the companies' equity investors. In practice, public companies in a tax loss position tend to increase the dividend yield to compensate for their inability to pay fully franked dividends. The cost of capital is effectively higher for these companies. The franking credit utilisation factor is thus lower for the regulated utilities than that for the market as a whole.

It is also argued that the benefit of imputation is likely to change over time as the tax profile of the company changes.

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[26] Hathaway N, *Another Voice*, JASSA, December 1995, pp 18-21.

[27] McKinsey & Company (1994) 68 percent; Hathaway & Officer (1992) 58 percent - 82 percent; Brown & Clarke (1993) 72 percent.

8.5.2 Dividend payout ratio

If regulated utilities were expected to pay out a lower than market average profit in dividends, there would be an argument for adjusting the franking credit gamma below an overall market observation. Australian industrial stocks currently show an average dividend payout ratio of approximately 70 percent. The financial distribution policy of the NSW Treasury also adopts a similar payout rate for the NSW Government Trading Enterprises (GTEs) which include the NSW electricity distribution businesses.

8.5.3 Shareholder mix

The NSW electricity distribution businesses are wholly government owned. Although NSW distributors are not subject to the Commonwealth tax regime, they are required to pay tax equivalents to the NSW Government. Dividends distributed by these businesses therefore do not carry franking credits.

However, for the purposes of determining the regulated revenues for the network distribution businesses and estimating the required rates of return for these businesses, they are treated as if they are privately owned companies subject to Commonwealth tax legislation. The objective of this approach is to mimic the outcomes of competition.

The application of a value of imputation credit is necessary for the estimation of a generic 'benchmark' WACC, which can be applied uniformly across all regulated network businesses in NSW. This differs from a WACC which equates exactly with the opportunity cost of capital of the NSW Government as an investor. There is a strong case for using a market average value for gamma.

The 1997 Budget introduced provisions for reducing transferability of franking credits. Some practitioners commented that reductions in franking credit trading or liquidity may lower the observed values of franking credits in future.

In estimating the cost of equity for the Great Southern Energy Gas Networks Pty Limited access arrangement, the Tribunal used a gamma (γ) of 0.30 to 0.50.

Recognising that franking credit do have some value and the selection of a value for this particular parameter is a matter of judgement, ORG / ACCC have applied a gamma (franking credit) value of 0.50 for the Victorian Gas Access Arrangements,.

Comments are invited on:

- ***the appropriate value of gamma (γ) used to determine the cost of equity of the distribution network businesses.***

9 COST OF DEBT

The cost of debt varies, depending on the degree of gearing of a business and the term of the debt. The cost of long-term debt is established by reference to the Commonwealth 10 year bond rate and the cost of short term debt such as the 180 day bank bill. As a general rule, debt with a longer maturity has greater interest rate risk, and hence attracts a higher maturity risk premium. Given the long term nature of the electricity distribution business, a mix of 80 percent long term debt and 20 percent short-term debt is not unreasonable.

In recent years, a number of gas and electricity utilities have raised loans to finance their operations. For example, the long term debt raisings by Eastern Energy and National Power (which are rated A- and A). These debt raisings indicate an average spread to Commonwealth bond yields of 70 basis points. Debt margin in the range of 60 - 100 basis points above the 10-year bond rate is not unreasonable. This assumes a credit rating in the range of A to BBB-.

It is important to note that both absolute rates and 'spreads' change over time according to economic conditions. Due to the continuing difficulties of the Japanese and Asian economies, there is evidence that the number of lenders in the syndicated bank market and the size of commitments are decreasing. This places upward pressure on debt margins. A slightly higher margin will increase the WACC slightly, although not materially.

If the 'on the day' approach to determining market rates for WACC calculation is used, this may lead to an increase in the effective cost of debt. In order to fully mitigate interest rate risk, borrowers (utility owners) will be required to hedge on the very same day that the WACC inputs are determined.

Another element which needs to be considered is the establishment cost associated with the borrowings. If the regulated entities weight their debt portfolios towards five year maturities, the borrowers will be required to bear additional costs upon the refinancing of the maturing debt. In practice, such a portfolio would typically consist of maturities ranging from short to long term. It is reasonable to expect regulated entities to construct a portfolio with a weighted average cost below the margin paid for long term borrowings.

In its recent draft decision on the gas access arrangement proposed by the Great Southern Energy Gas Networks Pty Limited, the Tribunal indicated a preference for a benchmark cost of debt based on a premium on the current 10 year bond rate.

Comments are invited on:

- ***the appropriate risk free rate and debt margin applied in estimating the cost of debt for the distribution network businesses.***

10 EXPECTED INFLATION

Generally, financial markets appear to focus on rates of return expressed in post tax nominal terms. The National Electricity Code specifies the calculation of a pre tax nominal WACC. The regulatory rate base of the network assets is allowed to increase by the CPI within a regulatory period. Therefore, a real pre tax WACC is needed to set the target revenues. The preferred approach is to first identify a nominal WACC, and then to discount it for the effect of expected inflation. For a given nominal WACC, the higher the expected inflation, the lower the estimated real WACC will be.

Future inflation can be estimated by interpreting the inflationary expectations which markets imply in their pricing of nominal and real rate bonds. To ensure consistency with the nominal rate assumptions made in determining cost of equity and cost of debt estimates it is necessary to use Commonwealth indexed and nominal bond to identify the implicit inflation rate.

The difference between the nominal Commonwealth 2008 bond yield of 5 percent[28] and the 2010 CPI Indexed Bond real yield of 3.5 percent[29] implies an expected inflation rate of 1.5 percent over 10 years. The difference between the 5 year nominal and indexed bonds implies an expected inflation rate of 1.2 percent over 5 years.

A survey of market economists in the Australian market indicates there is an average short run (1 year) inflationary forecast of 2.5 percent with a standard deviation of 0.4 percent[30]. Over the longer term these forecasts are relatively consistent at around 2.5 percent. These forecasts are consistent with the Reserve Bank of Australia's stated intention of managing inflation within a band of 2 percent to 3 percent.

The Tribunal's analysis of the WACC in the draft determination on the Wagga gas networks assumed an inflation rate of 2.3 percent.

Comments are invited on:

- ***appropriate range of expected inflation rate that should be used to convert nominal pre tax WACC to real pre tax WACC.***

11 WACC TRANSFORMATION

As mentioned above, the setting of the revenues for regulated networks requires the conversion of a post tax nominal WACC to a pre tax WACC. The post tax nominal WACC is calculated as:

$$WACC = R_e * \frac{(1 - T)}{1 - T(1 - \gamma)} * \frac{E}{(E + D)} + R_d * (1 - T) * \frac{D}{(E + D)}$$

Accepted practice in changing from nominal post tax to real pre tax WACC appears to be to:

- convert the nominal post tax WACC to a nominal pre tax WACC
- deflate the nominal pre tax WACC to a real pre tax WACC.

However some practitioners[31] have argued that this conversion approach over-estimates the real pre tax WACC.

In order to preserve the correct cashflow valuations the conversion needs to be undertaken by:

- converting the nominal post tax WACC to a real post tax WACC
- 'grossing up' the real post tax WACC to a real pre tax WACC.

It is considered that this approach provides more robust valuation over multiple periods.

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28 As of 26 October 1998.

29 As of 26 October 1998.

30 As quoted in the Macquarie risk Advisory Services submission to the Office of Regulator General (Victoria), *WACC for Victorian Gas Distribution Access Arrangements*, (July 1998).

31 Such as Macquarie risk Advisory Services.

However, a study by Professor K Davis[32] reveals that this methodology is valid only for a multi-period model where tax is calculated using current cost depreciation. Davis has provided an alternative that is applicable where tax depreciation is calculated on the basis of historical cost:

$$r_o' = [1 + r_o (1-T)]/(1 + i) - [T.\, i.(1-1/n)]/[(1 + i)(1-T)]$$

where

r_o	=	post-tax nominal weighted average cost of capital
r_o'	=	pre-tax real weighted average cost of capital
i	=	inflation
T	=	effective tax rate
n	=	average asset life

Comments are invited on:

- ***an appropriate methodology for transforming a post tax nominal WACC to a pre tax real WACC.***

[32] *Access Arrangements and Discount Rates: Real Pre Tax and Nominal Post Tax Relationships*, K Davis, 16 May 1998.

12 COMPARISON OF WACC PARAMETERS AND PROPORSED WACC ESTIMATES

Listed below are WACC parameters and WACC estimates proposed by TransGrid, the NSW Distribution Network Service Providers, New South Wales Treasury in its submissions as well as the parameters and estimates used by ACCC, ORG and IPART in their recent price determinations.

Table 9 WACC parameters and WACC estimates

	TransGrid	DNSPs[33]	NSW Treasury[34]	IPART (GSN draft[35])	ORG/ACCC (Gas Access Final[36])
Risk free rate	6.00%	6.10%	6.00%	5.67%	6.00%
CPI	2.00%	2.00%	2.00%	2.30%	2.50%
Real risk free rate	3.92%	4.02%	3.9%	3.30%	3.41%
Market risk premium	6.0%	6.5%	6.5%	5.5-7.0%	6.0%
Debt margin	n.s.	0.90%	1.10%	1.00%	1.20%
Debt funding	67%	50%	50%	60%	60%
Equity funding	33%	50%	50%	40%	40%
Gamma	0.00	0.25	0.40	0.50-0.30	0.50
Asset beta	n.s.	0.45	0.50	0.40-0.50	0.55
Debt beta	n.s.	0.09	0.09	0.06	0.06
Effective tax rate	36%	36%	36%	25-36%	36%
Equity beta	0.80	0.73	0.94	0.96-1.10	1.20
Cost of equity (nominal post tax)	10.8%	11.5%	12.1%	11.0-13.4%	13.2%
WACC (nominal post tax)	6.6%	7.3%	7.2%	6.8-7.1%	6.9%
Effective tax rate of grossing up	36%	36%	36%	30%	36%
WACC (real pre tax) conversion 1[37]	n.s.	8.1%	--	5.8-7.4%	6.7%
WACC (pre tax real) conversion 2[38]	n.s.	8.1%	--	5.8-7.4%	6.7%
WACC (pre tax real) conversion 3[39]	9.4%[40]	9.2%	9.1%	6.6-8.6%	8.0%

Note:
(1) ns = not supplied.
(2) DNSPs = NSW Distribution Network Service Providers.

33 NSW Electricity Distributors' joint submission to IPART's 1999 electricity prices review.

34 NSW Treasury response to IPART draft decision on Access Arrangement Great Southern Energy Gas Networks Pty Limited (October 1998)

35 IPART draft decision, *Access Arrangement for Great Southern Energy Gas Networks Pty Limited*.

36 ORG / ACCC final decision on Gas Access Arrangements for Multinet, Westar and Stratus.

37 Using the conversion process (nominal post tax=>real post tax=>gross up to real pre tax) as recommended by Macquarie Risk Advisory Services Limited to ORG in the recent Victorian Gas Access Arrangements determination.

38 Using the conversion approach (nominal post tax=>real post tax=> real pre tax) as recommended to ORG by K Davies in the recent Victorian Gas Access Arrangements determination.

39 Using the conversion approach (nominal post tax=>nominal pre tax=>real pre tax which is generally used by finance practitioners. Applicants to the Victorian Gas Access Arrangements also adopted this approach.

40 WACC (pre tax real) is provided by TransGrid and is not calculated by the ACCC / ORG formula.

As shown above, the risk free rate estimated by the network providers, the owner and the regulators falls into the range 5.67 to 6.10 percent. These estimates are largely based on observations of the 10 Year Commonwealth bond rates. Combined with the prospective inflation rate used, the risk free rate is estimated to be around 3.30 to 4.02 percent in real terms, a difference of 70 basis points.

In regard to the capital structure, a benchmark of 50-60 percent debt funding was used by most providers et al. Debt margin of 90 - 120 basis points was applied to reflect the premium required to be paid by the regulated businesses. With the exception of the NSW distributors, a debt beta of 0.06 is used to estimate the WACC.

There seems to be a common view that the asset (ungeared) beta range for regulated businesses is 0.45 - 0.55. There is only a half a percent point difference in the market risk premiums (MRP) used to estimate the cost of equity.

The most used range of franking credit utilisation is 0.40 - 0.50. This contrasts with the WACC calculation for TransGrid and NSW Distributors which assumes a zero and 25 percent franking credit utilisation respectively. This partially explains the relatively higher WACC estimates proposed by TransGrid and the NSW distributors.

13 CONCLUSION

The estimation of the cost of capital under CAPM for the purpose of setting regulated revenues is complex. To achieve an appropriate balance between stakeholders' expectations and an efficient outcome, the regulator must exercise judgement.

Recognising that CAPM is just one approach to assessing the cost of equity and the weighted average cost of capital, the Tribunal uses it as a guide for ascertaining a "fair and reasonable rate of return" for a regulated business. To determine a single and 'precise' value for each of the input parameters is somewhat problematic. Careful consideration of the input parameters will help establish a reasonable range for the cost of capital within the CAPM approach. The choice of a rate of return within this range is a matter of regulatory judgement. This judgement may be informed by the results of alternative models for assessing the cost of capital, assessment of risks specific to the utility, and evidence of market expectations.

APPENDIX 1 GEARING LEVELS OF AUSTRALIA'S TOP 100 LISTED COMPANIES

Company	Equity	Debt	Gearing (Net debt/Equity)	Debt/ (Debt+Equity)	Capitalisation ($M)	Debt to Debt+Mkt Cap
News Corporation Ltd	22,234	8,400	38%	27%	36,602	19%
BHP Ltd	16,213	10,020	62%	38%	26,506	27%
Telstra	9,938	7,981	--	45%	18,634	30%
Rio Tinto Ltd	12,376	4,676	38%	27%	11,371	29%
Lend Lease Corporation Ltd	2,919	499	17%	15%	8,271	6%
Coles Myer Ltd	2,516	1,497	60%	37%	7,793	16%
Brambles Ltd	1,464	867	59%	37%	7,418	10%
Woolworths Ltd	1,226	381	31%	24%	6,247	6%
Fosters Brewing Group Ltd	2,898	1,136	39%	28%	6,060	16%
Woodside Petroleum Ltd	1,387	1,006	73%	42%	5,160	16%
Coca Cola Amatil Ltd	5,423	2,126	39%	28%	4,553	32%
Amcor Ltd	3,467	1,903	55%	35%	3,743	34%
CSR Ltd	3,454	1,796	52%	34%	3,587	33%
AGL Ltd	898	343	38%	28%	3,433	9%
Comalco Ltd	1,601	1,367	85%	46%	3,279	29%
Publishing & Broadcasting Ltd	2,013	640	32%	24%	3,145	17%
Qantas Airways Ltd	2,671	3,138	118%	54%	2,990	51%
Mayne Nickless Ltd	1,121	1,251	104%	53%	2,977	30%
Wesfarmers Ltd	1,012	245	24%	19%	2,950	8%
Pioneer International Ltd	2,009	655	33%	25%	2,911	18%
Southcorp Ltd	1,393	795	57%	36%	2,813	22%
Goodman Fielder Ltd	1,307	980	75%	43%	2,785	26%
Tabcorp Holdings Ltd	696	-	--	0%	2,778	--
Boral Ltd	3,236	1,579	49%	33%	2,576	38%
North Ltd	1,926	1,140	59%	37%	2,415	32%
John Fairfax Holdings Ltd	1,091	807	74%	43%	2,231	27%
Lion Nathan Ltd	1,922	1,219	63%	39%	2,081	37%
Smith, Howard Ltd	765	222	29%	22%	1,815	11%
Seven Network Ltd	708	608	86%	46%	1,701	26%
James Hardie Industries Ltd	726	276	38%	28%	1,489	16%
Pasminco Ltd	778	241	31%	24%	1,428	14%
CSL Ltd	363	36	10%	9%	1,328	3%
Brierly Investments Ltd	4,521	2,844	63%	39%	1,312	68%
MIM Holdings Ltd	2,241	1,600	71%	42%	1,278	56%
FH Faulding & Co Ltd	461	149	32%	24%	1,029	13%
Email Ltd	678	248	37%	27%	726	25%
Village Roadshow Ltd	830	358	43%	30%	637	36%
BRL Hardy Ltd	250	166	67%	40%	635	21%
David Jones Ltd	469	234	50%	33%	581	29%
Hoyts Cinemas Group	270	143	53%	35%	553	20%
Sons of Gwalia Ltd	138	141	102%	51%	473	23%
Capral Aluminium Ltd	459	123	27%	21%	378	25%
Burns Phillip	306	329	108%	52%	111	75%
Total companies: 43						24%

Debt to debt+equity: Arithmetic mean: 34 percent. Weighted by market capitalisation: 24 percent.

Notes: 1.Market capitalisation figures are as at 4.9.98.
2.Banks and financial institutions have been excluded from the sample.

Source: *The Australian Financial Review Handbook of Australian Public Companies,* (1998).

APPENDIX 2 EFFECTIVE TAX RATES OF AUSTRALIA'S TOP 100 LISTED COMPANIES

Company	Pretax Profit ($m)	Income Tax($m)	Effective tax Rate
Amcor Ltd	13	-93	--
AGL Ltd	204	56	27%
Boral Ltd	437	31	7%
Brambles Ltd	376	128	34%
Brierly Investments Ltd	255	18	7%
BRL Hardy Ltd	42	13	32%
BHP Ltd	1,493	876	59%
Burns Phillip	-900	-35	--
Capral Aluminium Ltd	68	23	34%
Coca Cola Amatil Ltd	378	132	35%
Coles Myer Ltd	550	160	29%
Comalco Ltd	301	80	27%
CSL Ltd	50	15	30%
CSR Ltd	-107	2	--
David Jones Ltd	11	4	38%
Email Ltd	67	27	40%
John Fairfax Holdings Ltd	101	27	27%
FH Faulding & Co Ltd	64	21	33%
Fosters Brewing Group Ltd	296	48	16%
Goodman Fielder Ltd	156	58	37%
James Hardie Industries Ltd (ye:31Mar98)	60	18	31%
Hoyts Cinemas Group	35	11	33%
Lend Lease Corporation Ltd	359	37	10%
Lion Nathan Ltd	153	66	43%
Mayne Nickless Ltd	62	-38	--
MIM Holdings Ltd	-89	-150	--
News Corporation Ltd	905	126	14%
North Ltd	280	109	39%
Pasminco Ltd	110	40	36%
Pioneer International Ltd	295	79	27%
Publishing & Broadcasting Ltd	272	88	32%
Qantas Airways Ltd	404	151	37%
Rio Tinto Ltd	2,675	843	32%
Seven Network Ltd	141	52	37%
Smith, Howard Ltd	168	40	24%
Sons of Gwalia Ltd	-127	1	--
Southcorp Ltd	207	70	34%
Tabcorp Holdings Ltd	157	56	36%
Telstra	2,073	464	22%
Village Roadshow Ltd	82	8	10%
Wesfarmers Ltd	218	78	36%
Woodside Petroleum Ltd	434	159	37%
Woolworths Ltd	408	150	37%
Total companies: 43			**31%** (weighted average)

Notes: 1.Pretax profit including abnormals and income tax charges are for 1997 financial year.
2.Banks and financial institutions have been excluded from the sample.

Source: *The Australian Financial Review Handbook of Australian Public Companies,* (1998).

APPENDIX 3 BETAS FOR US ELECTRIC UTILITIES [41]

	Equity Beta	Ungeared Beta
Allegheny Power Station Southern Electric	0.62	0.40
American Electric Power	0.76	0.47
Carolina Power	0.77	0.54
Central & Southern	0.65	0.45
Commonwealth Edison	0.69	0.34
Consolidated Edison	0.74	0.55
Detroit Edison	0.71	0.42
Dominion Resources	0.67	0.43
Duke Power	0.68	0.50
Entergy Corporation	0.73	0.44
Florida Progress	0.64	0.44
FPL Group	0.61	0.41
General Public Utilities	0.68	0.42
Houston Industries	0.62	0.37
Niagara Mohawk	0.76	0.42
Northern States Power	0.78	0.56
Pacific Gas and Electric	0.70	0.47
PacificCorp	0.72	0.40
Pennsylvania Power and Light	0.61	0.41
Philadelphia	0.77	0.48
Potomac Electric Power	0.66	0.46
Public Service Enterprise Group	0.70	0.46
SCEcorp	0.72	0.48
Southern Company	0.65	0.43
Texas Utilities	0.60	0.36
Union Electric	0.64	0.48
Average	**0.70**	**0.45**

[41] Data as shown in the Infrastructure Pricing Forum paper, *How can infrastructure assets be valued?- a practical perspective*, S Morris (1995).

APPENDIX 4 ESTIMATED AVERAGE EFFECTIVE TAX RATES OF NSW DISTRIBUTION NETWORK BUSINESSES $M

	NPV of pre tax cashflow	Prima facie tax	Tax depreciation	Accounting depreciation	Deferred tax	Permanent difference	NPV (Tax payments)	ETR
EnergyAustralia	2,084	750	1,841	1,500	123	63	564	27%
Integral	1,322	476	931	750	65	37	374	28%
North Power	377	136	324	303	8	24	105	28%
Great Southern Energy	273	98	243	154	32	14	53	19%
Advance Energy	212	76	169	123	16	11	49	23%
Australian Inland Energy	17	6	31	11	5	1	-	0%
	4,285	1,542	3,539	2,841	249	150	1,145	27%

Note:
1: The NPV of the above figures is calculated using a discounting rate of 7 percent. The projection covers a period of 12 years from 1998.
2: The accelerated depreciation accounts for around 70 percent of timing differences.
3: Accounting depreciation averages 6 percent of the book value of the network assets.
4: Distributors have advised that tax depreciation is around 10 percent of the book value of the network assets.
5: The projection covers a period of 12 years commencing 1998.

APPENDIX 5 GEARED AND UNGEARED BETA OF AUSTRALIAN STOCK EXCHANGE INDUSTRY GROUPS

ASX industry group	Equity beta[42]	Ungeared beta[43]
Retail	0.50	0.36
Telecommunications	0.70	0.41
Food & household goods	0.73	0.46
Infrastructure & utilities	0.61	0.46
Property trusts	0.49	0.47
Miscellaneous industrials	0.75	0.62
Investment & financial services	0.70	0.64
Transport	1.04	0.67
Healthcare & biotechnology	0.91	0.68
Energy	0.86	0.69
Diversified industrials	1.11	0.71
Media	1.02	0.72
Insurance	1.10	0.73
Alcohol and tobacco	0.94	0.75
Building materials	1.02	0.76
Engineering	1.09	0.80
Developers and contractors	1.04	0.87
Paper and packaging	1.24	0.90
Diversified resources	1.22	0.90
Chemicals	1.04	0.92
Tourism and leisure	1.13	0.93
Gold	1.20	1.05
Other metals	1.45	1.19
All industrials	0.89	0.65

[42] Observed equity betas of the industry groups are based on the Risk Management Service published by the Centre for Research in Finance of AGSM, University of New South Wales (March 1998).

[43] The ungeared beta is calculated using the formula: $Ba = \frac{Be + Bd(1-(1-\gamma)tc) * \frac{D}{E}}{1 + (1 - tc(1-\gamma)) * \frac{D}{E}}$ where gamma=0.5, corporate tax rate=36% and debt beta (Bd)=0.06.

Abbreviations

ACCC	Australian Competition and Consumer Commission
ASX	Australian Stock Exchange
βa	The entity's ungeared beta
CAPM	Capital Asset Pricing Model
CCA	Current Cost Accounting
CPI	Consumer Price Index
D	Value of debt
E	Value of equity
EBIT	Earning before interest and tax
ETR	Effective tax rate
GTEs	Government trading enterprises
SOCs	State owned corporations
γ	Franking credit gamma
i	Inflation
IPART	Independent Pricing and Regulatory Tribunal
MRP	Market risk premium for equity
n	Average asset life
ODRC	Optimised depreciated replacement cost
ORG	Office of the Regulator General, Victoria
r_d	Required return on debt
r_e	Required return on equity
R_e	the entity's cost of equity
RECs	Regional Electricity Companies(UK)
R_f	Risk free rate of return
r_o	Post tax nominal weighted average cost of capital
r_o'	Pre tax real weighted average cost of capital
T	Effective tax rate
V	Value of assets
WACC	Weighted Average Cost of Capital