The Allen Consulting Group

Review of the Weighted Average Cost of Capital for the Purposes of Determining the Maximum Reserve Capacity Price

November 2007 (corrected September 2008)

Report to the Independent Market Operator

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Introduction

Western Australia's Independent Market Operator (IMO) commissioned the Allen Consulting Group to undertake a review of the weighted average cost of capital used to determine the Maximum Reserve Capacity Price. The required scope of this review was to:

- advise on the calculation of the WACC used in setting the Maximum Reserve Capacity Price, including available methods, parameters, and value to be used by the IMO in determining the maximum reserve capacity price (including the parameter 'D' in the Market Rules);
- advise on the methodology and model used to calculate *"k"*, a factor defined by the Market Rules to equate the net present value of 10 years worth of payments escalated on a CPI-1 per cent with the payment stream from 10 years worth of an unescalated payments; and
- advice on the use of the term "Nominal" in the definition of the term 'ANNUALISED_CAPCOST[t]'in Appendix 4 of the Market Rules.

The Maximum Reserve Capacity Price (and hence the WACC used to derive it) is used in two places in the Market Rules, namely:

- to establish a cap for the price that is payable where the IMO holds an auction to procure additional generation capacity; and
- as an input in setting the price that is paid to capacity that enters the market other than through an auction (for example, commercial entry).[1]

The IMO has indicated that the WACC should reflect the efficient cost of capital that would be required to support investment in an open cycle gas turbine (OCGT) peaking plant, where such plant is constructed following it being successfully bid into a Reserve Capacity Auction. Under this scenario, payments for capacity would be underwritten by a 10-year contract with the IMO with payments escalated by CPI-1 percent (known as a Long Term Special Price Arrangement).

We note at the outset that the WACC for the two situations set out above need not be the same. We also note that, in undertaking the tasks described above, we have found a number of other potential defects in the regime surrounding the Maximum Reserve Capacity Price, which are summarised below. We recommend further analysis of these matters.

Conclusions and recommendations

General Methodology

It is recommended that the IMO calculate WACC values by use of the capital asset pricing model (CAPM) to estimate the cost of equity.

[1] The administered price for this non-auctioned capacity cannot be higher than 85 per cent of the Maximum Reserve Capacity Price, and it will be lower if there is deemed to be surplus generation capacity and/or if an auction is held and the capacity is offered at a lower price (the auction price determining the new administered price).

It is recommended that the context for the application of the WACC implies that it should be expressed in real terms, consistency with which implies that all forecasts of cash flows should be presented in real terms.

The Allen Consulting Group is of the view that it is appropriate and preferable to use a post-tax WACC when determining regulated revenues and prices. This approach would determine regulated revenues and prices with a cost of taxation that is closer to the cost of taxation which would actually be incurred by an efficient provider of an open cycle gas turbine (OCGT) peaking plant.

However, Western Australia's Economic Regulator Authority (the ERA) must approve the Maximum Reserve Capacity Price. Consequently, the IMO may consider that maintaining consistency with the regulatory precedent, established by the ERA's determinations with respect to energy (electricity and gas) transmission and distribution, and rail access, warrants adopting a pre-tax WACC.

The Allen Consulting Group considers that the treatment of taxation is ultimately a matter for the IMO to determine taking into account these factors. Accordingly, both post-tax and pre-tax WACC values are presented in this report.

CAPM and WACC parameters

Recommended values of CAPM and WACC parameters are set out in Table 1.1 together with calculated returns on equity and WACC values. Of these parameters, the market variables of the nominal risk free rate of return and debt margins should be updated at the time that the IMO finally calculates the Maximum Reserve Capacity Price for a prospective capacity year.

Table 1.1

CAPM WACC ESTIMATION – RECOMMENDED PARAMETER ASSUMPTIONS AND WACC ESTIMATES

CAPM Parameter	Notation/ Determination	Recommended Value
Nominal risk free rate of return (%)	R_{fn}	6.21
Expected inflation (%)	π_e	3.00
Real risk free rate of return (%)	R_{fr}	3.12
Market risk premium (%)	MRP	6.00
Asset beta	β_a	0.5
Equity beta	β_e	0.83
Debt margin (%)	DM	1.60
Debt issuance costs (%)[a]		0.125
Corporate tax rate (%)	t	30
Franking credit value	γ	0.5
Debt to total assets ratio (%)	D/V	40
Equity to total assets ratio (%)	E/V	60
Nominal pre-tax cost of debt (%)	$R_{fn} + DM$	7.81
Nominal post-tax cost of equity (%)	$R_{fn} + \beta_e \times MRP$	11.19
Nominal post-tax WACC (%)	Vanilla WACC	9.84
Real post-tax WACC (%)	**Vanilla WACC**	**6.64**
Nominal post-tax WACC (%)	Officer WACC	7.72
Nominal pre-tax WACC (%)	Officer WACC	11.02
Real pre-tax WACC (%)	**Officer WACC**	**7.79**

Note a. Debt issuance costs are excluded from the calculated WACC as these costs are already included in a margin, represented by “M” in Appendix 4 of the Market Rules.

The WACC values that result are:

- a **real post-tax WACC of 6.64 per cent**, which assumes that taxation is explicitly provided for in cash flows; **or**
- a **real pre-tax WACC of 7.79 per cent**, which accounts for taxation through an adjustment to the WACC itself. (This approach is comparable to the current methodology implied in Appendix 4 of the Market Rules.)

Note that in calculating the WACC, the Allen Consulting Group has excluded the recommended debt issuance cost allowance of 12.5 basis points. This is because the calculation of the Maximum Reserve Capacity Price includes a margin to cover, amongst other things, financing costs. While regulatory precedent in Australia is to include these costs in the WACC, to do so here would double count these costs.

In terms of the annual calculation of the Maximum Reserve Capacity Price, the Allen Consulting Group recommends that:

- the nominal risk free rate of return, debt margin and forecast of inflation be updated each year – note that we recommend <u>against</u> using inflation-linked bonds as a means of providing a direct estimate of the real risk free rate or to establish a market-based forecast of inflation ; and
- the remaining variables (market risk premium, equity beta, corporate tax rate, franking credit value, and the gearing level) be fixed for a period of time, say five years.

The second group of variables are likely to remain stable over longer periods of time, and fixing the values of these parameters would minimise the administrative complexity, burden and cost of the recommended approach. This approach is also consistent with that taken in establishing the WACC for electricity transmission networks covered by the National Electricity Rules.

The parameter "D"

The parameter *"D"*, which is the real interest rate on debt, is used in the formula for CAPCOST[t] in Appendix 4 of the Market Rules to allow for the financing costs incurred during construction. It is erroneous to include an allowance for debt costs – the financing costs incurred include the opportunity cost incurred by equity providers and so the WACC is the appropriate rate to use.

The Allen Consulting Group recommends that the parameter "D" be replaced by the WACC (calculated on the basis outlined above).

Accounting for inflation between the calculation of the price and its application

While outside the current scope of the works, the Allen Consulting Group notes that there is no allowance in the costs included in CAPCOST[t] and PRICECAP[t] for the effects of inflation between the time the Maximum Reserve Capacity Price is established, and the Capacity Year in which it will apply.

The Allen Consulting Group considers that the Maximum Reserve Capacity Price should reflect the nominal cost that would be incurred by an OCGT peaking plant in a Capacity Year; this requires that costs are adjusted to reflect the impact of actual or forecast inflation.

The parameter "k"

The Allen Consulting Group recommends that the parameter *"k"* in the formula for PRICECAP[t] in Appendix 4 of the Market Rules be calculated using the model in the separate spreadsheet provided to the IMO.

Based on its preceding analysis, the Allen Consulting Group makes the following observations on the IMO's existing methodology and model.

- There are a number of inconsistencies in the current model:
  - the payment stream resulting from the annuity formula is a fixed constant dollar payment stream (real WACC applied to the asset base) — and the

NPV can be calculated by discounting the payment stream by the real WACC;

  – the payment stream under the Long Term Special Price Arrangement is a nominal payment stream — the NPV should be calculated using the nominal WACC (not the real WACC as occurs in the current model); and

  – the inflation rate implied in the real WACC, while not explicitly specified, likely differs from the inflation rate used to escalate the stream of payments under the Long Term Special Price Arrangement.

- The payment stream under a Long Term Special Price Arrangement would be escalated annually after the first year (that is, the first year of the two payment streams should originally be the same under the model before being adjusted by "k") — the current model escalates payments monthly (including the first payment).

- The real WACC (and nominal WACC) should be converted to monthly rates so that the compounded monthly rate is equivalent to the calculated WACC.

Other potential issues with the regime

As noted previously, while addressing the matters discussed above, we discovered a number of broader issues with the regime surrounding the Maximum Reserve Capacity Price which we recommend to be analysed further. These are set out below, separated into the issues that arise when the Maximum Reserve Capacity Price is being used as an input into setting the administered price for non-auctioned capacity and when it is being used as the price cap for an auction.

Maximum Reserve Capacity Price – non-auctioned capacity

- *WACC* – as alluded to above, the cost of capital associated with capacity that enters commercially may be higher than that procured through an auction because the former is not underwritten by a long-term contract. This could lead to the administered price not being sufficiently high to attract commercial entry (and hence place greater reliance on the use of a Reserve Capacity Auction).

- *Limit on the price* – the fact that the maximum administered price for non-auctioned capacity is 85 per cent of the Maximum Reserve Capacity Price may lead to the administered price not being sufficiently high to attract commercial entry (and hence place greater reliance on the use of a Reserve Capacity Auction).

  – We note that the fact that the Maximum Reserve Capacity Price is calculated on the assumption that the life of the OCGT peaking plant is only 15 years may offset this (that is, if the true economic life exceeds 15 years) – in this context, we understand that an operational life of 30 years is assumed in calculating fixed operating and maintenance costs.

- *Implicit indexation* – a new entrant will only recover its costs if the Maximum Reserve Capacity Price is escalated for inflation in each year. This is because the Maximum Reserve Capacity Price is calculated on the basis that it is an indexed annuity. However, the escalation that is applied implicitly to the Maximum Reserve Capacity Price is the change in the input prices. This is because the Maximum Reserve Capacity Price is recalculated each year on the basis of new input prices. Hence, and ignoring the 85 per cent rule above, a new entrant will fail to recover costs if input prices do not keep pace with output price inflation, and make a windfall if input prices rise at a faster rate than inflation.

Maximum Reserve Capacity Price – auctioned capacity

- *Term* – the fact that the Long Term Price Arrangement is only for 10 years – after which time the generator would get paid the administered price (which in turn is set at a maximum of 85 per cent of the Maximum Reserve Capacity Price) leaves open the possibility that a generator may not be able to recover its total cost.
  - Again, we note that the fact that the Maximum Reserve Capacity Price is calculated on the assumption that the life of the OCGT peaking plant is only 15 years may offset this (that is, if the true economic life exceeds 15 years) – again, we understand that an operational life of 30 years is assumed in calculating fixed operating and maintenance costs.

Other issues

- *Calculation of annual fixed operating and maintenance costs (FIXED_O&M[t])* — there appear to be similarities between these costs and capital costs as in both cases a present value is established in the current year. However, rather than an annuity, the Allen Consulting Group understands that the present value of FIXED_O&M costs (based on the first 15 years of these costs) is divided by the number of years (that is, 15) and the size of the OCGT peaking plant (160 MW) to derive an annual cost.
- *Economic life* — as noted above, the technical report underpinning the estimate of fixed annual OCGT peaking plant operating and maintenance costs indicates the assumed operating life of an OCGT peaking plant is 30-years. If the economic life of the plant were equal to the operating life (or at least greater than 15 years), this would be expected to result in a price (revenue) that unambiguously over recovers costs.

Chapter 1

Introduction

1.1 Background and scope

Western Australia's Independent Market Operator (IMO) commissioned the Allen Consulting Group to undertake a review of the weighted average cost of capital used to determine the Maximum Reserve Capacity Price. The required scope of this review was to:

- advise on the calculation of the WACC used in setting the Maximum Reserve Capacity Price, including available methods and parameter values (including the appropriate risk free rate, characterised by *"D"* in the Market Rules);
- advise on the methodology and model used to calculate *"k"*, a factor defined by the Market Rules to equate the net present value of 10 years worth of payments escalated at a rate of CPI-1 per cent with the payment stream from 10 years worth of an unescalated payments; and
- advise on the use of the term "Nominal" in the definition of the term 'ANNUALISED_CAPCOST[t]'in Appendix 4 of the Market Rules.

1.2 Structure of this report

This report is structured in four parts as follows.

- Chapter 2 provides background discussion on the cost of capital, including the nature of the risks that are reflected in the cost of capital, and the role it plays in setting regulated prices.
- Chapter 3 discusses how the cost of capital can be estimated, detailing alternative methodologies and WACC expressions, and the manner in which taxation and inflation may be accounted for in the WACC.
- Chapter 4 reviews the methodology established under Appendix 4 of the Market Rules for establishing a WACC, provides a brief overview of the Reserve Capacity Mechanism, the Monthly Reserve Capacity Price, and the riskiness of costs and revenues of a notional OCGT peaking plant.
- Chapters 5 and 6 consider the capital-market evidence and regulatory precedents for market and firm-specific input parameters respectively, to the CAPM and WACC.
- Chapter 7 reviews the methodology and model used to calculate *"k"*.
- Chapter 8 details a number of issues that are outside the current scope of work, but which suggest that there remains potential that the financial model underpinning the calculation of the Maximum Reserve Capacity Price may result in a price that differs systematically from its stated objective.

Chapter 2

Background to cost of capital

2.1 What is the cost of capital?

Capital, that is investment funds, can be regarded as a tradable commodity with price determined by supply and demand. The cost (price) of capital is dependent upon the aggregate demand and supply of investment funds, and the risk cash flows potentially generated by the asset relative to the risk associated with other assets. The cost of capital for an asset or activity is not unilaterally determined by the owner of the asset, the provider of the capital or, in the case of regulated utilities, by a regulator – it is a market price for investment funds.

The cost of capital associated with an asset is the return that investors would expect to receive from a project in order to justify committing funds to that investment. That is, it is a level of return on invested capital that is just sufficient to motivate the capital investment in a particular asset and attract the capital away from alternative investments. In this sense, the cost of capital is an *opportunity cost* of capital – the return on capital available to investors in the next-best investment opportunities, taking into account the expected return and risk.

In practice, assets employed by a firm are normally financed in part by debt, with the residual portion financed by the equity holders. Of the returns that flow from a particular asset, part is paid to the debt providers and part to the equity holders. In addition, the tools from finance theory used to estimate the cost of capital are almost always applied to estimate separately the required returns for the providers of equity and debt. However, the relevant question is always the return required by a project irrespective of how it is financed, which is estimated as the weighted average of the estimated required returns to the providers of equity and debt, hence the asset's cost of capital is often referred to as its 'weighted average cost of capital', or WACC, in recognition of this.

2.2 What risks are reflected in the cost of capital?

The cost of capital for an activity reflects not only an aggregate supply and demand for investment funds, but also the risk in cash flows able to be generated by an asset relative to other assets. An important issue when estimating the cost of capital is to distinguish between classes of risk reflected in the cost of capital and those that are not.

A cornerstone of modern financial economics is that much of the risk associated with the returns to a particular asset can be eliminated at no cost, merely by holding that asset together with a broad portfolio of other assets. The act of combining assets into a portfolio in order to reduce the volatility of average returns is known as diversification.

However, diversification cannot eliminate all risk. This is because part of the volatility in expected returns may arise from economy-wide events that affect all assets similarly, albeit some more than others. This portion of the risk is often referred to as "non-diversifiable" or "systematic" risk. The degree of non-diversifiable risk associated with a particular asset depends upon the extent to which the returns expected from that asset are affected by these economy-wide events, such as unexpected changes in real gross national product, inflation, market risk aversion and long-term real interest rates.[2]

It is the non-diversifiable risk – risk that an investor cannot eliminate at no cost – for which the investor should be compensated through a return on capital investment, and therefore which should be reflected in the cost of capital.

2.3 What is the role of the cost of capital in setting prices?

The role of the IMO in setting a Maximum Reserve Capacity Price is similar to that of an economic regulator determining regulated prices for access to, for example, electricity transmission and distribution networks.

In setting regulated prices, the challenge for the regulator is to ensure that the prices are sufficient for the regulated business to be able to recover all its costs (operating and maintenance, and depreciation), as well as earn an appropriate return on existing and new capital invested in the relevant asset.

One of the regulator's objectives in setting efficient prices is to ensure that investment funds continue to be drawn into the regulated industry, so that the services that are valued by customers continue to be provided. Another objective, however, is to ensure that customers pay the lowest price commensurate with the ongoing provision of the service and an efficient level of new investment. The logical reconciliation of these objectives is for the pricing regime to create the expectation that investors will receive a return equal to the cost of capital associated with the activities.

Under the 'building-block' approach to the setting of regulated prices, prices are designed to deliver a stream of revenue equal to the sum of:

- a return on the value of the assets (the asset base) equal to the cost of capital associated with the activities (the rate of return);
- a return of the value of assets over time through deprecation (equivalent to a return of the principal of a loan); and
- the operating and maintenance costs associated with the activities.

Under this approach, investors should expect to earn a rate of return equal to the cost of capital on capital expenditure from the time that it is spent, and to receive a return of their funds over time through the depreciation allowance. Thus, investors should expect to get a return on, and return of, their capital over time, and investment should proceed.

[2] Chen, N., Roll, R., and Ross, S., 1986. Economic forces and the stock market, *Journal of Business* 59: 383–403.

The dual objectives of investment funds continuing to be attracted to the industry, but customers pay no more than is necessary, requires that the rate of return employed by the regulator (the regulated rate of return) is a statistically unbiased estimate of the actual cost of capital associated with the regulated activities.

The following chapter considers in more detail how the cost of capital may be estimated.

Chapter 3

Estimating the cost of capital

3.1 Introduction

The cost of capital is a market price for funds, dependent upon a supply and demand for capital funds. The cost of capital for an asset (or project) is typically estimated by estimating separately the returns that are required by the two types of investment funds: debt and equity. The weighted average cost of capital for the asset, or its WACC, is then estimated as the average cost of funds across the two types, weighted according to the proportions of debt and equity in the financial structure for the project.

A direct observation of the cost of debt is possible from capital market data. Both the interest payable on loans or the implied return on traded debt instruments (such as corporate bonds) can be observed.

In contrast, the required returns to equity providers cannot be observed, but only estimated. As for debt providers, the market value of any share market listed equity can be observed at any time – this is its share price. However, the returns that investors expect to receive from that share – the dividends and capital gains – cannot be observed, and indeed every investor may have a different opinion about the likely future returns. The cost of equity must be estimated using a model drawn from finance theory and practice.

A number of approaches have been developed for estimating the cost of equity capital, and these are briefly described in this chapter. In addition, there are two other matters that must be addressed in estimating a WACC for a project:

- the approach taken to account for inflation, in particular whether the rate of return on assets (and other elements of costs) are determined in nominal or real terms; and
- the approach taken to account for the cost of taxation, in particular whether to include an allowance for the cost of taxation in the WACC (a "pre-tax" WACC approach), or to include an allowance for the cost of taxation as an explicit cost forecast separate from the WACC (a "post -tax" WACC approach).

3.2 Estimating the cost of equity: alternative methodologies

Four alternative methodologies for estimating the cost of equity capital are discussed below, namely:

- the Capital Asset Pricing Model;
- arbitrage pricing theory
- the Fama-French Model; and
- the Dividend Growth Model.

Capital Asset Pricing Model

The Capital Asset Pricing Model (CAPM) is used extensively in corporate finance applications and is the sole methodology applied by Australian economic regulators in consideration of the cost of equity capital and regulated rates of return.[3] As a result, there is a broad familiarity and understanding of this approach by regulated businesses and other stakeholders in the regulation of infrastructure services, and the use of this method will facilitate comparability with regulatory determinations on rates of return across regulators, regulated businesses and infrastructure sectors.

While a 'theoretically pure' application of the CAPM would deliver a direct estimate of the required return for a project (that is, its WACC) without having to consider financing arrangements, in practice this is not possible. The reason that it is not possible is because continuous information on the economic returns to a financial asset is required to estimate the inputs to the CAPM. This is only possible for a traded asset, and it is only the equity share of an asset that is traded. Therefore, the more common formulation of the CAPM is the following expression relating to the return on equity:

$$R_e = R_f + \beta_e (R_m - R_f)$$

where R_f is the risk free rate, R_e is the required return on equity and β_e is the equity beta and (R_m–R_f) is the return over the risk free rate (the market or equity risk premium) that investors would need to expect in order to invest in a well-diversified portfolio of assets, generally proxied by a broad stock market index.

Under the CAPM, the required return on equity depends upon the return which could be earned from an investment that is risk free as well as a required return to compensate for the risk premium that an investor would require over the risk free rate. This risk premium is a function of two inputs:

- an estimate of the return that investors would require in order to hold a widely diversified portfolio of assets, which is also the return that an investor would require in order to hold an asset which has an "average" level of risk; and
- a ranking of the risk associated with the particular asset in question relative to the risk associated with the well-diversified portfolio of assets – the beta of the asset.

The risk premium that investors would require in order to hold a particular asset is calculated by scaling up, or scaling down, the risk premium required for the well-diversified portfolio of assets according to the beta measure of that asset's relative risk.

Betas cannot be observed or measured directly but rather must be estimated. The most common means of estimation is to examine historical information on the economic returns to the relevant asset (comprising the value of the returns plus the change in the market value of the asset), and on economic returns to the well-diversified portfolio of assets. As noted above, this type of information is only available on assets that are traded on a stock exchange, which only comprises trading in the equity share of an asset.

[3] However, having said that, its theoretical and empirical justification is mixed, and hence it is frequently criticised by finance academics.

Arbitrage Pricing Theory

Arbitrage pricing theory specifies a linear relationship between the expected return on a risky asset and returns on a range of portfolios of other assets for which returns vary with a set of factors, typically macroeconomic variables:

$$E(R_j) = E(R_z) + b_{j1}\left[E(R_{p1}) - E(R_z)\right] + \ldots + b_{jk}\left[E(R_{pk}) - E(R_z)\right]$$

where $E(R_z)$ is the expected rate of return on a portfolio of assets uncorrelated with all factors (a risk free rate of return), $E(R_{pi})$ is the expected rate of return for a portfolio of assets with unit coefficient on the *i*th factor.[4] Compensation for non-diversifiable risk is reflected in the regression parameters (sensitivity coefficients) for the observed return on the asset against the differences in observed returns between asset portfolios and the risk-free asset.

As with the CAPM, arbitrage pricing theory can only be practicably applied to estimate the cost of equity for listed entities given the model's requirement for continuous information on the economic returns to an asset.

Fama–French Model

The Fama–French model is an augmentation of the CAPM with two additional explanatory variables with explanatory power over cross sectional variation in equity returns:

$$E(R_j) = R_f + \left[E(R_m) - R_f\right]\beta_j + s_j E(SMB) + h_j(HML)$$

where SMB is the differential return between a portfolio of small capitalisation stocks and one of large capitalisation stocks, and HML is the differential return on a portfolio of stocks with high book to market equity ratios and one of stocks with low book to market equity ratios.[5] Compensation for non-diversifiable risk remains reflected in the beta value for the stock.

As with the CAPM, the Fama-French model can only be practicably applied to determine the cost of equity for listed entities.

Dividend Growth Model

The dividend growth model derives an estimate of the cost of equity from observations of a stock price and dividends per share and an assumed rate of dividend growth:

$$k_e = \frac{D_0(1+g)}{P} + g$$

where k_e is the cost of equity, D_0 is the observed current dividend per share, P is the observed stock price, and g is an assumed constant growth rate in expected dividends per share.[6]

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[4] Lally, M., 2000. *The Cost of Equity Capital and Its Estimation*, McGraw-Hill Series in Advanced Finance Volume 3, Sydney: McGraw-Hill, pp 41,42.

[5] *Ibid*, pp 42.

[6] *Ibid*, pp 42,43.

More complex formulations exist to allow for multiple dividend payments per year, the time before the next dividend is payable and for the rate of dividend growth to vary between years (and for a different 'terminal' growth rate). A variety of sources could be used to estimate investors' expectations about the expected growth in dividends per share, with a survey of equity analysts' forecasts being a common method.

As with the CAPM, the dividend growth model can only be practicably applied to determine the cost of equity for listed entities.

3.3 Estimating the weighted average cost of capital

Once the required returns to equity providers has been estimated, a proxy for the cost of debt financing is then normally taken from observed capital market data on current debt financing costs. The typical practice of regulators is to first posit a benchmark level of gearing for the asset in question (typically taken as a 60 per cent debt to assets ratio for regulated infrastructure) and to estimate the approximate credit rating that an efficiently run entity in the relevant industry and the benchmark level of debt would be able to maintain. The term of the debt is generally assumed to be 10 years when estimating the WACC for regulated infrastructure. The debt costs are then estimated by examining the current yields on Australian corporate bonds for the target credit rating and of the assumed term.

The WACC is estimated as the weighted average of the costs of equity and debt. That is, ignoring the effects of taxation for the moment:

$$WACC = R_e \frac{E}{V} + R_d \frac{D}{V}$$

where R_d is the cost of debt, and E/V and D/V are the assumed shares of equity and debt respectively in the financing structure.

3.4 Accounting for taxation

Pre tax vs. post tax rate of return

Regulators need to include, in the revenue benchmarks that are used to determine regulated prices, compensation for the expected taxation liabilities of the regulated entity. In practice, this compensation can be provided either by adjusting the rate of return (that is, providing a higher, pre-tax rate of return) or by including an allowance directly in the revenue benchmarks to reflect these liabilities. Australian regulators have applied both alternatives.

The first approach involves transforming the estimated post-tax WACC into a pre-tax WACC, usually reflecting a high level assumption about the effective tax rate of the entity, thus making an allowance for tax by using a higher WACC.

This approach has the benefit of computational simplicity. It does, however, have a number of problems, the most important of which is that no simple transformation method can capture the complexities of the Australian tax system. There has been substantial controversy about which of the numerous alternative transformation methods provide the best estimate. Moreover, it is very difficult to deduce the assumptions made about the taxation system from simple transformations, which has further exacerbated the controversy. In addition, there has been an impression amongst regulators that the simple transformation generally proposed by regulated entities, which has become known as the forward transformation, is likely to overstate the taxation liabilities of infrastructure firms (due to differences between regulatory and taxation depreciation allowances).

The second approach is to use a post-tax WACC and include an allowance for tax costs directly in the cash flows (or revenue benchmarks) of the entity, based upon an explicit projection of the taxation liabilities for the activity. It has also been typical practice to base the projections of company tax liabilities upon benchmark assumptions, for example, assumptions as to the applicable tax depreciation rates, and calculating the interest deduction based upon the benchmark financing arrangements (that is, capital structure and cost of debt).

This approach requires an explicit statement of the assumptions being made about the taxation system, and thus is more transparent. While this second approach may be more demanding in terms of the amount of information required, it is up to the regulator (or analyst) as to how closely the full implications of the taxation system are modelled, and the modelling of taxation payments by regulators is much more straightforward than would be undertaken by, say, analysts for an asset valuation exercise. In particular, the norm for regulators has been to adopt benchmark assumptions about financing arrangements, and hence an otherwise complex modelling task is made straightforward. The only additional information required to model benchmark taxation payments is to permit a benchmark tax depreciation allowance to be derived, which again is straightforward for a standalone asset (albeit subject to more complexity for a complex business).

Alternative post-tax WACC expressions

If the decision is made to use a post-tax WACC and model taxation allowances explicitly, a decision must then be made about the precise form of the WACC expression that is to be used. Three different forms are used commonly in Australia, with the differences between these alternative post-tax WACC expressions reflecting a choice of dealing with certain tax benefits (namely, tax benefits from the dividend imputation system and the deductibility of debt) being reflected on the WACC or in the taxation allowance that is modelled. The different forms are described in Box 3.1.

Box 3.1

ALTERNATIVE POST TAX WACC EXPRESSIONS

(Post tax) Vanilla WACC

This form of the WACC is an estimate of the total return that the asset owners demand, and requires all potential costs and benefits (such as cash tax payments, net of the tax deductibility of interest and the non cash value of franking credits) to be reflected in the cash flows. It is the simplest form of WACC, hence its name, and is expressed as:

$$WACC = R_e \frac{E}{V} + R_d \frac{D}{V}$$

where Re is the cost of equity, Rd is the cost of debt, and E/V and D/V are the shares of equity and debt, respectively, in the financing structure (also referred to as the level of gearing).

(Post tax) Officer WACC

The Officer WACC is an estimate of the cash return on assets that the company needs to generate. Cash flows are not adjusted (downwards) to account for non-cash benefits (such as the tax deductibility of interest and the value of franking credits created) as occurs in the Vanilla WACC, rather the WACC is adjusted downward to reflect these benefits.

This form of the WACC overstates the firm's taxation liability in the cash flows because:

- it assumes that all of the return on assets is taxed, whereas the portion distributed to debt providers is not taxed; and
- it ignores the additional benefits created for providers of equity capital through Australia's dividend imputation system.

To compensate for the resultant lower cash flows (relative to those under the Vanilla WACC), the Officer WACC is lower than the Vanilla WACC.

The Officer WACC is specified as follows:

$$WACC = \left[\frac{(1-t)}{1-t(1-\gamma)}\right] R_e \frac{E}{V} + (1-t) R_d \frac{D}{V}$$

where t is the effective tax rate, γ (or 'gamma') reflects the value of franking credits under the dividend imputation system, R_e is the cost of equity, R_d is the cost of debt, and E/V and D/V are the shares of equity and debt, respectively, in the financing structure.

(Post tax) Monkhouse WACC

The Monkhouse WACC[7] is an estimate of the return on assets that a company would need to generate, where the value of franking credits (γ) is counted as part of that return. As a result, it is higher than the Officer WACC, but lower than the Vanilla WACC.

The Monkhouse WACC is specified as follows:

$$WACC = R_e \frac{E}{V} + [1 - t(1-\gamma)] R_d \frac{D}{V}$$

where R_e is the cost of equity, R_d is the cost of debt, t is the effective tax rate, γ (or 'gamma') reflects the value of franking credits under the dividend imputation system, and E/V and D/V are the shares of equity and debt, respectively, in the financing structure.

[7] We note that this form of the WACC has become known in regulatory circles as the Monkhouse WACC, but that it bears little resemblance to the writings of Peter Monkhouse, its namesake. This form of the WACC was presented in Officer (1988) as one of the alternatives to use in the version of the imputation adjusted WACC derived in that paper, alongside what have become known as the Officer and Vanilla WACCs. Accordingly, all of the WACC versions could be referred to as Officer WACCs.

In practice, the only reason for not selecting the Vanilla WACC is to avoid the need to model financing arrangements explicitly. However, while such a concern has some validity for an asset valuation exercise, financial arrangements are straightforward to model in the regulatory context because simple benchmark assumptions are adopted. Accordingly, every regulator who has used a post-tax WACC has selected the Vanilla form of post-tax WACC.

3.5 Accounting for Inflation

The choice to use either a real or nominal WACC depends upon the context to which it is applied. A real WACC is one that will only reflect the opportunity cost of capital after the effects of inflation have been compensated for elsewhere, whereas a nominal WACC reflects the total opportunity cost of capital, inclusive of compensation for inflation.

Some simple rules for consistency are that where cash flows are to be discounted, then:

- if those cash flows are forecast in nominal (or 'money of day') terms, then a nominal WACC must be employed; and
- if those cash flows are forecast in real (or 'constant price') terms, then a real WACC must be employed:
  - cash flows will be in constant price terms where the revenue is subject to CPI escalation (with that escalation being ignored in the forecasts) and where expenditure is expected to rise with the CPI (again, with that escalation being ignored in the forecasts).

Alternatively, if a revenue requirement is to be created (and prices determined), then:

- if asset values are to be carried forward at their original cost (that is, following a historical cost accounting-type approach) then a nominal WACC must be used; but
- if asset values (and, in parallel, prices) are to be escalated for outturn inflation (that is, following a current cost accounting-type approach) then that escalation already compensates investors in the asset for inflation and so a real WACC must be used.

All other things being equal, the two approaches are mathematically equivalent in *ex ante* terms. The substantive issue in accounting for inflation when setting price controls for regulated utilities relates to the question of who bears inflation risk – with inflation indexation and use of a real WACC implying that the regulated business is largely shielded from inflation risk. The inflation-indexation approach is generally used where price controls are set for a period of time. This shelters the asset owner from inflation risk – which historically has been a significant risk in Australia and other countries – makes the commitment to retain a price control for a period of time without review (which is at the heart of CPI-X regulation) more credible.

One further matter relevant to the choice of a nominal or real WACC is the (implicit or explicit) choice of depreciation method when deriving prices. When a real WACC is used, profit is defined as the surplus remaining after the real value of the asset has been maintained, and depreciation is defined as the return of the real value of the investment to investors. In contrast, where a nominal WACC is used, profit is defined as the surplus after the historical cost of the asset has been maintained and depreciation is defined as the return of the historical cost of the investment to the investors. That is, as the definition of profit is different, so is the definition of depreciation. As a consequence, applying the same depreciation method (for example, straight line or annuity) in a real WACC model will generate a materially different time path for prices than would the use of the same depreciation method in a nominal WACC model.

3.5 The current Appendix 4 methodology

Appendix 4 of the Market Rules sets out the manner in which the Maximum Reserve Capacity Price is to be calculated, and indicates the WACC to be used in calculating this price is equal to:

> a real pre-tax return to equity equal to the Commonwealth 10 Year Bond Rate (Real) plus a Margin for Equity of 15.1%, a real return to debt equal to the Commonwealth 10 Year Bond Rate (Nominal) plus a Margin for Debt of 1.5%, and a debt to equity ratio of 60:40;

The manner in which the WACC used in calculating the Maximum Reserve Capacity Price has most recently been derived by the IMO is outlined in detail in Appendix B of its *Final Report: Maximum Reserve Capacity Price Review for the 2009/10 Reserve Capacity Year*, published in January 2007.

Cost of equity

Appendix 4 of the Market Rules indicates that the cost of equity is calculated as:

$$R_e = R_f + 15.1\%$$

where R_e is the real cost of equity, and R_f is the real risk free rate, which is the yield on indexed 10-year Commonwealth bonds.

Cost of debt

Appendix 4 of the Market Rules indicates that the cost of debt is calculated as:

$$R_d = R_f + 1.5\%$$

where R_d is the real cost of debt, and R_f is the nominal risk free rate, which is derived as the implied yield on 10-year Commonwealth bonds.

The IMO has indicated it considers the reference to “nominal” in connection with the Commonwealth bond rate used to establish “a real return to debt” in Appendix 4 of the Market Rules to be an error.

The following matters are relevant to considering whether this is indeed an error.

- If the *intent* were to establish a real return to debt, it is the “real risk free rate” that would be relevant. This implies that the relevant bond would be the indexed 10-year Commonwealth bond rate — that is, the reference would be to “the Commonwealth 10 Year Bond Rate (Real)”.

- There is an *explicit reference* in Appendix 4 of the Market Rules to a "real return to debt", which implies that the relevant bond is the indexed 10-year Commonwealth bond rate — that is, the reference would be to "the Commonwealth 10 Year Bond Rate (Real)".
- As a real (pre-tax) return to equity is also calculated using the "real risk free rate", it would appear that the *intent* of Appendix 4 of the Market Rules is to establish a real WACC.

Consequently, and consistent with the application of the methodology specified in Appendix 4 of the Market Rules in the IMO's January 2007 report, this would imply that the cost of debt is calculated as:

$$R_d = R_f + 1.5\%$$

where R_d is the cost of debt, and R_f is the real risk free rate, which is derived as the implied yield on indexed 10-year Commonwealth bonds.

Weighted Average Cost of Capital

Appendix 4 of the Market Rules implies, but does not definitively require, that the WACC should be calculated as follows:

$$WACC = R_e \frac{E}{V} + R_d \frac{D}{V}$$

where R_e is the cost of equity, R_d is the cost of debt, and E/V and D/V are the shares of equity and debt, respectively, in the financing structure (also referred to as the level of gearing).

Substituting the two previous formulas for the real cost of equity and the real cost of debt into the WACC equation, and setting the debt to equity ratio to 60:40 as specified in Appendix 4, results in the following:

$$WACC = R_f + 6.94\%$$

Observations

The following broad observations are made on the current WACC that is required to be used in calculating the Maximum Reserve Capacity Price.

First and foremost, while the form with which the WACC is prescribed in the Rules – as a margin over real risk free instruments – is simple, it obscures the inputs that sit behind the WACC, and hence reduces the degree of transparency of the regime.

In addition, the WACC formula that is postulated – that the real pre-tax costs of equity and debt will be a constant margin over the real risk free rate – is only approximately true, and will not hold for modest changes in expected inflation. It would be more appropriate for the Market Rules to require the use of the CAPM and describe the desired form of the WACC, and to prescribe most of the inputs to be used in the calculation.

The variables that should not be prescribed by the Market Rules are the risk free rate, the forecast of inflation and debt risk margin, which should be updated on an annual basis. The derivation of these values is addressed in later sections of this report.

Choices exist in relation to the treatment of taxation and inflation. The current approach to these matters can be summarised as follows.

- *Taxation* – It is clear from Appendix 4 of the Market Rules that the WACC is intended to be a pre-tax WACC, as the return on equity is explicitly stated as being a pre-tax return on equity. The context of the application of the WACC is also consistent with the WACC being a pre-tax WACC as Appendix 4 makes no other reference to taxation. Specifically, there is no allowance for taxation in the fixed operating and maintenance cash flows (the term "FIXED_O&M" in Appendix 4) which are included in the calculation of the Maximum Reserve Capacity Price as would be expected if the Vanilla WACC were used.
- *Inflation* – It is also clear (with the exception of the apparent inconsistency with the definition of the real cost of debt discussed above) that the WACC is intended to be a real WACC. This has several implications for the computation of the other cost-components, including the following.
  - Depreciation is defined in current cost accounting-like terms. Accordingly, the prescribed use of annuity depreciation implies that real annuity depreciation is to be applied to determine the Maximum Reserve Capacity Price.[8]
  - In the period between setting the Maximum Reserve Capacity Price and the Capacity year in which it applies, capital costs should be escalated for actual or forecast inflation and for the real cost of funds used during construction. However, the Appendix 4 formulae do not escalate capital costs for inflation, and also fail to reward adequately for the real cost of funds used during construction (the real debt cost is used, whereas the appropriate measure of the opportunity cost of capital during construction is the WACC).
  - In the period between setting the Maximum Reserve Capacity Price and the Capacity year in which it applies, the fixed operating costs should be escalated by the price index that most closely reflects the change in operating expenditure input prices. However, the Appendix 4 formulae do not escalate operating costs for the change in input prices.

Our conclusions on how taxation and inflation should be treated are set out in subsequent sections of this report.

[8] That said, several issues remain with the depreciation calculation that is prescribed. Most notably, as the maximum price is reset every year on the basis of new equipment costs, a person who constructs an OCGT generator at a point in time will only recover its costs at the maximum price if the price of new equipment costs rise by the CPI (that is, the amount of compensation that the investors would require for inflation). If equipment prices fall in real terms, then the investors would not recover costs.

The magnitude of the WACC is an empirical issue. At this stage we note that the risk margin for debt is within the bounds of margins used by regulators in recent years (albeit now somewhat high as rates have fallen in recent years) and broadly consistent with empirical evidence, but the risk margin for equity would appear to be higher than would be supported by empirical evidence. Using standard assumptions about the market risk premium and plausible inflation assumptions, the implied equity beta is approximately 2.0. This compares to a beta of 1.0, which is often used for the regulated aspects of energy infrastructure, and approximately 1.7 for the market average firm (that is, with the beta of 1 for the average firm adjusted to be consistent with an assumed level of gearing of 60 per cent debt-to-assets).

3.6 Recommended approach to estimating the Weighted Average Cost of Capital

There is a lack of transparency in Appendix 4 of the Market Rules in both the expression used to calculate the WACC and the key assumptions underpinning the values for specified input values, which themselves are ordinarily calculated based on an explicit set of assumptions and capital market evidence.

It is recommended that Appendix 4 be amended to prescribe:

- a formula to calculate the cost of equity capital;
- a formula for the WACC expression to be used; and
- the values of most of the inputs to these formulae, with the exceptions being the risk free rate of return, the forecast of inflation and the prevailing margin on debt over the risk free rate of return.

By setting out the formulae that are used to give rise to the WACC estimate, it will be obvious how it is intended that taxation and inflation be treated.

The Allen Consulting Group's recommendations with respect to each of these issues are discussed in more detail as follows.

Recommended methodology to calculate the cost of equity capital

As noted in Section 3.2, the CAPM is used extensively in corporate finance applications, and is the sole methodology applied by Australian economic regulators to estimate the cost of equity capital when deriving regulated rates of return. As a result, there is a broad familiarity and understanding of this approach by regulated businesses and other stakeholders in the regulation of infrastructure services, while regulatory determinations on rates of return are also readily comparable across regulators, regulated businesses and infrastructure sectors.

Given this, the Allen Consulting Group considers it would not be desirable to contemplate methodologies other than the CAPM to estimate the cost of equity capital in the WACC for the purposes of determining the Maximum Reserve Capacity Price under the Market Rules.

Recommended treatment of taxation

There are potentially two separate but sequential decisions to be made in considering how taxation is to be reflected in the WACC. The outcome of these decisions will have implications for the expression of the WACC that is subsequently used to calculate the cost of capital.

- Firstly, a decision is required to be made as to whether to apply:
  - a pre-tax WACC, with all taxation issues reflected in the WACC (which implies that the pre-tax Officer WACC would be used to estimate the WACC); or alternatively
  - a post-tax WACC, with the cost of taxation reflected in the cash flows.
- Secondly, if the cost of taxation is to be reflected in the cash flows, a decision is required on the extent to which non-cash benefits generated by the taxation system (that is, the tax deductibility of interest payments on debt and franking credits) are reflected in the WACC or in cash flows. This determines whether, respectively, the Officer or Vanilla post-tax WACC expressions are used.

On balance, the Allen Consulting Group considers that a post-tax WACC expression should generally be preferred.

The latter approach will result in a more accurate estimate of the cost of taxation, while the former is generally computationally simpler. However, where a hypothetical activity or notional project is modelled, such as is the case for estimating the WACC to be used in calculating the Maximum Reserve Capacity Price, the degree of complexity associated with modelling taxation payments under the later approach is lessened considerably.

Where Australian regulators use a post-tax WACC, all use the Vanilla WACC as the regulatory target as it is the easiest to understand and permits a more accurate treatment of taxation benefits.

That said, the Allen Consulting Group notes that Rule 4.16.8 of the Market Rules requires that the ERA approve the Maximum Reserve Capacity Price that is calculated by the IMO. To date, the ERA's practice in its regulatory decisions and determinations for energy (electricity and gas) transmission and distribution and rail access in Western Australia has been to consistently apply a pre-tax WACC. As is usual when a pre-tax WACC is used, the ERA transforms the post-tax Officer WACC into a pre-tax WACC by adjusting the WACC to reflect an assumption about the effective tax rate of the entity, usually simply the statutory rate of company income tax. As discussed earlier, the major criticism of this approach is that it may fail to capture the complexities of the Australian tax system and lead to an allowance for taxation that is materially incorrect.

In our view, implementation of a post-tax approach would be reasonably straightforward for a standalone notional OCGT peak generation project, which is the assumption behind the derivation of the Maximum Reserve Capacity Price. In particular, the only additional information required would be the tax depreciation rates that would be applicable to the project.

Having said that, should consistency with other regulatory decisions in Western Australia be a primary consideration, the IMO may prefer to adopt the pre-tax (Officer) WACC expression.

If a post-tax approach is to be used, then the Appendix 4 of the Market Rules would need to be changed to authorise an allowance for taxation to be included in the calculation of total cost. This would be reasonably straightforward to do – rather than prescribing an annuity, the Rules would need to require the price to be set on the basis of a constant stream of payments over the asset's 15-year life, and for taxation over that period to be modelled explicitly.

Recommended treatment of inflation

The asset values used to calculate the Maximum Reserve Capacity Price are calculated each year, and hence are escalated for outturn inflation (that is, following a current cost accounting-type approach). As noted earlier, since that escalation already compensates investors in the asset for inflation, it is appropriate to use a real WACC to estimate the revenue requirement and determine prices.

While outside the scope of estimating the WACC, we note consistency in a real approach to derivation of the Maximum Reserve Capacity Price would require that capital costs be escalated for actual or forecast inflation over the period between setting the Maximum Reserve Capacity Price and the Capacity Year in which the price applies. Further, the real cost of funds (that is, the WACC) should be applied to capital costs during construction rather than the real cost of debt (the parameter "D") as currently occurs.

Further, in the period between setting the Maximum Reserve Capacity Price and the Capacity Year in which the price applies, fixed operating and maintenance costs should also be escalated by the price index that most closely reflects the change in operating expenditure input prices.

Recommended approach to estimating the Weighted Average Cost of Capital

We present below two alternative sets of equations which could be inserted into Appendix 4 of the Market Rules – the CAPM and post-tax real Vanilla WACC, or the CAPM and pre-tax real Officer WACC. Our conclusions on the values of the input parameters are addressed in later chapters. Note that the values for the input parameters are discussed in more detail in Chapters 5 and 6.

Pre-tax real Vanilla WACC approach

The cost of capital used to calculate ANNUALISED_CAPCOST[t] and CAPCOST[t] is the post-tax real weighted average cost of capital (WACC) which must be calculated in accordance with the following formula:

$$WACC_{real} = \left(\frac{(1 + WACC_{no\min al})}{(1+i)} \right) - 1$$

and

$$WACC_{no\min al} = R_e \frac{E}{V} + R_d \frac{D}{V}$$

Where:

1. R_e is the nominal return on equity (determined using the Capital Asset Pricing Model) and is calculated as:

   $$R_e = R_f + \beta_e \times MRP$$

   Where:

   R_f is the nominal risk free rate for the Capacity Year;

   β_e is the equity beta, established at a value of 0.83; and

   MRP is the market risk premium, established at a value of 6.0 per cent;

2. R_d is the nominal return on debt and is calculated as:

   $$R_d = R_f + DRP$$

   Where:

   R_f is the nominal risk free rate for the Capacity Year;

   DRP is the debt risk premium for the Capacity Year;

3. *E/V* is the market value of equity as a proportion of the market value of total assets, established at a value of 0.6; and

4. *D/V* is the market value of debt as a proportion of the market value of total assets, established at a value of 0.4.

5. The nominal risk free rate, R_f, for a Capacity Year is the rate determined for that Capacity Year by the IMO on a moving average basis from the annualised yield on Commonwealth Government bonds with a maturity of 10 years:

   – using the indicative mid rates published by the Reserve Bank of Australia; and

   – averaged over a 20-trading day period.

6. The debt risk premium, *DRP*, for a Capacity Year is the premium determined for that Capacity Year by the IMO as the margin between the observed annualised Australian benchmark corporate bond rate for corporate bonds which have a BBB+ (or equivalent) credit rating from Standard and Poors and a maturity of 10 years and the nominal risk free rate:

   – using the predicted yields for corporate bonds published by Bloomberg; and the nominal risk free rate calculated as directed above; and

   – the nominal risk free rate and Bloomberg yields averaged over the same 20-trading day period.

7. If there are no bonds with a maturity of 10 years on any day in the period referred to in paragraphs 5 and 6, the IMO must determine the nominal risk free rate and the *DRP* by interpolating on a straight line basis from the two bonds closest to the 10 year term and which also straddle the 10 year expiry date.

8. In establishing a forecast of inflation to be used in the Fisher equation to convert the nominal WACC into a real WACC, the IMO is to have regard to the forecasts of the Reserve Bank of Australia, the Western Australian Department of Treasury and Finance, and financial market participants.

Pre-tax real Officer WACC approach

The cost of capital used to calculate ANNUALISED_CAPCOST[t] and CAPCOST[t] is the real pre-tax weighted average cost of capital (WACC) which must be calculated in accordance with the following formula:

$$WACC_{real} = \left(\frac{(1 + WACC_{nominal})}{(1+i)}\right) - 1$$

and

$$WACC_{nominal} = \frac{1}{(1 - t(1-\gamma))} R_e \frac{E}{V} + R_d \frac{D}{V}$$

Where:

1. R_e is the nominal return on equity (determined using the Capital Asset Pricing Model) and is calculated as:

   $R_e = R_f + \beta_e \text{ x } MRP$

   Where:

   R_f is the nominal risk free rate for the Capacity Year;

   β_e is the equity beta, established at a value of 0.83; and

   MRP is the market risk premium, established at a value of 6.0 per cent;

2. R_d is the nominal return on debt and is calculated as:

   $R_d = R_f + DRP$

   Where:

   R_f is the nominal risk free rate for the Capacity Year;

   DRP is the debt risk premium for the Capacity Year;

3. *t* is the benchmark rate of corporate income taxation, established at either an estimate defective rate or a value of the statutory taxation rate (0.3);

4. γ is the value of franking credits, established at a value of 0.5;

5. *E/V* is the market value of equity as a proportion of the market value of total assets, established at a value of 0.6; and

6. *D/V* is the market value of debt as a proportion of the market value of total assets, established at a value of 0.4.

7. The nominal risk free rate, R_f, for a Capacity Year is the rate determined for that Capacity Year by the IMO on a moving average basis from the annualised yield on Commonwealth Government bonds with a maturity of 10 years:

   – using the indicative mid rates published by the Reserve Bank of Australia; and

   – averaged over a 20-trading day period.

8. The debt risk premium, *DRP*, for a Capacity Year is the premium determined for that Capacity Year by the IMO as the margin between the observed annualised Australian benchmark corporate bond rate for corporate bonds which have a BBB+ (or equivalent) credit rating from Standard and Poors and a maturity of 10 years and the nominal risk free rate:

   – using the predicted yields for corporate bonds published by Bloomberg; and the nominal risk free rate calculated as directed above; and

   – the nominal risk free rate and Bloomberg yields averaged over the same 20-trading day period.

9. If there are no bonds with a maturity of 10 years on any day in the period referred to in paragraphs 7 and 8, the IMO must determine the nominal risk free rate and the DRP by interpolating on a straight line basis from the two bonds closest to the 10 year term and which also straddle the 10 year expiry date.

10. *i* is the forecast rate of inflation. In establishing a forecast of inflation, the IMO is to have regard to the forecasts of the Reserve Bank of Australia, the Western Australian Department of Treasury and Finance, and financial market participants.

Chapter 4

The WACC for which project?

4.1 Introduction

The WACC is the return that investors (equity and debt providers combined) would require to invest in a particular project, given the risk associated with the returns to a particular project relative to that of other projects. A WACC is not something that can be estimated in isolation – rather, the first step in estimating a WACC is to understand the project for which the WACC is to be estimated.

Normally when a WACC is estimated, the project for which it is to be estimated is obvious, for example an electricity distribution network. This is not, however, the case with the Maximum Reserve Capacity Price.

As discussed in more detail below, the Maximum Reserve Capacity Price (and hence the WACC used to derive it) is used in two places in the Market Rules, namely:

- to establish a cap for the price that is payable where the IMO holds an auction to procure additional generation capacity; and
- as an input in setting the price that is paid to capacity that enters the market other than through an auction (for example, commercial entry).[9]

We note at the outset that the WACC for these two situations need not be the same — only capacity that is successfully bid into an auction is contracted for a 10-year period, giving it price certainty and reducing project risk.

The IMO has asked for advice on the WACC that is appropriate when the Maximum Reserve Capacity Price is used in the first of these circumstances, indicating that the advice on the WACC provided by the Allen Consulting Group should reflect the efficient cost of capital that would be required to support investment in an open cycle gas turbine (OCGT) peaking plant where such plant is constructed following it being successfully bid into a Reserve Capacity Auction. As noted above, under this scenario, payments for capacity would be underwritten through a 10-year contract with the IMO, under which payments are escalated by CPI-1 percent under a long-term contract (known as a Long Term Special Price Arrangement).

An important consideration is how Western Australia's Reserve Capacity Mechanism would affect the cash flows to an investor in an OCGT peaking plant following a Reserve Capacity Auction. Accordingly, the Reserve Capacity Mechanism and its possible effects on a new entrant provider of capacity are discussed next.

[9] The administered price for this non-auctioned capacity cannot be higher than 85 per cent of the Maximum Reserve Capacity Price, and it will be lower if there is deemed to be surplus generation capacity and/or if an auction is held and the capacity is offered at a lower price (the auction price determining the new administered price).

4.2 Reserve Capacity Mechanism

Purpose and operation

The Reserve Capacity Mechanism is intended to ensure there is adequate generation capacity and demand-side-management capacity available each year to meet system peak demand, that demand can be met in the event of the failure of the largest generator, and that there remains some capability to respond to frequency variations — the Reserve Capacity Requirement.

Market Customers are each notionally allocated a share of the Reserve Capacity Requirement, called an Individual Reserve Capacity Requirement, in proportion to their share of the system load.

Generation and demand side management facilities capable and willing to contribute capacity in a particular year must annually apply to the IMO to have their capacity certified. The level of Certified Reserve Capacity indicates the contribution that a facility could make towards the Reserve Capacity Requirement in a Capacity Year.

Capacity Credits are then created to the extent that the IMO is advised that all or part of a facility's Certified Reserve Capacity is to be made available to Market Customers through bilateral contracts. While Market Customers may bilaterally contract for Capacity Credits, to the extent that a Market Customer may at any point not hold sufficient Capacity Credits to meet its Individual Reserve Capacity Requirement, such differences will be "settled" by the IMO at the Monthly Reserve Capacity Price.

Monthly Reserve Capacity Price

The Monthly Reserve Capacity Price is the "administered price" (in dollars per megawatt) that would be paid/received by a Market Customer where it is short/long Capacity Credits relative to its Individual Reserve Capacity Requirement. This price is calculated by the IMO in accordance with Rule 4.29 of the Market Rules, which states the Monthly Reserve Capacity Price is to equal:

- if a Reserve Capacity Auction is run for the Reserve Capacity Cycle, the Reserve Capacity Price for the Reserve Capacity Cycle divided by 12; or
- if no Reserve Capacity Auction is run for the Reserve Capacity Cycle:
  - prior to 1 October 2008, 85 per cent of the Maximum Reserve Capacity Price for the Reserve Capacity Cycle divided by 12; or
  - from 1 October 2008, 85 per cent of the Maximum Reserve Capacity Price for the Reserve Capacity Cycle multiplied by the Excess Capacity Adjustment and divided by 12;
- the Excess Capacity Adjustment is equal to the minimum of:
  - one, and
  - the Reserve Capacity Requirement for the Reserve Capacity Cycle divided by the total number of Capacity Credits assigned by the IMO for the Reserve Capacity Cycle

Maximum Reserve Capacity Price

It follows that the Maximum Reserve Capacity Price plays two roles in the Reserve Capacity Mechanism:

- firstly, it establishes a ceiling price, or cap, for the Reserve Capacity Auction (if an auction is required to be held); and
- secondly, if an auction is not required to be held it is used to determine an administered price for capacity, where the administered price can be no higher than 85 per cent of the Maximum Reserve Capacity Price.

The precise methodology for calculating the Maximum Reserve Capacity Price is set out in Appendix 4 of the Market Rules. It is consistent with the "building block" approach to setting prices outlined in Section 2.3, providing:

- a return on the value of assets (in this case, the cost of constructing an OCGT peaking plant and connecting it to the electricity transmission network) based on:
  - (double) the equipment price for the turbines (in American dollars, adjusted for US inflation and converted to Australian dollars)[10];
  - a 15 per cent margin for legal, approval and financing costs;
  - network connection and augmentation costs; and
  - the costs associated with constructing on-site fuel storage capacity equivalent to 24 hours fuel burn, and maintaining storage levels equivalent to 12 hours fuel burn;
- a return of the value of the OCGT peaking plant's capital costs over 15 years; and
- the fixed operating and maintenance costs of the peaking plant.

The methodology allows for all capital and fixed costs to be recovered through the Maximum Reserve Capacity Price — that is, all costs other than costs associated with actually generating electricity from the plant.

4.3 Implications for the new entrant supplier of capacity

Existing facilities or those under construction are granted Capacity Credits by the IMO to the extent that the facility's operator advises the IMO that it intends to bilaterally trade some or all of the facility's Certified Reserve Capacity. Once granted Capacity Credits, an OCGT peaking plant would no longer face demand risk, as it would be paid for capacity for which it holds Capacity Credits either under bilateral contracts with Market Customers or otherwise at the Monthly Reserve Capacity Price. That is, there is a significant transfer of risk from the new entrant supplier of capacity to Market Customers.

[10] It is understood that the doubling of the equipment price is to convert the equipment price into a plant cost, including construction and land acquisition costs.

The Monthly Reserve Capacity Price and Maximum Reserve Capacity Price are determined annually and consequently, an OCGT peaking plant would face some price risk, as prices may be affected by economy-wide events. For example, a decline in economic activity could result in a fall in the Reserve Capacity Requirement, while the number of Capacity Credits may initially remain constant (as it would take time for the market to adjust to the new level of required capacity), thereby resulting in a reduction in the Maximum Reserve Capacity Price (see Section 4.2).

Nevertheless, prices are likely to be reasonably predictable as there would be a reasonable degree of transparency on other projects that might increase system capacity (and hence might decrease the Monthly Reserve Capacity Price).

Of the two roles of the Maximum Reserve Capacity Price (Section 4.2 of this report), the IMO has indicated that the WACC (and hence the Maximum Reserve Capacity Price) should reflect the first scenario — where the Maximum Reserve Capacity Price cap is the efficient cost of capital that would be required to support investment in an OCGT peaking plant where such a plant is constructed following it being successfully bid into a Reserve Capacity Auction. Under this scenario, payments for capacity would be underwritten through a 10-year contract with the IMO, in which payments would be escalated by CPI-1 percent under a Long Term Special Price Arrangement. This degree of certainty about the initial revenue stream for the project is expected to affect the risk borne by the provider of the facility, which is discussed in further detail in Chapter 6.

Chapter 5

Cost of capital — market-wide input parameters

5.1 Introduction

Input parameters into the CAPM and the WACC consist of two groups — those that are common for the market generally and hence whose values are independent of the asset or project in question, and those whose values must be established from the market with regard to the nature of the asset or project. This chapter considers the first set of parameters and their respective values.

5.2 The risk free rate

The risk free rate measures the return an investor would expect from an asset with zero beta risk. It is required for estimating the cost of equity capital when using the CAPM, and also forms the base to which a debt risk premium is applied to derive a cost of debt.

Australian regulators have typically derived values of nominal and real risk-free rates from capital market observations of yields on Commonwealth Government securities (government bonds): either nominal government bonds to derive a nominal risk free rate, or inflation indexed government bonds to derive a real risk free rate. A forecast of inflation is then derived from the real and nominal risk free rates by application of the Fisher equation:

$$R = \left[\frac{(1+r)}{(1+i)} \right] - 1$$

where: R is the real risk free rate;
r is the nominal risk free rate; and
i is the rate of inflation.

Capital market evidence

Recent analysis of capital market observations suggests there may be a bias in using observed yields on real government bonds to derive a real risk free rate. In a recent study, NERA suggested there was:[11]

- a relative (downward) bias of around 20 basis points between the yield on indexed and nominal government bonds as a result of structural changes in the market for government bonds which have increased institutional demand for the indexed government bonds at a time of limited supply of these debt instruments; and
- an absolute (downward) bias of 42—44 basis points in yield on nominal government bonds relative to the "true" nominal risk free rate as a result of a shortage in supply of nominal debt instruments.

[11] NERA Economic Consulting, 2007, *Bias in Indexed CGS Yields as a Proxy for the CAPM Risk Free Rate*, A report for the ENA, March 2007,

For indexed government bonds, these two sources of bias are additive, meaning that NERA's findings imply that indexed government bonds (as a proxy for the real risk free rate) underestimate the "true" real risk free rate by 62 to 64 basis points.

Consistent with NERA's first conclusion, the Reserve Bank of Australia (RBA) has acknowledged that current conditions in the market for real government bonds appears to be lowering the usefulness of the Fisher equation in measuring forecast inflation. The RBA has also stated on many occasions that inflation expectations derived from the indexed government bond market were at odds with other measures of inflation, such as surveys.[12] The Commonwealth Treasury Department has also recognised the potential bias in yields on real government bonds and has advised the Australian Energy Regulator (AER) that it:[13]

> ...agree[s] that as Treasury Indexed Bonds (TIBs) mature without replacement, their usefulness for estimating long term real risk free rates will diminish. Consequently, their use for estimating the market-implied inflation forecast will lead to inflation estimates with an upward bias.

The Allen Consulting Group has also previously concluded that the yields on real government bonds provide a downward-biased estimate of the real risk free rate of return. Specifically, the Allen Consulting Group has confirmed that forecasts of inflation implied by returns on government bonds are generally above the RBA's target inflation range of two per cent to three per cent:[14]

- as at 28 June 2007, the average annual levels of inflation implied by the 2010, 2015 and 2020 real government bonds were 2.77 per cent, 3.26 per cent and 3.47 per cent respectively; and
- as at the same date, the level of inflation implied by the 10 year nominal and real risk free rates calculated using the Fisher equation was 3.33 per cent.

The Allen Consulting Group has also consulted a number of financial market participants on conditions in the market for indexed government bonds, revealing that many participants consider that there is an element of downward bias in the yields of indexed bonds.[15]

However, NERA's assertion that there also exists an absolute bias in the yield on nominal government bonds relative to the "true" nominal risk free rate as a result of a shortage in supply of nominal debt instruments has found little support in the RBA and Commonwealth Treasury.

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12 Reserve Bank of Australia, 2007, Letter from Mr Guy Debelle, Assistant Governor (Financial Markets) to ACCC, 9 August 2007.

13 Commonwealth Treasury, 2007, Letter from Mr Jim Murphy, Executive Director (Markets Group) to ACCC, 7 August 2007.

14 Allen Consulting Group, 2007, *'Relative bias' in yields of indexed Commonwealth Government Securities when used as a proxy for the CAPM risk-free rate*, Statement by Balchin and Lawriwsky, August 2007, p.4.

15 *Ibid*, p.4.

In previous advice on the derivation of the real risk free rate, the Allen Consulting Group has concluded that there is some evidence of a bias in yields of real government bonds, but advised that there is no straightforward means of either estimating the level of the bias or obtaining an unbiased estimate of the true real risk free rate of return. The Allen Consulting Group has, accordingly, proposed two possible alternative approaches to determining a value for the real risk free rate to be applied in the CAPM and WACC models:[16]

- use a value equal to the observed yield on the shortest-dated indexed government bond, recognising that this may overstate the true risk free rate of return due to possible liquidity premium in the value of these bonds reflecting limited trading, or
- use the observed yield on 10-year nominal government bonds as the nominal risk free rate, adjust this value (using the Fisher equation) for a value of the forecast rate of inflation that is derived from another source.

Regulatory precedent

Australian economic regulators have, in the past, almost invariably determined values of risk free rates as observed or imputed yields on long-term nominal and real government bonds.

To date, the ERA has also applied this 'conventional' approach to derive the real risk free rate and a forecast of inflation across industries it regulates: gas pipelines under the National Gas Code, electricity transmission and distribution under the *Electricity Networks Access Code 2004*, and the freight and passenger rail systems under the *Railways (Access) Code 2000*. That is, nominal and real risk free rates are derived from observed yields on nominal and government bonds, with a forecast of inflation then being derived from these rates using the Fisher equation.

The potential relative bias in the real risk free rate observed from indexed government bonds and the implications this has for establishing WACC parameters have been considered in recent regulatory decisions by the AER and the Victorian Essential Services Commission (ESC).[17]

In its determinations on regulated rates of return applied in determining revenue caps for SP AusNet and Powerlink, the AER departed from past practice in determining an inflation forecast and instead adopted an assumed value for forecast inflation based on consideration of a range of inflation indicators: the RBA's target inflation range; Australia's historical inflation rate; independent market forecasts; commentary provided by the RBA and the Commonwealth Treasury Department; current Bloomberg inflation swap rates; and the current difference between nominal and indexed Commonwealth Government bond yields. On this basis, the AER subsequently favoured adopting a forecast inflation rate of 3 per cent.

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[16] Allen Consulting Group, 2007, *'Relative bias' in yields of indexed commonwealth government securities when used as a proxy for the CAPM risk-free rate*, Statement by Balchin and Lawriwsky, July 2007, pp.6-7.

[17] Australian Energy Regulator, 2007, Draft decision: SP AusNet transmission determination 2008-09 to 2013-14, 31 August 2007.
Australian Energy Regulator, 2007, Decision: Powerlink Queensland transmission network revenue cap 2007-08 to 2011-12.
Essential Services Commission, 2007, Gas Access Arrangement Review 2008-2012: Draft Decision, 28 August 2007.

In its recent draft decision on proposed revisions to access arrangements for the Victorian gas distribution networks, the ESC recognised the potential relative bias in observed yields on real government bonds as an estimate of the real risk free rate and determined that observed yields on indexed government bonds cannot be relied upon to provide an unbiased estimate of the real risk-free rate, or to derive a market forecast of inflation. The ESC concluded that the most appropriate methodology to estimate the real risk free rate in the current market environment was to observe the yield on 10-year nominal government bonds to derive a nominal risk-free rate, to then establish a forecast for the expected rate of inflation, and then to use the Fisher equation to derive the real risk-free rate.[18]

In doing so, the ESC applied a forecast of inflation of 3 per cent based on a number of short-term forecasts of inflation of between 2.5 per cent and 3.8 per cent (including forecasts made or assumed by ANZ Economic and Financial Market forecasts; BIS Shrapnel; KPMG; the Melbourne Institute Survey of Consumer Inflationary Expectations; the RBA; the Commonwealth Government; and the Victorian Government) and giving weight to the RBA's target range for inflation of 2 to 3 per cent.[19]

Recommendation

In light of capital market evidence, the Allen Consulting Group supports the revised approach adopted by the AER and ESC in deriving a forecast rate of inflation and the real risk free rate, and consequently recommends that the IMO:

- derive a nominal risk free rate based on the 20 trading day average of the 10-year nominal government bond rate;
- use its judgement to establish a forecast rate of inflation from other sources (which may have regard to forecasts prepared by the RBA, financial institutions and governments); and
- then use the Fisher equation to derive the real risk free rate.

The average yield on nominal government bonds for the 20-days prior to 28 September 2007 was 6.21 per cent, which was calculated as an annualised yield, using an interpolation on Commonwealth Government bonds with maturity closest to ten years.

The Allen Consulting Group notes that the GDP forecasts included in the IMO's January 2007 report as proxies for the CPI imply an assumption of average CPI inflation of 3.9 per cent over the period, which is significantly higher than the RBA's target range for inflation of between 2 and 3 per cent.

5.3 Market risk premium

The market risk (or equity) premium (MRP) is the difference between the expected return on a well-diversified portfolio of stocks and the risk free rate. It represents the reward that investors require to accept the risk associated with the diversified portfolio of equity investments.

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[18] Essential Services Commission, 2007, Gas Access Arrangement Review 2008-2012: Draft Decision, 28 August 2007, p.382.

[19] *Ibid*,p.382.

The MRP is not an observable or measurable parameter and, consequently, a range of information sources have generally been relied upon to derive an estimate or assumption of the expected MRP. These data sources have tended to include:

- capital market observations of historical returns to equity;
- studies on imputed expectations of the MRP;
- surveys of opinions and assumptions of capital-market participants; and
- qualitative considerations of factors that may cause the expected MRP to change over time and to vary from historically observed returns.

Capital market evidence

Capital market evidence on the MRP comprises:

- capital market observations of historical returns to equity;
- studies on imputed expectations of the MRP;
- surveys of opinions and assumptions of capital-market participants; and
- qualitative considerations of factors that may cause the expected MRP to change over time and to vary from historically observed returns.

There have been several recent studies of historical returns to equity in the Australian stock market, undertaken in the context of regulatory determinations for regulated infrastructure.

Capital Research[20] and the South Australian Centre for Economic Studies (SACES)[21] separately undertook studies of historical returns to equity with weight given to relatively recent (post-1950s) observations, various use of geometric and arithmetic means of observations, and removal of bias caused by expected inflation of asset values. These studies concluded that historical returns to equity support MRP values of 4.5 to 6 per cent (Capital Partners) and 5.0 to 5.6 per cent (SACES).

The conclusions of Capital Partners and SACES are consistent with results of a further study by Brailsford et al that indicated, using only post 1958 data, geometric average returns to equity in a range of 3.8 per cent to 6 per cent and arithmetic average returns to equity in the range of 5.1 per cent to 7.3 per cent.[22]

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[20] Capital Research Ltd. January 2005, *Australian Market Risk Premium*, submission to the Essential Services Commission of Victoria in response to the 2006-10 *Victorian Electricity Distribution Price Review Position Paper*.

[21] South Australian Centre for Economic Studies (SACES) April 2005, 'The Market Risk Premium for Australian Regulatory Decisions', submission to the Essential Services Commission of Victoria in response to the 2006-10 *Victorian Electricity Distribution Price Review Position Paper.*

[22] Brailsford, T., J. Handley, and K. Maheswaran 2006, *A re-examination of the historical equity risk premium in Australia*, 1 August. Working Paper, UQ Business School, and Department of Finance, University of Melbourne, quoted in Essential Services Commission, 2007, Gas Access Arrangement Review 2008-2012: Draft Decision, 28 August 2007, p.401.

The conclusions of Capital Research and SACES have been disputed by Gray and Officer[23] on the basis of contentions that the weight of evidence indicates historical returns to equity in excess of 6 per cent, and estimates below 6 per cent can only be achieved by making selective adjustments to the historical data (as made by both Capital Partners and SACES).

On the matter of future expectations of the MRP, Dr Shane Oliver, Chief Economist at AMP, has suggested that the MRP for the coming 5 to 10 years might be around 3.8 per cent, arguing that there were several reasons to suspect that the MRP demanded by investors may have fallen over time, including:[24]

- low inflation and reduced business cycle volatility;
- a greater feeling of global political security – no major wars in 60 years and the end of the Cold War;
- improved regulatory and legal protection for investors;
- lower trading costs in equities, greater scope to spread risk via diversification and improved market liquidity; and
- increased demand for shares from pension funds.

Regulatory precedent

A MRP of 6 per cent has become fairly firmly entrenched in Australian regulatory decisions, either as a point estimate of the MRP or the upper bound of a range of values.

Under the National Electricity Rules, an MRP of 6 per cent is required to be applied in determining price controls for transmission network service provides in the National Electricity Market.

In its 2005 electricity distribution price review, the ESC adopted an MRP of 6 percent, noting that while this value was less than might be suggested by historical equity returns on the Australian stock market, it was confident that the value did not understate the expected MRP, taking into account the "totality of evidence".[25] In its more recent draft decision on gas distribution access arrangements in Victoria, the ESC indicated that it considered the MRP should be assessed with reference to a range of possible values of 4 per cent to 7 per cent, but determined the MRP value to be 6 per cent.[26]

Finally, in its most recent decisions on price controls for electricity transmission and distribution networks, the ERA determined a range of values for the MRP of 5 to 6 per cent.[27]

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[23] Gray, S and Officer, R.R. 2005, *A review of the market risk premium and commentary on two recent papers*, A report prepared for the Energy Networks Association, August 2005, p.3.

[24] AMP 2006, *The equity risk premium – is it enough?* Oliver's insights, AMP Capital Investors, Edition 13, May 2006.

[25] Essential Services Commission, October 2005, Electricity Distribution Price Review 2006-10, Final Decision Volume 1, Statement of Purpose and Reasons, p.365.

[26] Essential Services Commission, August 2007, Gas Access Arrangement Review 2008-2012 Draft Decision. pp. 403, 416.

[27] Economic Regulation Authority 2006, *Draft Decision on the Western Power Networks Business Unit Proposed Access Arrangement for the South West Interconnected Network,* Submitted by Western Power Corporation, 21 March 2006, p.167.

Recommendation

The Allen Consulting Group considers that the weight of capital market evidence, including evidence on the expected future MRP, provides support for a MRP of 6 per cent for this purpose.

5.4 Debt issuance and equity raising costs

Debt raising costs may include underwriting fees, legal fees, company credit rating fees and other costs incurred in raising debt finance. Regulators have typically included an allowance for these costs in the cost of debt as an increment to the debt margin.

Recently regulators have also given consideration to including an allowance for the cost of raising the 'benchmark' share of equity finance when constructing a new asset (either actually or hypothetically, such as when an ODRC estimate is obtained) or when financing capital expenditure. Such equity raising costs may include underwriting fees, legal fees, company credit rating fees and other costs.

The Allen Consulting Group notes that the capital cost used to calculate the Maximum Reserve Capacity Price includes a margin "M" for "legal, approval and financing costs and contingencies". It would appear, therefore, that under the current methodology, debt issuance and equity raising costs are already provided for elsewhere. If so, a separate allowance should not be included in the calculated WACC.

Capital market evidence

The Allen Consulting Group undertook a study for the ACCC in 2004 on appropriate debt and equity raising costs to be included in costs recognised for the purposes of determining regulated revenues and prices.[28]

This study determined debt raising costs based on long-term bond issues, consistent with the benchmark assumption applied in determining costs of debt benchmark regulated entity. Debt raising costs were based on costs associated with Australian international bond issues and for Australian medium term notes sold jointly in Australia and overseas. Estimates of these costs were equivalent to 8 to 10.4 bp per annum when expressed as an increment to the debt margin.

The study advised that equity raising costs were a legitimate part of the cost of constructing a hypothetical new asset, such as is assumed when undertaking an ODRC valuation. It estimated benchmark equity raising costs by consideration of costs incurred in actual infrastructure capital raisings, deriving an estimate of costs of 3.83 per cent of capital raised. It concluded that whether equity raising costs for ongoing capital expenditure are appropriate is an empirical matter, noting that much of the capital expenditure would be expected to be financed from retained earnings, which do not attract transaction costs.

Regulatory precedent

Two broadly different approaches have been adopted by regulators in the treatment of debt and equity raising costs in determination of regulated revenues and prices.

[28] Allen Consulting Group, 2004, *Debt and equity raising transaction costs*: Final report to the ACCC, December 2004.

The ACCC and AER have tended to derive estimates of debt raising costs as a bottom-up calculation of costs notionally incurred for particular values and terms of debt. Other regulators, including the ERA, the ESC and the Queensland Competition Authority (QCA) have adopted a regulatory 'benchmark' of 12.5bp, although often acknowledging that this would tend to overstate debt-raising costs.

Equity raising costs have only recently been considered by Australian regulators. The AER has recently accepted that equity raising costs in respect of ongoing capital expenditure may reasonably be expected to occur where a regulated entity is not able to fund all of the approved capital expenditure through retained earnings and debt.[29] The QCA has permitted an allowance for equity raising costs to be included in the estimate of the ODRC for the Dalrymple Bay Coal Terminal (the ACCC/AER has not dealt with a similar matter since receiving our 2004 report).

Recommendation

Regulatory precedent has varied from attempts at precise calculation of debt issuance costs, to adopting a benchmark allowance of 12.5 bp, which is generally acknowledged as a conservatively generous allowance for these costs.

The Allen Consulting Group recommends that the IMO include an allowance of 12.5 bp for debt issuance costs in the estimate of the WACC, on the basis that this figure is likely to be close to the reasonable estimate of these costs.

Equity raising costs should be included in the estimate of the hypothetical capital cost of the notional project to build an OCGT peaking plant.

These recommendations are subject to the IMO excluding such financing costs from the margin "M", which currently provides for "legal, approval and financing costs and contingencies".

5.5 Taxation and dividend imputation

Adjusting the WACC to reflect taxation liabilities requires assumptions to be made about the effective rate of company income tax, and the value of franking credits attached to distributions to shareholders.

A franking credit is received by Australian resident shareholders for corporate taxation paid at the company level when determining their personal income taxation liabilities under the system of dividend imputation.

The actual value of franking credits, represented in the WACC by the parameter 'gamma', depends on the proportion of the franking credits that are created by the firm that are distributed, and the value that the investor attaches to the credit, which depends on the investor's tax circumstances (that is, their marginal tax rate). As these will differ across investors, the value of franking credits may be between nil and full value (that is, a gamma value between zero and one).

[29] Australian Energy Regulator, 2007, Decision: Powerlink Queensland transmission network revenue cap 2007-08 to 2011-12, p.102.

Capital market evidence

Taxation rate

In the pre-tax specification of the WACC, the effective tax rate is typically assumed to be the statutory rate of company income tax, which is currently 30 per cent. Due to particular features of the Australian taxation system, particularly remaining areas of accelerated depreciation of assets, effective taxation rates for infrastructure businesses are typically less than the statutory taxation rate. However, if it was intended to take account of the particular features of the Australian taxation system, then a post WACC should be used and taxation payments modelled explicitly, which is beyond the scope of this study.

Dividend imputation

The value of gamma depends on the proportion of franking credits that are distributed by the firm, and the value placed on the distributed credits by investors. The capital market evidence on the appropriate values for these two parameters, and hence an appropriate value for gamma, was considered in detail by the ESC in its recent draft decision on gas distribution arrangements in Victoria and are outlined below.

- Proportion of franking credits created that are distributed:
  - In 2004, Hathaway and Officer found that between 1988 and 2002 an average of 71 per cent of franking credits were distributed to Australian shareholders.[30]
  - The value adopted for the proportion of franking credits distributed by the firm should reflect that of a benchmark firm in the respective industry rather than an average for all Australian firms.[31] For regulated energy utility businesses, the ESC has found that 100 per cent of franking credits created would be distributed, reflecting the higher dividend yields of utility firms than the average for Australian firms.
- Value placed on distributed franking credits by investors. Conflicting estimates have been made for both the value placed on imputation credits by the 'marginal investor' in the economy and by the actual composition of investors in Australian listed securities:
  - Handley and Maheswaran found that 81 per cent of distributed imputation credits were used to offset taxation liabilities over the 2001-2004 period.[32]
  - Beggs and Skeels found that changes to taxation law in 2000, which provided full income rebates for unused franking credits, had caused the market to put a statistically significant value on franking credits, which the authors estimated at 0.572.[33]

30 Hathaway, N. and Officer, B. 2004, The Value of Imputation Tax Credits: 2004 Update, 2 November 2004, p.12.

31 Essential Services Commission, 2007, Gas Access Arrangement Review 2008-2012: Draft Decision, 28 August 2007, p.422 and p.427.

32 Ibid, p.422 and p.423.

33 *Ibid*, p.422 and p.425.

- Results presented in Hathaway and Officer found that the marginal investor placed a value of around 63 per cent on distributed franking credits.[34]
- A review of studies by the Strategic Finance Group found support to adopt a zero value for distributed franking credits.[35] Specifically, the Strategic Finance Group referred to a study by Cannavan, Finn and Gray in 2004, which concluded that when cash dividends are fully valued, franking credits were valued at up to 50 per cent of their face value prior to 1997; but are not valued by the price-setting investor (and therefore do not affect the corporate cost of capital) after 1997.[36]

Of these studies, the ESC has claimed that the results of Cannavan et al. have limited validity due to a failure to recognise changes in tax law that increased the value of franking credits to superannuation funds and life insurance companies.[37]

- Gamma

  The ESC's recent review of evidence for the value of franking credits indicates that the value of gamma may be determined with reference to a proportion of franking credits distributed of between 71 and 100 per cent, and a value of franking credits to investors of between 0.57 and 0.81 per cent, indicating a possible range of gamma values of 0.4 to 0.8.

Regulatory precedent

The ERA's past regulatory decisions for gas, electricity and rail infrastructure have calculated pre-tax WACC values using the statutory tax rate of 30 per cent and a gamma value of either 0.5 (for decisions prior to 2003) or within a range of 0.3 to 0.5 (for decisions in or subsequent to 2003).

The National Electricity Rules require the AER to apply the prevailing statutory tax rate and a gamma value of 0.5 in establishing the estimated cost of corporate income tax in regulatory determinations for electricity transmission in the National Electricity Market.

The ESC has consistently adopted a gamma value of 0.5, including in its recent draft decision for gas distribution networks.[38]

Recommendation

Consistent with the ERA's regulatory precedent, the Allen Consulting Group recommends that the pre-tax WACC for determining the Maximum Reserve Capacity Price (if used) be estimated with reference to an effective taxation rate equal to the statutory rate of corporate income tax of 30 per cent. If a more accurate representation of the likely taxation payments for a provider of generation capacity is sought, we recommend using a post tax WACC and modelling taxation explicitly.

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[34] Hathaway, N. and Officer, B. 2004, The Value of Imputation Tax Credits: 2004 Update, 2 November 2004, p.24.

[35] Strategic Finance Group 2007, *The impact of franking credits on the corporate cost of capital: Empirical evidence*, Report Prepared for Envestra, 22 March 2007, p.13.

[36] *Ibid*, p.15.

[37] Essential Services Commission, 2007, Gas Access Arrangement Review 2008-2012: Draft Decision, 28 August 2007, pp.425, 426.

[38] *Ibid*, p.433.

The most recent capital market evidence supports use of a gamma value of between 0.4 and 0.8 for regulated utility businesses. It is possible that the notional project would have a dividend yield similar to those of energy utilities. As such, it is recommended that a value of at least 0.5 be applied, consistent with general regulatory precedent.

Chapter 6

Cost of capital — project-specific input parameters

6.1 Introduction

Input parameters into the CAPM and the WACC consist of two groups — those that are relevant for the market as a whole and hence whose values are independent of the asset or project in question, and those whose value must be established from the market with regard to the nature of the asset or project. This chapter considers the second set of parameters and their respective values.

6.2 Comparable entities

The beta, gearing and credit ratings of other generators would ordinarily be considered in establishing the value of those parameters for the WACC to be used in calculating the Maximum Reserve Capacity Price.

However, it follows from Chapter 4 that the transfer of risk under the Reserve Capacity Mechanism in Western Australia suggests that such observations are likely to form an upper bound for these values and that a degree of judgement will need to be exercised in setting appropriate values. Rather the Long Term Special Price Arrangement following a Reserve Capacity Auction results in a relatively stable cash flow to a provider of capacity.

In considering the appropriate values for project specific input parameters, consideration is given to capital market evidence from comparable generation companies and regulated infrastructure businesses, as well as established regulatory precedents.

6.3 Financial structure and the cost of debt

A firm's capital structure refers to the relative levels of debt and equity used to finance its assets. The proportion of debt to total asset value is referred to as a business's level of "gearing".

The capital structure assumed for the purposes of estimating the WACC affects the value of the WACC through the relative weightings given to the costs of debt and equity, the value of the equity beta (which is levered to reflect the assumed capital structure) and the value of the debt margin over the risk free rate (which is affected by assumptions of the credit rating of the business, of which gearing is an important determinant).

It is common regulatory practice to make a benchmark assumption for the financial structure of a regulated business or activity, rather than base estimation of the cost of capital on the actual financial structure of the individual business. This approach is taken to avoid regulatory decisions distorting the incentives of regulated businesses to adopt efficient financing structures.

The cost of debt in the WACC is normally estimated as the risk free rate plus a debt risk premium (debt premium). The debt premium reflects the margin above the risk free rate that would be required by lenders providing debt funding. Regulators typically establish a value of the debt premium from capital market data on yields on corporate bonds consistent with benchmarks assumptions for the capital structure and credit rating of the regulated business or activity.

Determining a benchmark assumption on financial structures and for estimating the cost of debt involves:

- examining evidence on a representative or efficient capital structure;
- determining an appropriate assumption of a credit rating that would be attached to the debt; and
- based on the assumed credit ratings, estimating the debt margin over government bonds for each business.

Capital market evidence

Financial structure and credit rating

Both a company's level of gearing and the credit rating associated with its debt will be influenced by the risk associated with its cash flows. Table 6.1 provides the observed capital structures and credit ratings of listed electricity generation businesses. In summary:

- the average level of gearing was relatively low at 35 per cent, with a range from a low of 12 per cent to a high of 64 per cent; and
- credit ratings ranged from B to BBB+.

Table 6.1

INTERNATIONAL ELECTRICITY GENERATING COMPANIES — GEARING AND CREDIT RATING[39]

Company	Country	Comment	Gearing	Rating
International Power PLC	UK		42%	BB-
AES Corporation	US	50% of revenue from regulated utilities	64%	BB-
NRG Energy Inc	US		40%	B+
Ormat Technologies	US	28% of revenue from turbine manufacturing	35%	NR
Reliant Energy Inc	US		62%	B
Energy Developments Ltd	Australia	Methane gas generation	36%	NR
Contact Energy Ltd	NZ	Hydroelectricity	22%	BBB+
Great Lakes Hydro Income Fund	Canada	Hydroelectricity	39%	NR
Maxim Power Corp	Canada		15%	NR
TransAlta Corp	Canada		37%	BBB
Northland Power Income Trust	Canada	Hydroelectricity	15%	NR
Arendals Fossekompani	Norway	Hydroelectricity	12%	NR
Average			**35%**	

Source: Bloomberg

Debt margin

Debt margins BBB+ rated debt were estimated from empirical data for 10 year BBB+ rated bonds for a 20-day period commencing 24 August 2007 and concluding on 20 September 2007.

The margins were derived from the fair yield margins of BBB+ bonds over Commonwealth Government bonds, using data from the Bloomberg service, which provides a prediction of yields on 10-year bonds of 159 basis points.

Regulatory precedent

There is no precedent in Australia of price regulation for generation infrastructure.

As part of a recent report that estimated the short and long run marginal costs in the National Electricity Market (NEM), ACIL Tasman estimated a WACC for generators operating in the competitive (energy-only) market using an assumed gearing ratio of 60 per cent debt and 40 per cent equity but did not explicitly indicate its assumed credit rating for the company making the investment.[40] The debt margin it estimated for the business was 200 bp (2 per cent).

[39] In the Table 6.1, gearing was calculated as a simple average of the gearing calculated for the five years to 2006. In each year, gearing was measured as the ratio of the net book value of debt (that is, the total book value of debt less cash) to the market value of equity plus the net book value of debt. The credit rating reflects each company's current credit rating.

[40] ACIL Tasman 2007, *Fuel resource, new entry and generation costs in the NEM, Report 2 – Data and documentation*, Final report prepared for NEMMCO, 6 June 2007, p.125.

Precedent determinations on credit-rating assumptions for regulated transmission and distribution infrastructure are shown in Table 6.2.

Table 6.2

AUSTRALIAN REGULATORY DECISIONS ON CREDIT-RATING ASSUMPTIONS FOR TRANSMISSION AND DISTRIBUTION BUSINESSES

Year	Decision/Determination	Credit rating
2002	ACT GasNet Gas Transmission Decision	BBB+
2002	ACCC ElectraNet Electricity Transmission Final Decision	A
2002	ACCC SPI PowerNet Electricity Transmission Final Decision	A
2002	ESC Gas Distribution Final Decision	BBB+
2003	ACCC Transend Electricity Transmission Final Decision	A
2004	ICRC ActewAGL Electricity Distribution Final Decision	BBB+
2004	IPART Electricity Distribution Final Decision	BBB to BBB+
2004	ESCOSA Electricity Price Review Final Decision	BBB+
2005	QCA Electricity Distribution Final Decision	BBB+
2005	IPART Revised Access Arrangement for AGL Gas Networks Final Decision	BBB to BBB+
2005	ESC Electricity Distribution Price Review	BBB+
2006	ESCOSA Final Decision Revisions to Envestra Gas Distribution Access Arrangements	BBB+

Source: Essential Services Commission, 2007 and the Allen Consulting Group

Recommendation

The Allen Consulting Group considers that the total risk (that is, variance of cash flows) associated with investment in capacity that is procured by the IMO would be substantially lower than for a generation business operating in a competitive market, given the existence of a long term contract guaranteeing cash flows for the first ten years and the effects of the administered price that is paid for capacity thereafter. However, we also consider that the risk would be higher than that of regulated energy infrastructure, reflecting the fact that the Maximum reserve Capacity Price is set with reference to a hypothetical project and reset annually (the latter affecting cash flows after the initial long tern contract has expired).

We recommend using an assumption that the generator that is procured by the IMO would be able to maintain a BBB+ credit rating, but that to do so its gearing level would be lower than the 60 per cent debt-to-assets assumed for regulated energy infrastructure and, on balance, recommend an assumed gearing level of 40 per cent debt-to-assets.

Accordingly, the Allen Consulting Group recommends that the following benchmark assumptions be adopted:

- gearing of 40 per cent;
- credit rating of BBB+; and

- debt margin of 160 bp (rounded).

6.4 Systematic risk (Beta)

The systematic risk (beta) of a firm is the measure of how the changes in the returns to the firm's stock are related to the changes in returns to the market as a whole. It reflects that business' exposure to non-diversifiable risk, which relates to that portion of the variance in the return on an asset that arises from market-wide economic factors that affect returns on all assets, and which cannot be avoided by holding the assets as part of a diversified portfolio of assets.

Beta may be estimated from observed capital-market returns on equity stocks. Where a firm is not listed on the stock market, an equity beta is commonly estimated by estimating asset beta from observations on equity returns for comparable listed entities and 're-levering' the asset beta values into equity beta values that are consistent with the assumed capital structure (debt to equity ratio) of the entity being examined.

Capital market evidence

The Allen Consulting Group has given consideration to capital market evidence on beta values for listed businesses that might be expected to have a similar exposure to non-diversifiable risk as an OCGT peaking plant providing capacity in the Reserve Capacity Mechanism. This capital market evidence is set out below.

Asset betas for the generation and the transmission and distribution companies have been derived from Bloomberg "raw" (that is, unadjusted) equity betas using five years of monthly observations. Each five-year equity beta has been de-levered using the average five-year debt to asset ratio for each company, again based on Bloomberg data. Proxy asset beta values derived from the comparable businesses were then re-levered to equity beta values for benchmark financial structures (40 per cent gearing).

In undertaking this analysis, de-levering and re-levering of beta values has been undertaken using the Brealey & Myers formula:

$$\beta_a = \frac{E}{V} \cdot \beta_e$$

Generation

Table 6.3 shows the asset betas of internationally listed electricity generation businesses, and the corresponding re-levered equity betas at a gearing of 40 per cent debt to assets. The average equity beta is 0.83, although the range of estimated betas is very wide, ranging from 0.10 to 1.58.

Table 6.3

INTERNATIONAL ELECTRTICITY GENERATING COMPANIES — ASSET BETA AND EQUITY BETA (RE-LEVERED FOR 40 PER CENT DEBT:ASSETS)

Company	Country	Comment	Asset beta	Equity beta
International Power PLC	UK		0.95	1.58
AES Corporation (?)	US	50% of revenue from regulated utilities	0.23	0.38
NRG Energy Inc	US		0.76	1.27
Ormat Technologies	US	28% of revenue from turbine manufacturing	0.06	0.10
Reliant Energy Inc	US		0.32	0.53
Energy Developments Ltd	Australia	Methane gas generation	0.53	0.88
Contact Energy Ltd	NZ	Hydroelectricity	0.75	1.25
Great Lakes Hydro Income Fund	Canada	Hydroelectricity	0.41	0.68
Maxim Power Corp	Canada		0.89	1.48
TransAlta Corp	Canada		0.19	0.32
Northland Power Income Trust	Canada	Hydroelectricity	0.53	0.88
Arendals Fossekompani	Norway	Hydroelectricity	0.36	0.60
Average			**0.50**	**0.83**

Source: Bloomberg

We note that the electricity generation businesses in Table 6.3 operate in a wide range of electricity market structures and may be subject to various degrees of economic regulation. For example, AES Corporation indicates that it sells electricity under long-term contracts. We understand that around half of its revenue comes from regulated sources. In addition, a significant proportion of Ormat Technologies' revenue is sourced from non-generation activities. If these two companies were excluded from the analysis, the average equity beta of the remaining set would rise to 0.95.

Transmission and distribution

The Allen Consulting Group has recently reviewed empirical evidence on equity beta values for energy transmission and distribution businesses (geared at 60 per cent), finding that:[41]

- the beta estimates obtained using the longest data period for Australian businesses ranged between 0.5 and 0.7 (which is equivalent to between 0.33 and 0.47 at 40 per cent gearing), depending on the manner in which outliers were adjusted for; and
- beta estimate from United States' businesses suggests that the beta is between 0.6 and 0.8 (equivalent to between 0.40 and 0.53 at 40 per cent gearing).

[41] Allen Consulting Group 2007, *Empirical evidence on proxy beta values for regulated gas distribution activities*, Report for the Essential Services Commission, June 2007.

Regulatory precedent

The values of asset and equity betas applied in determination of WACC values are specific to the nature of the regulated business or activity rather than the capital market as a whole.

One precedent that does exist in relation to the WACC for generation is the equity beta estimate of 1.75 that ACIL Tasman has used in work that it has undertaken for NEMMCO to estimate the long run marginal cost of new generation capacity in the NEM.[42] We note, however, that the report in question does not disclose the basis for its assumed beta, although its estimate is widely used as a benchmark for generators operating in the NEM. Re-levering the ACIL Tasman asset beta at a gearing of 40 per cent debt to assets, as recommended in Section 6.3, results in an equity beta of 1.17.

Precedent determinations on beta values for regulated transmission and distribution infrastructure are shown in Table 6.4

[42] ACIL Tasman 2007, *Fuel resource, new entry and generation costs in the NEM, Report 2 – Data and documentation*, Final report prepared for NEMMCO, 6 June 2007, p.125. We note that while the ACIL Tasman derived equity beta of 1.75 appears to be very high, this reflects in large part the assumed gearing level of 60 per cent debt to assets, and in reality implies that generation is only marginally more risky than the firm of average risk (once adjustments are made for gearing).

Table 6.4

AUSTRALIAN REGULATORY DECISIONS ON BETA VALUES FOR TRANSMISSION AND DISTRIBUTION BUSINESSES

Year	Decision/Determination	Equity beta (gearing at 60% debt-to-assets)	Equity beta (gearing at 40% debt-to-assets)
2000	ESC Electricity Distribution Price Review	1.00	0.67
2001	ACCC Powerlink Transmission Decision	1.00	0.67
2002	ACCC ElectraNet Transmission Decision	1.00	0.67
2002	ACCC SPI PowerNet Transmission Decision	1.00	0.67
2002	ACCC Victoria Gas Transmission Final Decision	0.98	0.65
2003	ACCC Moomba to Adelaide Pipeline Gas Transmission Final Decision	1.16	0.77
2003	ESC Gas Access Arrangements	1.00	0.67
2004	ACCC Transend Transmission Decision	1.00	0.67
2004	ICRC ActewAGL Electricity Distribution Final Decision	0.90	0.60
2004	ICRC ActewAGL Gas Final Decision	1.02	0.68
2004	IPART Electricity Distribution Final Decision	1.01	0.67
2005	ESCOSA Electricity Distribution Re-determination	0.90	0.60
2005	QCA Electricity Distribution Final Decision	0.90	0.60
2005	IPART Revised Access Arrangement for AGL Gas Networks Final Decision	1.00	0.67
2005	ESC Electricity Distribution Price Review	1.00	0.67
2006	ESCOSA Final Decision Revisions to Envestra Gas Distribution Access Arrangements	0.80 – 1.00	0.53—0.67

Note: All equity betas have been re-levered to reflect a gearing of 40 per cent debt-to-assets

Source: Essential Services Commission, 2007 and the Allen Consulting Group

In its recent Draft Decision on proposed revisions to access arrangements for the Victorian gas distribution networks, the ESC determined WACC values on the basis of an equity beta value equivalent to 0.7 (equivalent to 0.47 at 40 per cent gearing), placing greater value on recent capital market evidence rather than regulatory precedent.[43]

Recommendation

ACIL Tasman derived an equity beta of 1.75 in estimating a WACC that it argued represented an investment hurdle rate for generation businesses in the NEM. The Allen Consulting Group considers this value to be an important point of reference, and is accorded as such in the eastern states, corresponding to a market generation business.[44]

Available capital market evidence indicates equity beta values (at 40 per cent gearing) for electricity generation businesses of between 0.83 and 0.95. By comparison, capital market evidence indicates equity beta values for similarly geared energy transmission and distribution businesses of between 0.33 and 0.53.

Regulatory precedent is limited to determinations on energy transmission and distribution businesses, and comprises determinations of equity beta values (at 40 per cent gearing) of about 0.67, although with some lower values applied in recent determinations.

Determination of an equity beta value is ultimately a subjective judgement, albeit informed by capital market evidence.

On balance, the Allen Consulting Group recommends that an equity beta of 0.83 be adopted for calculating the WACC to apply in setting the Maximum Reserve Capacity Price, as provision of capacity in Western Australia's wholesale electricity market is:

- less risky than market generation in the NEM (that is, the equity beta should be less than 1.17) — due to the effects of a long term contract covering determining revenue for the first ten years and the effects of the administered capacity pricing regime thereafter; and
- more risky than regulated transmission and distribution businesses (that is, the equity beta should be greater than 0.67, if past regulatory precedents are used as the reference point) — which arises from the fact that:
  - the investor would face price risk after the expiry of the long term contract;
  - the fact that revenue is fixed for twice the length of the typical regulatory period will expose the investor to greater interest rate risk than the typical regulated entity; and
  - the fact that the maximum price is calculated with reference to hypothetical costs rather than actual costs will impose greater risk, both at the start of the project (that is, if the maximum price caps the outcome available under the long term agreement) and when the administered price is re-calculated

43 Essential Services Commission 2007, *Gas Access Arrangement Review 2008-2012*, Draft Decision, 28 August 2007.

44 We note that while the ACIL Tasman derived equity beta of 1.75 appears to be very high, this reflects in large part the assumed gearing level of 60 per cent debt to assets, and in reality implies that generation is only marginally more risky than the firm of average risk (once adjustments are made for gearing).

annually (that is, as the maximum price will feed into the administered price, which will be received after year 10).

A value of 0.83 is consistent with the lower end of the risk profile of a portfolio of internationally listed electricity generation businesses.

Chapter 7

The variable "*k*"

7.1 Introduction

As noted previously, the methodology for calculating the Maximum Reserve Capacity Price is set out in Appendix 4 of the Market Rules, and establishes a price that is set to recover:

- a return on the value of assets (in this case, the cost of constructing an OCGT peaking plant and connecting it to the electricity transmission network) based on:
  - (double) the equipment price for the turbines (in American dollars, adjusted for US inflation and converted to Australian dollars)[45];
  - a 15 per cent margin for legal, approval and financing costs;
  - network connection and augmentation costs; and
  - the costs associated with constructing on-site fuel storage capacity equivalent to 24 hours fuel burn, and maintaining storage levels equivalent to 12 hours fuel burn;
- a return of the value of the OCGT peaking plant's capital costs over 15 years; and
- the fixed operating and maintenance costs of the peaking plant.

The methodology allows for all capital and fixed costs to be recovered through the Maximum Reserve Capacity Price — that is, all costs other than costs associated with actually generating electricity from the plant.

Within the formulae used to determine the Maximum Reserve Capacity Price, the variable "*k*" is established at a value that equates the net present value of 10 years worth of payments escalated at a rate of CPI-1 per cent with the payment stream from 10 years worth of unescalated payments.

The IMO required that the Allen Consulting Group review the methodology and model currently used to calculate *"k",* and, in the event that these were considered incorrect or inappropriate, propose a new methodology and provide a new model as a Microsoft Excel spreadsheet.

7.2 Objective in setting the Reserve Capacity Price

The determination of the Maximum Reserve Capacity Price is directly analogous to determining a regulated price for an infrastructure service.

Determination of prices for (regulated) infrastructure services is generally undertaken with the objective of determining prices that are sufficient to generate a stream of revenue equal to the cost incurred in providing the service.

[45] It is understood that the doubling of the equipment price is to convert the equipment price into a plant cost, including construction and land acquisition costs.

Financial calculations applied in determining prices typically take the form of a net present value (NPV) analysis, where all cash flows are discounted into present value terms. The objective is to determine the prices that allows for a revenue stream consistent with a NPV of zero for the project, with a discount rate applied that is equal to the cost of capital for the relevant (notional) infrastructure project, typically expressed as the WACC.

The form of the discount rate depends upon whether cash flows are specified in nominal or real terms:

- if the cash flows are forecast in nominal (or 'money of day') terms, then a nominal WACC is employed; and
- if the cash flows are forecast in real (or 'constant price') terms, then a real WACC is employed.

Further, prices and regulated revenues may be expressed in nominal or real terms. As illustrated using a simple example in Table 7.1 for a notional 15-year project costing $100 in year 0, the revenue or "payment stream" may be specified as either:

- a fixed nominal cash flow (that is, the annual "nominal price") that embodies a forecast of inflation (Column 1); or
- a fixed constant-dollar cash flow (Column 2) (that is, the annual "real price") (Column 2) that is escalated annually for inflation to derive the (nominal) price in any particular year (Column 3).

As shown in Table 7.1, for an asset costing $100, an investor would require an annual fixed nominal payment of $13.92 (in which case the investor bears the risk that the actual inflation rate differs from that forecast), or alternatively an annual fixed constant payment of $11.53 in real terms with annual escalation for realised inflation (in which case, the investor is substantially shielded from inflation risk). In both cases, the NPV of the initial cost and payment streams is zero when calculated with the appropriate nominal or real discount rate.

Table 7.1

NOMINAL AND REAL PAYMENT STREAMS FOR A NOTIONAL REGULATED PROJECT

Year	Constant nominal dollar payment stream	Constant current (real) dollar payment stream	CPI and escalation factor	Nominal dollar payment stream (Column 2 adjusted by Column 3)
	(1)	(2)	(3)	(4)
	Nominal WACC	**Real WACC**	**CPI**	**Nominal WACC**
	11.02%	**7.79**	**3.00%**	**11.02%**
0	($100.0000)	($100.0000)	1.0000	($100.0000)
1	$13.9240	$11.5330	1.0300	$11.8790
2	$13.9240	$11.5330	1.0609	$12.2353
3	$13.9240	$11.5330	1.0927	$12.6024
4	$13.9240	$11.5330	1.1255	$12.9805
5	$13.9240	$11.5330	1.1593	$13.3699
6	$13.9240	$11.5330	1.1941	$13.7710
7	$13.9240	$11.5330	1.2299	$14.1841
8	$13.9240	$11.5330	1.2668	$14.6096
9	$13.9240	$11.5330	1.3048	$15.0479
10	$13.9240	$11.5330	1.3439	$15.4994
11	$13.9240	$11.5330	1.3842	$15.9643
12	$13.9240	$11.5330	1.4258	$16.4433
13	$13.9240	$11.5330	1.4685	$16.9366
14	$13.9240	$11.5330	1.5126	$17.4447
15	$13.9240	$11.5330	1.5580	$17.9680
NPV	**$0.00**	**$0.00**		**$0.00**

Source: Allen Consulting Group

7.3 The variable "*k*" and the Maximum Reserve Capacity Price

The variable *"k "* features in the calculation of the Maximum Reserve Capacity Price as follows:[46]

PRICECAP[t] = **k** X (FIXED_O&M[t] + ANNUALISED_CAPCOST[t] / (CAP/SDF))

Where:

PRICECAP[t] is the Maximum Reserve Capacity Price to apply in a Reserve Capacity Auction held in calendar year t;

[46] Appendix 4 of the Market Rules.

ANNUALISED_CAPCOST[t] is the CAPCOST[t], expressed in Australian dollars in year t, annualised over a 15 year period, using a real pre-tax return to equity equal to the Commonwealth 10 Year Bond Rate (Real) plus a Margin for Equity of 15.1%, a real return to debt equal to the Commonwealth 10 Year Bond Rate (Nominal) plus a Margin for Debt of 1.5%, and a debt to equity ratio of 60:40;

CAP is the capacity of an open cycle gas turbine, expressed in MW;

SDF is the summer derating factor of a new open cycle gas turbine, and equals 1.18;

CAPCOST[t] is the total capital cost, expressed in million Australian dollars in year t, assumed for an open cycle gas turbine power station of capacity CAP; and

FIXED_O&M[t] is the fixed operating and maintenance costs for a typical open cycle gas turbine power station and any associated electricity transmission facilities, expressed in Australian dollars in year t, per MW per year.

k is a factor set so that the net present value of 10 years worth of payments escalated on a CPI-1% basis is equivalent to the payment stream from 10 years worth of an unescalated payments.

7.4 Relevant cash flows

The annual capital cost of the investment in OCGT peaking plant (ANNUALISED_CAPCOST[t]) is determined as an annuity over 15 years, with the discount rate being specified as the real WACC. Note that as the real WACC is used to calculate the annuity, it is assumed implicitly that the plant receives the same real (or 'constant price') payment over its assumed 15 year economic life – only if the payment is escalated fully for inflation will capital costs be recovered (assuming the economic life is 15 years, the WACC is correct, etc.).

Should a proposed OCGT peaking plant be successfully bid into a Reserve Capacity Auction, the price paid for capacity would be determined under a Long Term Special Price Arrangement by annual escalation of the initial bid price by a factor equal to the rate of change in the Consumer Price Index less one per cent (CPI – 1 per cent). That is, the starting payment will not be fully escalated for inflation. It follows that if the price cap applies and if "ANNUALISED_CAPCOST[t]" is used as the starting point for that price cap, then capital costs will not be recovered fully under that cap.[47]

Table 7.2 illustrates this proposition, showing that a payment stream (for the notional 15 year project with an initial cost of $100 — that is "CAPCOST[t]" is $100) based on an initial price that is escalated at CPI-1 per cent per annum would:

- under-recover if the initial price was set equivalent to the fixed constant dollar payment (Column 2) – which is the situation that exists under the Market Rules as described above; and

[47] In order to simplify the analysis, fixed annual operating and maintenance costs (FIXED_O&M[t]) have been excluded from the analysis — this does not impact on the value of the variable "*k*". However, we note that the manner in which the annual value of these costs is calculated differs from that adopted for capital costs. The Allen Consulting Group understands that the present value of FIXED_O&M costs based on the first 15 years of these costs is first calculated (the discount rate that is applied is unknown, but should be the WACC), and that the resultant present value is then divided by the number of years (15) and the size of the OCGT peaking plant (160 MW) to derive an annual cost. This approach may impact on a generator recovering all of its costs, and should be investigated further.

- over-recover, if the initial price was set equivalent to the fixed nominal dollar payment (Column 4) – which is the situation that would arise if "ANNUALISED_CAPCOST[t]" was calculated using a nominal rather than real WACC.

Table 7.2

PAYMENT STREAMS FOR A NOTIONAL REGULATED PROJECT WITH "CPI – 1" PER CENT PRICE ESCALATION

Year	"Unescalated" real payment stream	CPI – 1% escalated payment stream	"Unescalated" nominal payment stream	CPI – 1% Escalated payment stream
	(1)	(2)	(3)	(4)
	Real WACC	**Nominal WACC**	**Nominal WACC**	**Nominal WACC**
	7.79%	**11.02%**	**11.02%**	**11.02%**
		Escalation factor		**Escalation factor**
		CPI-1%		**CPI-1%**
1	$11.5330	$11.5330	$13.9240	$13.9240
2	$11.5330	$11.7636	$13.9240	$14.2025
3	$11.5330	$11.9989	$13.9240	$14.4866
4	$11.5330	$12.2389	$13.9240	$14.7763
5	$11.5330	$12.4837	$13.9240	$15.0718
6	$11.5330	$12.7333	$13.9240	$15.3733
7	$11.5330	$12.9880	$13.9240	$15.6807
8	$11.5330	$13.2478	$13.9240	$15.9944
9	$11.5330	$13.5127	$13.9240	$16.3142
10	$11.5330	$13.7830	$13.9240	$16.6405
11	$11.5330	$14.0586	$13.9240	$16.9733
12	$11.5330	$14.3398	$13.9240	$17.3128
13	$11.5330	$14.6266	$13.9240	$17.6591
14	$11.5330	$14.9191	$13.9240	$18.0122
15	$11.5330	$15.2175	$13.9240	$18.3725
NPV	**$100.0000**	**$91.9759**	**$100.0000**	**$111.0449**

Source: Allen Consulting Group

7.5 Determining the variable "*k*"

The objective in setting the Maximum Reserve Capacity Price should be to ensure that the present value of the payment stream under the Long Term Special Pricing Arrangement is such that the overall NPV of the notional OCGT project is zero.[48]

[48] More specifically, the "*k*" factor should ensure that the present value of revenue under the arrangement is equal to the present value of 10 years of payments set at "ANNUALISED_CAPCOST[t]". We note that the arrangement can only last for ten years, whereas "ANNUALISED_CAPCOST[t]" is calculated on the basis of a 15 year life, and that after the expiration of the arrangement, the maximum price that can be earned by the

In the notional example set out in Table 7.2, this would require that the present value of the payment stream be $100 — the value of the initial capital investment. As also illustrated in Table 7.2, this does not occur where the escalation factor is set at CPI – 1 per cent if "ANNUALISED_CAPCOST[t]" is used as the starting price.

The logical role for the variable "*k*" is to scale-up the unescalated payment stream to equate the present values of the escalated and unescalated payment streams. The value of the variable *"k"* can be determined by solving for the value that achieves this equality, which is a value of 1.0872 for the illustrative notional project (Table 7.3).

Table 7.3

PAYMENT STREAMS AND *k* FACTOR FOR A NOTIONAL REGULATED PROJECT WITH "CPI – 1" PRICE ESCALATION

Year	"Unescalated" real payment stream	CPI – 1% escalated payment stream	*"k"* factor adjusted escalated payment stream
Year	(1)	(2)	(3)
	Real WACC	**Nominal WACC**	**Nominal WACC**
	7.79%	**11.02%**	**11.02%**
		Escalation factor	**"*k*"**
		CPI-1%	**1.0872**
1	$11.5330	$11.5330	$12.5391
2	$11.5330	$11.7636	$12.7899
3	$11.5330	$11.9989	$13.0457
4	$11.5330	$12.2389	$13.3066
5	$11.5330	$12.4837	$13.5727
6	$11.5330	$12.7333	$13.8442
7	$11.5330	$12.9880	$14.1211
8	$11.5330	$13.2478	$14.4035
9	$11.5330	$13.5127	$14.6916
10	$11.5330	$13.7830	$14.9854
11	$11.5330	$14.0586	$15.2851
12	$11.5330	$14.3398	$15.5908
13	$11.5330	$14.6266	$15.9026
14	$11.5330	$14.9191	$16.2207
15	$11.5330	$15.2175	$16.5451
NPV	**$100.0000**	**$91.9759**	**$100.0000**

Source: Allen Consulting Group

generator could be 85 per cent of "ANNUALISED_CAPCOST[t]". This raises some uncertainty as to whether the generator would recover all of its costs under the existing financial model inherent in the Market Rules, and suggests further investigation is warranted of whether the financial model (and hence the Market Rules) should be amended to better achieve the market objectives.

As illustrated by Table 7.3, the effect of the variable *"k"* is to "un-do" the "– 1 per cent" component of the "CPI – 1 per cent" escalation factor by inflating the escalated payment stream to fully compensate the investor for inflation.

However, the payment stream that would be applied under the Long Term Special Price Arrangement is only for 10 years rather than the 15-year period over which the annuity is calculated. For the same notional project, the resultant payment streams, NPV and calculated *"k"* are shown in Table 7.4.

Table 7.4

PAYMENT STREAMS AND "*k*" FACTOR FOR A NOTIONAL REGULATED PROJECT WITH "CPI – 1" PRICE ESCALATION AND A PAYMENT STREAM LIMITED TO 10 YEARS

Year	"Unescalated" real payment stream	CPI – 1 escalated payment stream	k factor adjusted escalated payment stream
Year	(1)	(2)	(3)
	Real WACC	**Nominal WACC**	**Nominal WACC**
	7.79%	**11.02%**	**11.02%**
		Escalation factor	**"*k*"**
		CPI-1%	**1.0655**
1	$11.5330	$11.5330	$12.2882
2	$11.5330	$11.7636	$12.5340
3	$11.5330	$11.9989	$12.7847
4	$11.5330	$12.2389	$13.0404
5	$11.5330	$12.4837	$13.3012
6	$11.5330	$12.7333	$13.5672
7	$11.5330	$12.9880	$13.8386
8	$11.5330	$13.2478	$14.1153
9	$11.5330	$13.5127	$14.3976
10	$11.5330	$11.5330	$12.2882
NPV	**$72.8408**	**$68.2140**	**$72.8408**

Source: Allen Consulting Group

With the payment stream limited to 10 years, the calculated *"k"* and the nominal values of each annual payment, are lower than they would be if the payment stream were determined for the full 15-year period. This is because the longer the period over which the CPI-1 per cent escalation factor applies, the greater the divergence between the two payment streams.

7.6 Recommended method and model

As discussed above, the purpose of the variable *"k"* should be to equalise the present value of the stream of payments under the Long Term Special Price Arrangement with the present value of the future cash flows implied by the calculation of "ANNUALISED_CAPCOST[t]" (that is, a series of payments that start at "ANNUALISED_CAPCOST[t]" and then are fully escalated for inflation).

The preceding analysis represents the appropriate method and model for establishing *"k"*. A detailed spreadsheet model has been provided to the IMO that provides the basis for the preceding tables, and which also calculates *"k"* based on monthly, rather than annual, payments (consistent with the payment frequency under the Long Term Special Price Arrangement). The value of the variable *"k"* when calculated on a monthly basis is 1.0548 (to 4 decimal places)

Current methodology and model

The IMO's current methodology to calculate "*k*" is summarised in Box 7.1. The Allen Consulting Group has also been provided with an electronic copy of the Excel model used by the IMO to calculate "*k*" for the 2009/10 Capacity Year.

Box 7.1

IMO'S DERIVATION OF THE VARIABLE k

The net present value of the unescalated payments is defined by:

$$NPV_{unescalated} = \sum_{t=1}^{n} \frac{C}{(1+r_w)^t}$$

Where:

C is the constant monthly payment

r_w is a monthly real WACC derived by dividing the annual real WACC by 12; and

n is equal to 120

The net present value of escalated payments is defined by:

$$NPV_{escalated} = \sum_{t=1}^{n} \frac{C(1+r_e)^t}{(1+r_w)^t}$$

Where

r_e is the monthly escalation parameter equal to the annual "CPI-1 per cent" escalation factor divided by 12.

Introducing the variable "*k*", the equality between the unescalated and escalated payment streams is:

$$k \times \sum_{t=1}^{n} \frac{C}{(1+r_w)^t} = \sum_{t=1}^{n} \frac{C(1+r_e)^t}{(1+r_w)^t}$$

Normalising C, k is derived as:

$$k = \frac{\sum_{t=1}^{n} \frac{(1+r_e)^t}{(1+r_w)^t}}{\sum_{t=1}^{n} \frac{1}{(1+r_w)^t}}$$

The IMO indicates that the above equations consider an equal and consistent escalation of CPI through the investment period but, in practice, the IMO has used annual CPI forecasts.

Source: IMO 2007, Final Report: Maximum Reserve Capacity Price Review for the 2009/10 Reserve Capacity Year, IMO Report 19, January 2007, p.23.

The following observations are made on the IMO's existing methodology and model.

- There is an inconsistency in the current model:
  - the payment stream resulting from the annuity formula is assumed to be a fixed constant dollar payment stream (real WACC applied to the asset base) and so correctly discounted using a real WACC; but
  - the payment stream under the Long Term Special Price Arrangement is a nominal payment stream and the present value *should* be calculated using the nominal WACC, not the real WACC as occurs in the current model.
- There are errors in deriving the monthly real WACC and monthly CPI – 1 escalator, which should be calculated by taking into account compounding effects rather than simply dividing the annual figure by 12.
- The current model appears inconsistent with the Market Rules, in that payments under a Long Term Special Price Arrangement should be escalated *annually*, and only *after the first year* (that is, the first year of both escalated and unescalated payments should be the same — before being adjusted by "*k*") — the current model escalates payments monthly (including the first payment).
- Finally, the nominal WACC used to discount the payment stream under the Long Term Special Price Arrangement would be calculated using the Fischer equation and a forecast of inflation. This means that care is required to ensure there is consistency between this (single) forecast of inflation and that underpinning the "CPI-1 per cent" escalation under the Long Term Special Price Arrangement (where multiple single year inflation forecasts are currently used by the IMO).[49]

Recommended mathematical expression

Correction of the above inconsistencies and errors indicates the variable *"k"* should to be calculated by the expressions indicated in Box 7.2.

Box 7.2

ALLEN CONSULTING GROUP'S RECOMMENDED DERIVATION OF THE VARIABLE "*k*"

The present value of the unescalated payments is defined by:

$$PV_{unescalated} = \sum_{i=1}^{10}\sum_{j=1}^{12}\frac{C}{\left(1+r_{w_{real}}\right)^{12(i-1)+j}}$$

Where:

C is the unescalated payment;

r_{wreal} is the (effective monthly) real WACC;

i represents the year; and

j represents each month.

49 The Fisher equation is specified as: R = (1 + r) / (1 + i) – 1, where: R is the real risk free rate; r is the nominal risk free rate; and *i* is the rate of inflation. The Allen Consulting Group also notes that the IMO has previously based the "CPI" forecast under the Long Term Special Price Arrangement on forecast Gross Domestic Product increases, which are likely to differ significant from changes in the Consumer Price Index.

The present value of escalated payments is defined by:

$$PV_{escalated} = \sum_{i=1}^{10} \sum_{j=12}^{12} \frac{C\prod_{k=1}^{i}\left[1+r(k)\right]}{\left(1+r_{w_{nominal}}\right)^{12(i-1)+j}}$$

Where:

C is the unescalated payment;

$r_{wnominal}$ is the (effective monthly) nominal WACC;

r(k) represents the inflation rate (CPI-1%) for the previous year and r(1)=0;

i represents the year; and

j represents each month.

Given the present value of the two payment streams must be equivalent, the variable "k" can be defined as follows:

$$PV_{unescalated} = k \times PV_{escalated}$$

It follows that the variable "k" is defined as follows:

$$k = \frac{PV_{unescalated}}{PV_{escalated}}$$

Source: Allen Consulting Group

Chapter 8

Other issues

8.1 Introduction

While addressing the matters within the scope of work, we discovered a number of broader issues with the regime surrounding the Maximum Reserve Capacity Price that we would recommend being analysed further.

These issues suggest that even after correcting the approach to the calculation of the WACC and the variable "*k*", there remains potential for the financial model underpinning the calculation of the Maximum Reserve Capacity Price to result in a price that differs systematically from its stated objective, which was for it to be at "a level slightly higher than the expected cost of a new entrant peaking plant".[50]

These broader issues are set out below, separated into the issues that arise when the Maximum Reserve Capacity Price is being used as an input into setting the administered price for non-auctioned capacity and when it is being used as the price cap for an auction. We also identify a number of issues that are relevant in both cases.

8.2 Maximum Reserve Capacity Price – non-auctioned capacity

- *WACC* – as noted previously, the cost of capital associated with capacity that enters commercially may be higher than that procured through an auction because the former is not underwritten by a long-term contract (and hence is more risky). This could lead to the administered price not being sufficiently high to attract commercial entry (and hence place greater reliance on the use of a Reserve Capacity Auction).
- *Limit on the price* – the fact that the maximum administered price for non-auctioned capacity is 85 per cent of the Maximum Reserve Capacity Price may lead to the administered price not being sufficiently high to attract commercial entry (and hence place greater reliance on the use of a Reserve Capacity Auction).
  - We note the fact that the Maximum Reserve Capacity Price is calculated on the assumption that the life of the OCGT peaking plant is only 15 years may offset this (that is, if the true economic life exceeds 15 years).

[50] Independent Market Operator 2006, *Wholesale Electricity Market Design Summary*, Version 1.2 September 2006, p.31.

- *Implicit indexation* – a new entrant will only recover its costs if the Maximum Reserve Capacity Price is escalated for inflation in each year. This is because the Maximum Reserve Capacity Price is calculated on the basis that it is an indexed annuity. However, the escalation that is applied implicitly to the Maximum Reserve Capacity Price is the change in the input prices. This is because the Maximum Reserve Capacity Price is recalculated each year on the basis of new input prices. Hence, and ignoring the 85 per cent rule above, a new entrant will fail to recover costs if input prices do not keep pace with output price inflation, and will make a windfall if input prices rise at a faster rate than inflation.

8.3 Maximum Reserve Capacity Price – auctioned capacity

- *Term* – the fact that the Long Term Price Arrangement is only for 10 years, after which time the generator would get paid the administered price (which in turn is set at a maximum of 85 per cent of the Maximum Reserve Capacity Price), leaves open the possibility that a generator may not be able to recover its total cost.
  - Again, we note the fact that the Maximum Reserve Capacity Price is calculated on the assumption that the life of the OCGT peaking plant is only 15 years may offset this (that is, if the true economic life exceeds 15 years).

8.4 Other issues

- *Calculation of annual fixed operating and maintenance costs (FIXED_O&M[t])* — there appear to be similarities between these costs and capital costs as in both cases a present value is established in the current year. However, rather than an annuity, the Allen Consulting Group understands that the present value of FIXED_O&M costs (based on the first 15 years of these costs) is divided by the number of years (that is, 15) and the size of the OCGT peaking plant (160 MW) to derive an annual cost.
- *Economic life* — the technical report underpinning the estimate of fixed annual OCGT peaking plant operating and maintenance costs indicates the assumed operating life of an OCGT peaking plant is 30-years. If the economic life of the plant were equal to the operating life (or at least greater than 15 years), this would be expected to result in a price (revenue) that unambiguously over recovers costs.

Appendix A

Scope of Works

The IMO seeks advice on the two finance related aspects to the methodology. These are:

- Use of the Weighted Average Cost of Capital (WACC) in determining annualised capital costs.
- Definition of the term D in Appendix 4 of the Market Rules which is represented at present as the real interest rate on debt.

Under the current Market Rules, the term D is defined to be the real interest rate on debt and equals the Commonwealth 10 Year Bond Rate (real) plus a margin for debt equal of 1.5%.

The issue of WACC determination and the D-term above are related and it is expected that an analysis of the WACC could lead to re-definition of the D-term (specifically the margin for debt) in the Market Rules.

The Consultant is required to:

- Provide advice and analysis of the available methods that can be used to calculate the WACC.
- Propose which method should be adopted for the determination of the Maximum Reserve Capacity Price.
- Propose appropriate parameters for the selected methodology.
- Recommend the WACC to be used for the determination of the Maximum Reserve Capacity Price.
- Recommend the appropriate value of D to be used for the determination of the Maximum Reserve Capacity Price.

Appendix 4 of the Market Rules also includes a parameter termed "*k*", which is defined as:

> "*k*" is a factor set so that the net present value of 10 years worth of payments escalated on a CPI-1% basis is equivalent to the payment stream from 10 years worth of an unescalated payments.

The Consultant is required to review the methodology and model currently used by the IMO. In the event that the existing methodology and model is deemed insufficient, the Consultant is required to propose a new methodology and provide a new model as a Microsoft Excel spreadsheet.

The Consultant is to provide advice on the appropriateness of the following definition included as part of Appendix 4 of the Market Rules:

> ANNUALISED_CAPCOST[t] is the CAPCOST[t], expressed in Australian dollars in year t, annualised over a 15 year period, using a real pre-tax return to equity equal to the Commonwealth 10 Year Bond Rate (Real) plus a Margin for Equity of 15.1%, a real return to debt equal to the Commonwealth 10 Year Bond Rate (Nominal) plus a Margin for Debt of 1.5%, and a debt to equity ratio of 60:40.

The IMO requires advice in respect of the use of the term "(Nominal)" in the above rule. The IMO believes the statement should read:

> ANNUALISED_CAPCOST[t] is the CAPCOST[t], expressed in Australian dollars in year t, annualised over a 15 year period, using a real pre-tax return to equity equal to the Commonwealth 10 Year Bond Rate (Real) plus a Margin for Equity of 15.1%, a real return to debt equal to the Commonwealth 10 Year Bond Rate (Real) plus a Margin for Debt of 1.5%, and a debt to equity ratio of 60:40.

The Consultant is required to provide advice on the appropriateness of this change so that the rule is consistent with normal practices. However, it is noted that the outcome of the WACC components of this work package may require a different definition of the above rule, which should be proposed by the Consultant as part of the Contract if applicable.

Appendix B
Generation companies

This appendix provides a general description of the generation companies that have been selected in establishing capital market evidence to guide recommendations on the gearing and credit rating and equity beta for an OCGT peaking plant.

Table B.1
COMPARATOR CHARACTERISTICS: ELECTRICITY GENERATION

Code/ Company/ Country	Operations
AES AES Corporation	The AES Corporation acquires, develops, owns and operates generation plants and distribution businesses in several countries. The Company sells electricity under long term contracts and serves customers under its regulated utility businesses.
AFK Arendals Fossekompani (Norway)	Arendals Fossekompani ASA is a Norway-based company which is engaged primarily in the ownership and operation of three hydroelectric power plants located in the region of Arendal, south Norway. The Company also owns 62.4% of Markedskraft AS, an independent service provider within the Norwegian and European wholesale electricity market, which performs services including market analysis, advisory services, risk management and portfolio management for customers in Norway, Sweden and Germany.
CEN Contact Energy (New Zealand)	Contact Energy Limited is a diversified and integrated energy company, which focuses on the generation of electricity and the sale of electricity and gas in New Zealand.
ENE Energy Developments Limited (Australia)	Energy Developments Limited develops and operates power generation, power transmission, cogeneration and waste-to-energy conversion projects. The Company also operates landfill gas processing plants. The Company has operations in Australia, Asia, the UK and North America.
GLH Great Lakes Hydro Income Fund (Canada)	Great Lakes Hydro Income Fund produces electricity from hydroelectric resources. It owns, operates and manages five integrated hydroelectric generation systems located in Quebec, Ontario, British Columbia, Maine and New Hampshire.
IPR LN **International Power plc**	International Power is an international power generating company. It also provides wholesale production of freshwater through saltwater desalination, production and distribution of steam, district heating via cogeneration, gas transportation and renewable energy.
MXG Maxim Power Corporation (Canada)	Maxim Power Corp. is a diverse power development company which develops thermal and electric energy projects. It performs a range of services with respect to power plant operation, including initial evaluation of power supply needs, engineering, construction and daily operation.
NPI Northland Power Income Trust (Canada)	Northland Power Income Fund was established to acquire the Iroquois Falls Cogeneration Facility and all related and ancillary assets, contracts, and rights. The facility generates electricity and sells it exclusively to Ontario Hydro.
NRG NRG Energy Inc	NRG Energy Inc owns and operates a diverse portfolio of power-generating facilities, primarily in the United States. Its operations include energy production and cogeneration facilities, thermal energy production, and energy resource recovery facilities.

ORA Ormat Technologies	Ormat Technologies designs, develops, builds, owns and operates geothermal power plants. The company also designs, develops, and seeks to own and operate, recovered energy-based power plants using equipment that it designs and manufactures.
RRI Reliant Energy (United States)	Reliant Energy Inc. provides electricity and energy services, focusing on the electric power industry in the United States and Europe. The Company acquires, develops, and operates electric power generation facilities that are not subject to cost-based regulation. Reliant also trades and markets power, natural gas and other energy-related commodities.
TA TransAlta Corporation	TransAlta Corporation is a non-regulated electric generation and marketing company with its growth focused in developing coal and gas-fired generation. It is currently focused on Australia, Canada, the United States, and Mexico.

Source: Bloomberg