Maximum Reserve Capacity Price - WACC methodology

Independent Market Operator of Western Australia

Final report

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pwc

What would you like to grow?

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Executive Summary

Introduction

PricewaterhouseCoopers (PwC) has been engaged by the Independent Market Operator of Western Australia (IMO) to review the appropriate parameters, assumptions, calculations and application of the weighted average cost of capital (WACC) that is applied in determining the maximum reserve capacity price (MRCP). These are set out in the *Market Procedure for: Determination of the Maximum Reserve Capacity Price Version 2* (Market Procedure).

The scope of PwC's engagement is to:

- review any changes in the regulatory environment that have occurred since the 2007 Review and. if appropriate, recommend an appropriately revised methodology to calculate the WACC;
- review the values of parameters applied in the estimation of the WACC;
- consider how the WACC should be applied in calculating the amount of compensation within the MRCP for costs incurred in the "construction phase" of the generic power station project.

A previous review of the WACC determination was undertaken by the IMO in 2007 (2007 Review), involving provision of advice by the Allen Consulting Group.[1]

Conclusions and recommendations

General approach

PwC has approached the assessment of the parameters, assumptions, calculations and application of the WACC by considering what an independent economic regulator would be expected to determine in the same circumstances. Under this approach, PwC has taken into account recent developments in methods applied by Australian economic regulators, recent precedent for the exercise of discretion and, as appropriate, recent capital market data.

WACC methodology

In advice to the IMO for the 2007 Review, the Allen Consulting Group set out the WACC formulae for calculation of both a real or nominal post-tax WACC (the 'Vanilla WACC') and a real or nominal pre-tax WACC (the 'Officer WACC').

These WACC formulae remain the most commonly-applied formulae for determination of WACC values amongst finance practitioners and economic

[1] Allen Consulting Group, November 2007, *Review of the Weighted Average Cost of Capital for the Purposes of Determining the Maximum Reserve Capacity Price*, Report to the Independent Market Operator.

regulators. PwC considers that they remain the preferred WACC formulae for the IMO to apply in determining the WACC.

Which of these forms of the WACC should be applied is ultimately a decision for the IMO. Considerations relevant to this decision are as follows.

- Whether to use a nominal or real WACC is largely incidental as long as the consistency is maintained between the form of WACC and other elements of the calculation of the MRCP.
- Use of a post-tax WACC (in combination with specification of the cost of taxation in the cash flows for the generic power station project) will tend to produce a MRCP that more accurately reflects the cost of taxation to the investor in the generic power station project, although this introduces some additional computational complexity in derivation of the MRCP.
- The Economic Regulation Authority maintains a convention of using a real WACC in its functions of access and price regulation of other infrastructure services in Western Australia, including electricity network services provided by Western Power. The Authority is required to approve the MRCP and use of a real pre-tax WACC may facilitate the ERA's approval. Also, the use of a real pre-tax WACC allows for stakeholders to readily compare the value of the WACC applied in the MRCP and WACC values applied in other Western Australian regulatory determinations.

In this report, indicative values of the WACC are presented as all combinations of nominal and real and pre-tax and post-tax values.

Whichever of these forms of WACC are adopted, PwC recommends that there be no change from the current Market Procedure in the basic methods used to estimate the cost of equity and the cost of debt. That is:

- the cost of equity should continue to be estimated using the Sharpe-Lintner capital asset pricing model (CAPM); and
- the cost of debt should continue to be estimated as a margin over the risk-free rate, with the margin derived from observations of costs of debt in capital markets.

WACC parameters

The Market Procedure distinguishes between a set of WACC parameters for which values should be estimated on an annual basis (minor components) and a set of parameters for which the values determined in this review of the WACC should be applied each year until the next review (major components).

Minor components

The minor components comprise:

- nominal risk free rate;
- forecast rate of inflation;
- real risk free rate of return; and
- debt margin (which should be re-named the debt risk premium).

PwC's recommended methods for annual determination of the values of these parameters are set out below.

- Nominal risk free rate. The 10 year Commonwealth Government Security (Government bond) yield should be applied as the proxy for the nominal risk free rate. This is consistent with the current Market Procedure.
- Forecast rate of inflation. A forecast rate of inflation should be estimated as a forecast rate over 10 years based on short to medium term rates as forecast by the Reserve Bank and longer term rates at the mid-point of the Reserve Bank's target range for inflation.
- Real risk free rate of return. The real risk free rate of return is not directly applied in determination of the WACC but, if stated for illustrative purposes, should be calculated from the nominal yields on 10 year Government bonds and the forecast rate of inflation (calculated through the Fisher equation).
- Debt risk premium. The debt risk premium should be established for a notional 10 year BBB rated bond using estimates of fair value yields for bonds of relevant ratings and term published by Bloomberg. At the current time, Bloomberg does not publish estimates of fair value yield estimates for 10 year BBB rated bonds and PwC recommends that an estimate be derived by extrapolation of the fair value yield curve for 7 year BBB rated bonds by the rise in the fair value yield estimates of AAA rated bonds from 7 to 10 year terms (for the latest published yield estimates for the AAA rated bonds). The IMO should determine whether debt issuance costs that are of an ongoing nature and associated with refinancing of debt are, or are not, included in the separately determined capital cost of the generic power station project and, if not, the debt margin should be derived as the sum of the debt risk premium and debt issuance costs (established as a major component).

The values of these parameters determined at 31 January 2011 are:

- nominal risk free rate – 5.62 per cent;
- forecast rate of inflation – 2.64 per cent;
- real risk free rate of return – 2.90 per cent; and
- debt risk premium – 465 basis points.

Major components

The major components comprise:

- market risk premium;
- equity beta;
- debt issuance costs (if relevant);
- corporate tax rate;
- value of imputation credits (*gamma*); and
- financial structure (gearing).

PwC's recommended values of these parameters are:

- market risk premium – 6.0 per cent;
- equity beta – 0.77;
- debt issuance costs – 12.5 basis points;

- corporate tax rate – 30 per cent;
- value of imputation credits (*gamma*) – 0.50; and
- financial structure (gearing) – 35 per cent.

The recommended value of imputation credits (gamma) is based on regulatory precedent and that this is subject to change pursuant to a direction given by the Australian Competition Tribunal to the Australian Energy Regulator. PwC recommends that this value be re-visited when the Australian Energy Regulator has re-determined the value of gamma in accordance with the direction.

Indicative WACC value at 31 January 2011

An indicative estimate of the WACC is indicated in Table E.1, determined on the basis of values of risk free rates and inflation at 31 January 2011. For comparison purposes, Table E.1 also shows the estimate of the WACC that would result from values of the major components derived in the 2007 Review.

Table E.1 WACC estimates derived from PwC's recommended parameter values, including risk-free rate and inflation values at 31 January 2011

Parameter	Notation		
Nominal risk free rate of return (%)	R_{fn}	5.62	5.62
Expected Inflation (%)	i	2.64	2.64
Real risk free rate of return (%)	R_{fr}	2.90	2.90
		2007 review	**2010 Review**
Market Risk Premium (%)	*MRP*	6.00	6.00
Asset beta	β_a	0.50	0.50
Equity beta	β_e	0.83	0.77
Debt risk premium (%)	*DRP*	1.60	4.65
Debt issuance costs (%)	*d*	0.125	0.125
Corporate tax rate (%)	*T*	30	30
Gamma	γ	0.5	0.5
Gearing	*D/V*	0.40	0.35
Nominal pre-tax cost of debt (%)	R_{fr+DRP}	7.35	10.40
Nominal post-tax cost of equity (%)	$R_{fr} + \beta_e \times MRP$	10.24	10.62
Nominal post-tax WACC (%)	**Vanilla WACC**	**9.31**	**10.29**
Real post-tax WACC (%)	**Vanilla WACC**	**6.50**	**7.45**
Nominal pre-tax WACC (%)	**Officer WACC**	**10.43**	**11.47**
Real pre-tax WACC (%)	**Officer WACC**	**7.59**	**8.60**

Compensation for financing costs during construction

The construction phase of the generic power station project is the time period commencing when investors first commit significant funds to the project and ending when revenues from the project commence. Although revenues are not received during the construction phase, there is still a cost of equity and debt funds committed to the project. An amount of compensation to investors for this cost is typically referred to as the "allowance for funds used during construction" (AFUDC).

The current Market Procedure allows for the AFUDC in the maximum reserve capacity price by including two years of return on the total investment cost of the generic power station project in the capital cost of the project.

PwC considers that the current Market Procedure provides for too high a value for the AFUDC and, as a consequence, substantial over-compensation of investors for the financing costs during the construction period.

It is PwC's view that, for the purposes of simplicity in the market procedure, a rule-of-thumb method for determining the AFUDC provides a reasonable estimate of the AFUDC for the generic power station project, which is to determine the AFUDC as a return on the total investment cost for half of the construction period, which can reasonably be assumed to be one year. This rule of thumb would reduce the AFUDC by approximately 75 per cent from that which would be determined under the current market procedure.

This rule of thumb method can be implemented in the Market Procedure by a change to the CAPCOST formula in the Market Procedure to the following:

$$CAPCOST[t] = (PC[t] \times (1 + M) \times CAP + TC[t] + FFC[t] + LC[t]) \times (1 + WACC)^{\wedge 1/2}$$

Recommended revisions to the Market Procedure

Recommended revisions to the Market Procedure are set out in Appendix A of this report.

1 Introduction

1.1 Background

The method currently applied by the IMO in setting the maximum reserve capacity price (MRCP) is set out in the IMO document *Market Procedure for: Determination of the Maximum Reserve Capacity Price Version 2* (Market Procedure).

The method to be applied by the IMO in determining the MRCP is set out in section 1.14 of the Market Procedure. Under this method, the MRCP is calculated as an annualised cost over a 15 year period of a generic power station project.

The discount rate used in the calculation of the annualised cost is an estimate of the weighted average cost of capital (WACC) for the generic power station project, where that project is assumed to receive capacity credits through the reserve capacity auction and be eligible to receive a long-term special price arrangement through the reserve capacity mechanism.

The WACC is also used to determine an element of cost in the MRCP that is an amount of compensation to the investor in the generic power station project for costs incurred in the approximately two-year period between when the reserve capacity auction is held and when the payment stream for capacity credits is expected to be realised. At present, this amount is calculated as two years return on the estimated capital cost of the generic power station project, with the annual rate of return equal to the WACC.

Under section 1.13 of the Market Procedure, the IMO is required to determine the value of the WACC on an annual basis. Clause 1.13.7 provides for the IMO to determine the WACC on the basis of:

- using the capital asset pricing model (CAPM) as the basis for calculating the return to equity;
- specification of the WACC on a pre-tax basis; and
- calculating the WACC using the standard Officer WACC method.

Clause 1.13.3 of the Market Procedure contemplates that the components of the WACC are classed as a set of 'minor' components that require review annually (risk free rate of return, forecast inflation, debt margin and debt issuance costs) and a set of 'major' components that require review less frequently (market risk premium, beta, corporate tax rate, value of franking credits, financial structure).

The IMO most recently undertook a review of the method used to calculate the WACC and the values of major components in 2007 ('2007 Review'). In doing so, the IMO obtained advice from the Allen Consulting Group.[2]

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[2] Allen Consulting Group, November 2007, *Review of the Weighted Average Cost of Capital for the Purposes of Determining the Maximum Reserve Capacity Price*, Report to the Independent Market Operator.

1.2 Scope of this study

PwC has been engaged by the Independent Market Operator of Western Australia (IMO) to provide advice to assist the IMO in a new review of the method of calculation of the WACC and some other elements of the procedure to determine the MRCP.

The scope of the current review is to:

- review any changes in the regulatory environment that have occurred since the 2007 Review and, if appropriate, recommend an appropriately revised methodology to calculate the WACC;
- review the values of parameters applied in the estimation of the WACC;
- consider how the WACC should be applied to compensate the investor in the generic power station project for costs incurred in the approximately two-year period between when the reserve capacity auction is held and when the payment stream for capacity credits is expected to be realised.

2 Relevant features of the reserve capacity mechanism

2.1 Reserve capacity cycle and reserve capacity auctions

Under the reserve capacity mechanism, market customers (i.e. electricity retailers and some loads) are required to purchase capacity credits in proportion to their energy demand. Capacity credits may be purchased directly from generators or providers of a demand-side-management (DSM) facility through bilateral contracts, or capacity credits are purchased by the IMO and on-sold to market customers.

The set of events and activities governing the procurement of capacity and subsequent delivery of that capacity is termed the 'reserve capacity cycle'. Each reserve capacity cycle occurs over an approximately four year period, with a new reserve capacity cycle being initiated each year. The details of events in the reserve capacity cycle are set out in section 4 of the Market Rules and the timing of events set out in clause 4.1.

The key events in a reserve capacity cycle and the timing of these events are shown in Table 2.

Table 2 Key events of the reserve capacity cycle

Timeline	Actions
Year 1 – January to May	The IMO issues a request for expressions of interest to provide capacity with an indication from existing and potential new market participants of the amount of new generation and new Demand Side Management capacity they are willing to offer to make available as Reserve Capacity (Market Rules clause 4.2.4). Capacity providers submit expressions of interest.
Year 1 – July	The IMO publishes the Statement of Opportunities Report including specification of the reserve capacity requirement for the reserve capacity year commencing in October of year 3 of the reserve capacity cycle.
Year 1 – 5 August	Notification of certified reserve capacity
Year 1 – 10/11 August	Market participants notify the IMO of how much of their certified reserve capacity will be traded bilaterally and how much will be offered to the IMO in the reserve capacity auction. The IMO confirms amounts with each market participant.
Year 1 – 18 August	The IMO confirms the holding or cancellation of a reserve capacity auction. If a reserve capacity auction is to be held, the IMO publishes the amount of reserve capacity required to be procured by the auction and receives reserve capacity offers.
Year 1 – September	The IMO runs the reserve capacity auction and publishes results.
Year 3 – 1 October	"Reserve capacity year" commences Supply of capacity commences and payments from the IMO to suppliers of capacity commence.
Year 4 – 1 October	Reserve capacity year terminates.

Source: Market Rules, section 4.

A capacity provider must have capacity certified by the IMO prior to notification of the IMO that the capacity is to be bilaterally traded or offered to the IMO in a reserve capacity auction. In general terms, certified capacity needs to comprise either capacity in existence or capacity proposed or under construction. For capacity that is proposed or under construction, the provider must have network access secured and must provide evidence that environmental approvals have

been granted or will be granted in time for the facility to meet its reserve capacity obligations.

If the amount of certified capacity indicated by market participants to be traded bilaterally exceeds the reserve capacity requirement, the IMO will cancel the reserve capacity auction.

If the amount of certified reserve capacity indicated by market participants to be traded bilaterally is less than the reserve capacity requirement, the IMO will hold the reserve capacity auction to purchase an amount of certified capacity to meet the shortfall.

Under the process of the reserve capacity auction, market participants offer a price-quantity offer for each generator or DSM facility. The offered price must be less than or equal to the maximum reserve capacity price. The IMO will accept offers in ascending order of the offered price until sufficient certified capacity is secured to meet the reserve capacity requirement. All market participants that sell capacity to the IMO through the reserve capacity auction receive the price of the last offer accepted.

A provider of capacity purchased by the IMO through the reserve capacity auction has the option of entering into a "long term special price arrangement" with the IMO for that capacity to be priced at the reserve capacity price determined by the reserve capacity auction (with annual escalation for inflation) for a period of 10 years.

2.2 Determination of the maximum reserve capacity price

The method currently applied by the IMO in setting the MRCP is set out in the Market Procedure.

Under the Market Rules, the MRCP is used as the price cap for the reserve capacity auction, in the event that an auction is held. The price cap operates by the MRCP being the maximum offer price that can be submitted in a reserve capacity auction.

The method to be applied by the IMO in determining the MRCP is set out in section 1.14 of the Market Procedure. The MRCP to apply for a reserve capacity auction held in calendar year t is PRICECAP[t] where this is to be calculated as:

PRICECAP[t] = (ANNUALISED_FIXED_O&M[t] + ANNUALISED_CAPCOST[t] / (CAP / SDF))

Where:

PRICECAP[t] is the MRCP to apply in a reserve capacity auction held in calendar year t;

ANNUALISED_CAPCOST[t] is the CAPCOST[t], expressed in Australian dollars in year t, annualised over a 15 year period, using the WACC as determined as part of the Market Procedure and updated as required;

CAP is the capacity of an open cycle gas turbine, expressed in MW, and equals 160MW;

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, estimated for an open cycle gas turbine power station of capacity CAP; and

ANNUALISED_FIXED_O&M[t] is the annualised 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.

The value of CAPCOST[t] is to be calculated as:

CAPCOST[t] = (PC[t] x (1 + M) x CAP + TC[t] + FFC[t] + LC[t]) x (1+ WACC)^2

Where:

PC[t] is the capital cost of an open cycle gas turbine power station in year t, expressed in Australian dollars in year t per MW;

M is a margin to cover legal, approval, and financing costs and contingencies;

TC[t] is the cost of electricity transmission assets required to connect an open cycle gas turbine power station to the SWIS, plus an estimate of the costs of augmenting the shared network to facilitate the connection of the open cycle gas turbine power station, expressed in Australian million dollars in year t;

FFC[t] is the fixed fuel costs and must represent the fixed costs associated with an on-site liquid storage tank with sufficient capacity for 24 hours of Liquid Fuel including the cost of keeping this tank half full at all times expressed in Australian million dollars in year t;

LC[t] is the cost of land purchased in year [t]; and

WACC is the Weighted Average Cost of Capital.

The escalation factor applied to CAPCOST[t] of (1 + WACC)^2 comprises two years return on the capital cost of the generic power station project to compensate the investor in the generic power station project for the financing costs incurred in the approximately two-year period between when the reserve capacity auction is held and when the payment stream for capacity credits is expected to commence. In effect, this amount of compensation implies an assumption that the investor incurs all costs of the generic power station two years prior to commencement of the payment stream. The amount of compensation is the financing cost for funding the project costs two years prior the payment stream commencing.

2.3 Determination of the WACC

The method currently applied by the IMO in determining the WACC is set out in section 1.13 of the Market Procedure. This method is for determination of the WACC on the following basis:

- use of the CAPM as the basis for calculating the return to equity;

- specification of the WACC on a pre-tax basis;
- use of the standard "Officer WACC" method as the basis for calculation of a pre-tax real WACC.

The Officer WACC method is stated in the Market Procedure as:

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

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

Where

(a) R_e is the nominal return on equity (determined using the CAPM) 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; and

MRP is the market risk premium.

(b) $R_d = R_f + DRP$

where:

R_f is the nominal risk free rate for the capacity year;

DRP is the debt risk premium for the capacity year.

(c) *t* is the benchmark rate of corporate income taxation, established at either an estimated effective rate or a value of the statutory taxation rate;

(d) γ is the value of franking credits;

(e) *E/V* is the market value of equity as a proportion of the market value of total assets;

(f) *D/V* is the market value of debt as a proportion of the market value of total assets; and

(g) 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.

(h) 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 & 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.

(i) If there are no bonds with a maturity of 10 years on any day in the period referred to in steps (g) and (h), 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.

(j) If the methodology used in Step (i) cannot be applied due to suitable bond terms being unavailable, the IMO may determine the nominal risk free rate and the *DRP* by means of an appropriate approximation.

(k) *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.

3 Method of estimation of the weighted average cost of capital

3.1 What is the cost of capital?

The cost of capital is the return that investors would expect to receive from a project in order to justify committing funds to that investment. It is a level of return on invested capital that is 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 the *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.

The role of the IMO in determining the WACC for the maximum reserve capacity price is similar to the role of an economic regulator estimating a cost of capital to apply in determining regulated prices. In setting regulated prices, the regulator determines an appropriate cost of capital 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 a rate of return on existing and new capital investment that is sufficient to attract investment funds for that investment.

From a regulator's perspective, ensuring that regulated revenue provides a commercial return for the regulated business is important because where revenue falls below commercial returns, future investment in infrastructure is compromised, undermining the quality of service provided to users. Conversely, if regulated returns are set too high, the business would earn a return in excess of their cost of capital. This would distort price signals to consumers and investors, resulting in a misallocation of resources and sub-optimal economic outcomes. Similarly, the role of the IMO in determining the maximum reserve capacity price is to ensure that this price includes a return on investment that is just sufficient to make the investment in capacity commercially attractive.

3.2 How the cost of capital is estimated?

The cost of capital is usually estimated as the weighted average of the costs of equity and debt finance (the WACC), with the weighting being the proportion of equity and debt finance in the capital structure of the relevant business entity. Estimating the cost of capital requires estimating the costs of equity and debt and making a judgement about the optimal capital structure.

The required returns to equity providers cannot be directly observed in capital markets. While the market value of any share-market listed equity can be observed at any time, the returns that investors expect to receive from that share – in dividends and capital gains – cannot be observed. The cost of equity must be estimated using a model drawn from finance theory and practice.

The cost of debt can be directly observed from capital market data. Both the interest payable on loans and the implied return on traded debt instruments (such as corporate bonds) can be observed as the cost of debt.

3.3 Estimating the cost of equity

Four alternative approaches to the estimating the cost of equity were identified and described by the Allen Consulting Group for the 2007 Review.

- Capital Asset Pricing Model – Also known as the CAPM, this approach is used extensively in corporate finance as well as by Australian state and federal regulators. It is a forward looking model that estimates the required return for an asset to be a combination of the risk free rate, and the required yield to compensate for the asset's systematic risk.[3]
- Arbitrage Pricing Theory – This theory postulates that the expected return of an asset is linearly related to its sensitivity to various macroeconomic factors. The theory states that the return on an asset is the risk free rate, plus the sensitivity to the identified macroeconomic factors multiplied by yield premium of each factor in excess of the risk free rate. This methodology is information intensive, and varies with time because the factors that influence returns may change through time.
- Fama-French model – This model can be considered an extension of the CAPM discussed above. The Fama-French model augments the CAPM by adding two additional variables – the difference in the return for small compared to large capitalisation companies, and the difference in the return for stocks with high compared to low ratios of book value of equity to the market value of equity.
- Dividend Growth Model – This model estimates a return on equity based on the company's stock price and dividend payments. It states that the required return on a particular asset is dependent on tomorrow's dividend yield, plus the expected dividend yield growth rate.

Since the 2007 Review there has been an examination of the Fama-French model by the Australian Energy Regulator ('AER') in the context of a determination on the rate of return applied in gas distribution prices for Jemena Gas Networks (NSW) Limited ('Jemena').

Jemena proposed a rate of return that incorporated a return on equity estimated using the Fama-French model. This return on equity was significantly higher than would have been derived by the Sharpe-Lintner CAPM. In support of this proposal, Jemena provided the AER with the following information.

- A report by NERA that applied the Fama-French model to derive the estimate of the cost of equity and that sought to demonstrate that, for specific Australian energy utilities, the Fama-French model provides a better estimate of the cost of equity than the CAPM.[4]
- A second report by NERA providing evidence that the Fama-French model is consistent with the requirements of the National Gas Rules that the estimate of the rate of return be conducted using a 'well accepted' methodology and

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3 Systematic risk refers to risk that is not unique to a particular asset. It reflects risk that cannot be removed through portfolio diversification, and is common throughout the relevant market.

4 NERA, 12 August 2009, *Cost Of Equity – Fama-French Three-Factor Model*, p. Iii.

that any forecast or estimate be 'arrived at on a reasonable basis'.[5] This report cited evidence of a strong reputation of Fama and French, the teaching of their model in universities, and the fact that Morningstar (a commercial provider of investment research) publishes Fama-French betas for the US.

- A report by UK consulting firm Oxera that:
  - verified the analysis undertaken by NERA;
  - indicated that there is evidence supporting, and evidence raising concerns about both the CAPM and Fama-French models; and
  - concluded that there is mixed evidence from Australian studies on the relative performance of the CAPM and Fama-French models.[6]

The AER rejected the proposal for use of the Fama-French model on the grounds that it is not consistent with the requirements of the National Gas Rules that the estimate of the rate of return be conducted using a well accepted methodology and that any forecast or estimate be arrived at on a reasonable basis.[7] The AER expressed concerns that the Fama-French model is empirically driven, lacks a firm theoretical foundation, and provides unstable parameter estimates. The AER also pointed to the findings of the Oxera report that in 25 of the 33 studies comparing the CAPM to the Fama-French model the results could not be statistically distinguished at the 10 per cent level, and the remaining 8 cases provided more support for the CAPM.

Despite the proposal by Jemena for application of the Fama-French model, there has been no change in regulatory practice in Australia. In view of this, PwC recommends that the IMO continue to use the CAPM.

3.4 Form of the WACC

As indicated in the previous section of this report, the Market Procedure currently requires that the IMO determine the WACC as a real, pre-tax value that is calculated using the Officer WACC formula. Relevant considerations in reviewing this approach are the treatment of taxation, the treatment of inflation and the WACC formula.

Treatment of Taxation

In advice provided for the 2007 Review, the Allen Consulting Group set out the options for the IMO in adopting a pre-tax or post-tax form of the WACC.

In the pre-tax form of the WACC, an allowance is made in the WACC for the cost of taxation to the business entity by scaling up the return on equity.

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5 NERA, 19 March, 2010, *Jemena Access Arrangement Proposal for the NSW Gas Networks: AER Draft Decision*, a report for Jemena.

6 Oxera, 28 April, 2010, *Estimating the cost of equity from the Fama-French model*, Prepared for Jemena Gas Networks (NSW) Ltd.

7 AER, 10 February 2010, Draft decision – Public, Jemena Access Arrangement Proposal for the NSW Gas Networks, pp.100 – 121.

In the post tax form of the WACC, taxation liabilities of the business entity are determined separately from the WACC and provision made for these liabilities through, for example, a separate cost allowance in the MRCP.

In the 2007 Review, the Allen Consulting Group correctly identified that the pre-tax approach has an advantage of computation simplicity, but involves making simplistic assumptions about the cost of tax and tends to overstate the cost of taxation, and hence provide over-compensation for the cost of taxation. For the latter reason, a post-tax form of WACC is preferred by most economic regulators in Australia, including the Australian Competition and Consumer Commission and the Australian Energy Regulator. However, the Economic Regulation Authority in Western Australia maintains a convention of using a pre-tax WACC in its functions of access and price regulation of other infrastructure services in Western Australia.

It is the view of PwC that there has been no change in regulatory theory and practice since the report of the Allen Consulting Group that would change the consideration of whether to use a pre-tax or post-tax WACC; that is:

- a post-tax specification of the WACC would generally be preferred for reason of greater accuracy in allowing for a cost of taxation in the costs of the generic power station project, and this specification would be relatively easy to implement; but
- the IMO may prefer to use a pre-tax specification of the WACC for consistency with WACC determinations in other regulatory decisions in Western Australia.

Both pre-tax and post-tax WACC values are presented in this report (Table E.1 of the Executive Summary).

Treatment of inflation

In advice provided for the 2007 Review, the Allen Consulting Group set out the options for the IMO in adopting a real or nominal form of the WACC.

The Allen Consulting Group correctly identified that relevant considerations in selecting a real or nominal form of the WACC relate to issues of consistency in the treatment of inflation in the form of the WACC and other elements in the calculation of the MRCP. PwC is of the view that the following guidance provided by the Allen Consulting Group for consistency in the choice of a nominal or real WACC and other elements of the calculation of the MRCP is still valid.

> *Some simple rules for consistency are that where cash flows are to be discounted:*
>
> - *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.*

As with the treatment of taxation, it is the view of PwC that there has been no change in regulatory theory and practice since the 2007 Review that would change the consideration of whether to use a real or nominal WACC.

WACC Formula

In advice provided for the 2007 Review, the Allen Consulting Group set out the WACC formulae for calculation of both a real or nominal post-tax WACC (the 'Vanilla WACC') and a real or nominal pre-tax WACC (the 'Officer WACC').

These WACC formulae remain the most commonly applied formulae for determination of WACC values amongst finance practitioners. PwC considers that they remain the preferred WACC formulae for the IMO to apply.

The Officer WACC formula is that currently specified in the Market Procedure and reproduced in section 2.3 of this report. The Vanilla WACC formula is set out in Appendix B of this report.

Which of these forms of the WACC to apply is ultimately a decision for the IMO. Considerations relevant to this decision are as follows.

- Whether to use a nominal or real WACC is largely incidental as long as the consistency is maintained between the form of WACC and other elements of the calculation of the MRCP.
- Use of a post-tax WACC (in combination with specification of the cost of taxation in the cash flows for the generic power station project) will tend to produce a MRCP that more accurately reflects the cost of taxation to the investor, although this introduces some additional computational complexity in derivation of the MRCP.
- The Economic Regulation Authority maintains a convention of using a real WACC in its functions of access and price regulation of other infrastructure services in Western Australia, including electricity network services provided by Western Power. The Authority is required to approve the MRCP and this approval may be facilitated by use of a real pre-tax WACC. Also the use of a real pre-tax WACC allows for ready comparison between the value of the WACC applied in the MRCP and WACC values determined in other Western Australian regulatory determinations.

In this report, indicative values of the WACC are presented as all combinations of nominal and real and pre-tax and post-tax values (Table E.1 of the Executive Summary).

4 Cost of capital – market wide parameters

4.1 Introduction

The parameters used to estimate a WACC consists of two groups – the first group represents parameters that are applicable to the market as a whole, and therefore are independent to the type of company or project that is being assessed. The second group represents parameters specific to the company or project, and must be considered based on the nature and risks of the company or project.

The purpose of this chapter is to review the market wide parameters comprising:

- the risk free rate;
- the market risk premium;
- debt and equity issuance costs; and
- taxation and the value of imputation credits (gamma).

The determination of each of these parameters is addressed below. The review of each parameter comprises:

- definition of the parameter;
- a summary of the method of determination adopted from the 2007 Review and incorporated in the current Market Procedure;
- new developments in regulatory and finance theory and practice, and market conditions, that are relevant to the determination of the parameter; and
- PwC's recommendation on either maintaining or changing the current method of determination.

4.2 Risk free rate

Definition

The risk free rate is the return an investor would expect from an asset with no risk. Both the cost of equity and the cost of debt are expressed as margins over and above the risk free rate, with the margin reflecting a compensation for the risk borne by the provider of funds.

The risk free asset is a notional asset and proxy assets with very low levels of risk are usually used to estimate the risk free rate. Finance practitioners and Australian regulators have used implied returns on traded Commonwealth Government Securities (Government bonds) as a proxy measure of the risk free rate.

- A nominal risk free rate can be derived by observing the implied yields of nominal Government bonds.

- A real risk free rate can be derived by either observing the implied yields of inflation-indexed Government bonds or by scaling of the nominal risk free rate by a forecast of inflation using the Fisher equation.[8]

Current Market Procedure and 2007 Review

The current Market Procedure provides for determination of the real risk-free rate by estimating a nominal risk free rate as the annualised yield on Government bonds with a term to maturity of 10 years using average mid-rates published by the Reserve Bank of Australia averaged over a 20 trading day period. Where there are no bonds with a maturity of 10 years for a relevant trading day period, the nominal risk free rate is determined by interpolating on a straight line basis from the two bonds closest to the 10 year term.

A real risk free rate is not applied directly in determination of the real WACC. Rather, a nominal WACC is determined and adjusted to a real risk free rate using a formula equivalent to the Fisher equation and applying a forecast rate of inflation determined having regard to the inflation forecasts of the Reserve Bank of Australia, the Western Australian Department of Treasury and Finance and financial market participants.

In advice provided for the 2007 Review, the Allen Consulting Group recommended against estimating the real risk free rate by observed yields on inflation-indexed Government bonds due to a suspect downward bias, at the time, of yields on inflation-indexed Government bonds. Instead, the Allen Consulting Group recommended determining a forecast of inflation by reference to inflation forecasts of the Reserve Bank of Australia, financial institutions and governments; and deriving a real risk free rate by use of the Fisher equation.[9] The Allen Consulting Group has subsequently changed this approach to estimating a real risk free rate from observations of annualised yields on inflation-indexed Government bonds, and determining an implied forecast of inflation by applying the Fisher equation and the nominal and real risk free rates.[10] The reasons for this change have not been stated.

New developments

Nominal risk free rate

During the five year period leading up to the 2007 Review, capital markets world-wide exhibited the lowest levels of volatility for several decades. The

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8 $R_f^{real} = \frac{1+R_f^{nominal}}{1+i} - 1$ where R_f^{real} is the real risk free rate, $R_f^{nominal}$ is the nominal risk free rate i is the inflation rate.

9 Allen Consulting Group, November 2007, *Review of the Weighted Average Cost of Capital for the Purposes of Determining the Maximum Reserve Capacity Price*, Report to the Independent Market Operator, p. 28.

10 Allen Consulting Group, October 2010, Update of WACC Minor Parameters f9or the Purpose of Determining the Maximum Reserve Capacity Price, Report to the Independent Market Operator, pp. 8, 9.

global financial crisis has materially raised perceptions of risk in capital markets, with consequences for returns on Government bonds. This raises the question of whether the observed yield on Government bonds remains an acceptable proxy measure of the risk free rate, or whether there is an element of short-term bias in the observed yield.

This question is examined below addressing, in turn:

- whether there has been an impact of the global financial crisis on government-bond yields; and, if so
- whether this effect is currently material.

The global financial crisis unfolded over the 2007/08 financial year, with its worst effects extending through calendar year 2009. During this period the Australian bond market was virtually closed down, with no issue of new corporate bonds for some time. As prices in share markets tumbled, there was a 'flight to quality', with very high investor demand for Government bonds and a consequent effect of driving up the bond price and reducing yields. At the height of the crisis the yield on 10 year Government bond yield was below 4.5 per cent, which was 1 to 1.5 percentage points lower than in the previous five year period.

From 2007 to 2009 a number of reports by NERA and CEG questioned the appropriateness of the yield on Government bonds as a proxy for the risk free rate.

NERA argued that the yield of CGS securities is biased downwards on account of the fact that CGS have particular benefits (e.g. greater liquidity and 'convenience yield') than other similar default-free securities.[11]

CEG argued that the CGS yield was downwardly biased citing evidence of:

- an increase in the spread between Commonwealth Government Securities and state government debt yields;
- a large spread between the yield on Commonwealth Government Securities and Commonwealth Government guaranteed debt; and
- a large drop in the spread between Commonwealth Government Securities and inflation-indexed Commonwealth Government Securities.[12]

During the past year Government bond yields have risen to levels that are comparable with yields that existed prior to the global financial crisis. During the global financial crisis the convenience yield (measured as the difference between the yield on 10 year Commonwealth Government Securities and the 10 year Credit Default Swap) rose to 120 basis points, which was 76 basis points higher than the historical relationship measured over the period from 1991 to 2010. In these circumstances, an adjustment to the risk free rate was potentially justified. However, the current differential between the yield on 10 year Commonwealth Government Securities and the 10 year Swap yield is now close

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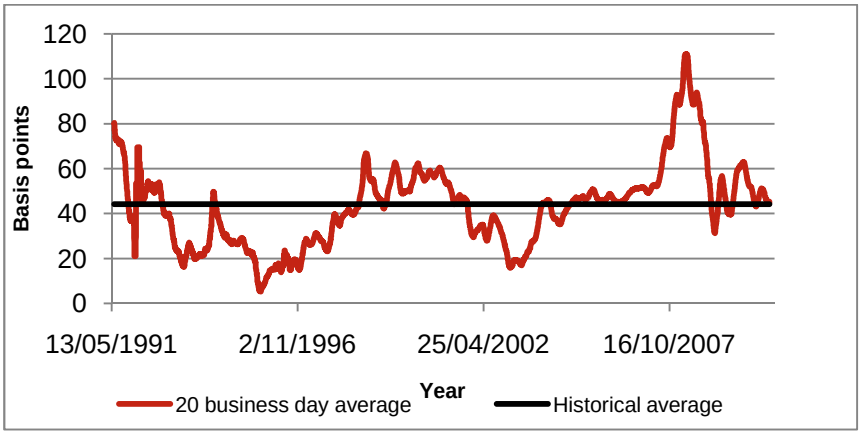
[11] NERA, *Bias in Indexed CGS Yields as a Proxy for the CAPM risk free rate,* March 2007

[12] CEG, *CGS as a proxy for the risk free rate – A report for the JIA,* January 2009

to the historically average differential (Figure 4.1). As such, it appears that the distortion of the market for Government bonds during the period of the global financial crisis has diminished.

Figure 4.1 Difference between the 10 year bank bill swap rate and yield on 10 year government bonds



Source: Bloomberg

Inflation rate and real risk-free rate

The current Market Procedure provides for determination of a forecast of inflation by reference to inflation forecasts of the Reserve Bank of Australia, the Western Australian Department of Treasury and Finance and financial market participants. A real risk-free rate is not directly applied in determination of the real WACC, but may be derived for illustration purposes by adjusting the nominal risk free rate for inflation using the Fisher equation.

The use of this approach to determine the inflation rate and the real risk free rate developed in regulatory practice at around the time of the 2007 Review in response to concerns by regulators over a decline in issues of inflation-indexed bonds and the possibility of a downward bias in observed yields on these bonds as a result of their limited supply.

In PwC's view, there has been no change to this situation. There has also not been any change to regulatory practice. PwC therefore recommends that the IMO maintains the current general approach to estimating the real risk-free rate and inflation rate.

Regulators generally estimate future inflation rates by reference to Reserve Bank of Australia forecasts for the short to medium term, and the mid-point of the Reserve Bank's target range for inflation in the longer term. For example, in the recent decision on the Victorian electricity distribution network service providers (DNSPs), the AER derived a 10 year inflation forecast of 2.57 per cent based on a medium term forecast of inflation of 2.75 per cent to December 2011 and 3.00 per cent to December 2012, based on forecasts presented in the Reserve Bank of Australia's August 2010 *Statement on Monetary Policy*, and a longer term forecast of inflation at 2.5 per cent, being the mid-point of the Reserve Bank's target range for inflation.

Recommendation

PwC recommends that the IMO:

- continue to estimate the annual nominal risk free rate by taking a 20 business day average of annualised yields of ten year term to maturity Government bonds (which was 5.62 per cent for the 20 business days to 31 January 2011); and
- estimate an inflation forecast by reference to other published inflation forecasts.

In deriving an inflation forecast, PwC recommends that the IMO have primary regard to the medium term inflation forecast of the Reserve Bank of Australia and a longer term inflation forecast at the mid-point of the Bank's target range for inflation. This is consistent with the practice of most regulators throughout Australia. As the Reserve Bank of Australia has regard to a range of factors and information sources in deriving its medium-term forecast, PwC considers that provision in the market procedure for the IMO to also have regard to other information sources does not add to the rigour of deriving a forecast.

In its latest Statement on Monetary Policy (February 2011), the Reserve Bank makes medium term forecasts of inflation of 3.00 per cent to December 2011, 3.00 per cent to December 2012, and 3.00 per cent to June 2013. Taking the Reserve Bank's June 2013 forecast as a forecast for the whole of 2013, the 10-year inflation forecast is derived as a geometric average of forecast annual rates as shown in Table 4.1.

Table 4.1 Calculation of forecast inflation (per cent)

Dec 2011	Dec 2012	June 2013	Dec 2014	Dec 2015	Dec 2016	Dec 2017	Dec 2018	Dec 2019	Dec 2020	Geom. Ave.
3.00	3.00	3.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.64

Source: RBA, (February 2011) *Statement on monetary policy*, p.60

Parameter values for the nominal risk free rate, forecast inflation rate and the implied real risk free rate as of 31 January 2011 are shown in Table 4.2.

Table 4.2 Forecast risk free rates and inflation

Parameter	Forecast
Nominal risk free rate	5.62%
Inflation rate	2.64%
Real risk free rate	2.90%

Source: PwC analysis

4.3 Market risk premium

Definition

The market risk premium (MRP) is a value reflecting the price of risk in the market. That is, it provides a measure of how much compensation in excess of the risk free rate investors require in order to accept average market risk. The MRP is a major determinant of the WACC.

The MRP is a variable that is not observable, and is difficult to quantify. In theory the MRP should reflect forward-looking market expectations but, as these are difficult to measure, reliance is often placed on historical data, in particular the historical difference between realised market returns and the risk free rate of return.

Current Market Procedure and 2007 Review

The current Market Procedure provides for application of a MRP of 6.0 percentage points.

In advice provided for the 2007 Review, the Allen Consulting Group recommended the MRP of 6.0 based on:

- capital market observations of historical returns to equity;
- studies attempting to estimate 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, in particular suggesting that the forward-looking MRP may be lower than suggested by historical measures.

New developments

In a review of WACC parameters during the period of the global financial crisis, the Australian Energy Regulator (AER) raised the value of the MRP from 6.0 to 6.5 for reason of a consideration that the level of stock-market volatility had increased and resulted in an increase in investors' expected MRP.[13] The AER contemplated two possible future scenarios for the MRP:

- the prevailing medium term MRP is above the long term MRP, but will return to the long term MRP over time, or
- there has been a structural break in the MRP and the forward looking long-term MRP (and consequently also the prevailing) MRP is above the long term MRP that previously prevailed. [14]

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13 AER, May, 2009, *Final decision – Electricity transmission and distribution network service providers: Review of the weighted average cost of capital (WACC) parameters.*

14 AER, May, 2009, p.238.

The AER did not take a view of which of these scenarios is more likely, but in any case concluded that there was persuasive evidence to depart from the previously adopted MRP of 6 per cent, and proposed an MRP of 6.5 per cent to be applied in WACC determinations for the period 2009 to 2015.

More recently, the ACCC has reversed this position on the MRP, with the ACCC in its recent final decision on Australia Post arguing that post GFC market conditions have improved and that a MRP of 6.0 per cent is now appropriate.[15]

Recommendation

PwC recommends a value of the MRP of 6.0 per cent taking into account an emerging regulatory position for a reversion to a long-standing position of adopting an MRP of 6.0 per cent after contemplating a higher value of 6.5 per cent for a period during and after the global financial crisis.

4.4 Debt and equity issuance costs

Definition

Debt and equity issuance costs refer to costs of securing debt and equity finance.

In keeping with the regulatory benchmarking approach applied in Australia, debt and equity issues costs are typically considered by regulators as representative or benchmark costs, rather than the actual costs incurred by businesses.

Current Market Procedure and 2007 Review

The current Market Procedure contemplates debt issuance costs being included as a parameter in the WACC as a percentage increment to the cost of debt, with the value treated as a minor parameter with a value determined annually.[16] It is observed, however, that the formulae for the WACC and the nominal return on debt as set out in the Market Procedure do not explicitly include the debt issuance cost as an increment in the cost of debt.

In advice provided for the 2007 Review, the Allen Consulting Group noted that the formula for the capital cost used to calculate the MRCP includes a margin "M" for "legal, approval and financing costs and contingencies". The Allen Consulting Group advised that under the current methodology, debt issuance and equity raising costs may already be provided for in this margin to the capital cost and, if so, a separate allowance should not be included in the calculated WACC.

The Allen Consulting Group further indicated that if an amount for debt issuance costs were to be included in the WACC, a value of debt raising transaction costs

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[15] ACCC, May 2010, Australian Postal Corporation – Decision, p.80.

[16] *Market Procedure for: Determination of the Maximum Reserve Capacity Price Version 2*, p. 10.

of 12.5 basis points should be added to the debt margin based on regulatory precedent.[17]

New developments

In considering debt and equity raising costs under the provisions of the current Market Procedure, a distinction can be made between construction and operating periods of the generic power station project.

- *Construction period* - debt and equity raising transaction costs form part of the capital cost of the generic power station project and are capitalised into the capital cost of the project.
- *Operating period* – during the operating period of the generic power station debt raising transaction costs will be incurred. These will be on-going costs associated with re-financing of debt and may be appropriately compensated for through the WACC.

It is common regulatory practice in Australia to include an allowance for debt raising costs in the WACC regardless of the inclusion of financing costs in the capital costs of assets, although with some attention being given to ensuring that this allowance reflects only costs associated with debt re–financing in an operating company and not costs of an initial raising of debt that are capitalised into the regulatory asset value of the relevant asset. It would be consistent with this regulatory practice for the IMO to include an allowance for debt raising transaction costs in the WACC, although the IMO should also seek to ensure that there is no double counting of these costs in financing costs that are included as an element of initial capital costs of the generic power station project.

Since the Allen Consulting Group's 2007 report, most Australian regulators apart from the AER and ACCC have continued to apply the 12.5 basis points assumption for debt raising transaction costs.

The AER has recently re-estimated the costs of debt-raising costs (as a mark up on the cost of debt) at 10.7 to 10.9 basis points per annum for one standard sized bond issue of $250 million, and lower values down to a range of 8.9 to 9.1 basis points for a bond program of 10 issues raising $2,500 million in debt.[18]

Recommendation

PwC recommends that no allowance be made in the WACC for equity raising costs but rather that these costs are allowed for in the maximum reserve capacity price through the margin "M" in the formula for the capital cost of the generic power station project.

PwC recommends that the allowance for debt raising costs continue to be made through the WACC as an increment to the cost of debt, subject to the IMO

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17 Allen Consulting Group, 2007, p.31.

18 AER, October, 2010, *Final decision – appendices: Victorian electricity distribution network service providers, distribution determination 2011 – 2015*, p.479.

ensuring that there is no double counting of ongoing debt transaction costs in the initial capital cost of the generic power station project.

The capital cost of the generic power station project is likely to be less than $600 million, and require only one standard bond issue of less than $250 million for debt finance. The AER's recent estimates of debt raising costs indicate that an appropriate allowance for debt raising costs would be close to 11 basis points.

PwC considers that a margin of 11 basis points is not materially different from the currently adopted value of 12.5 basis points and recommends that the value of 12.5 basis points continue to be applied.

PwC also recommends that:

- the formula for the nominal return on debt in the Market Procedure be revised to explicitly include the increment for the debt issuance costs, with the debt margin defined as the sum of the debt risk premium and the debt issuance cost; and
- the parameter for the debt issuance costs be defined as a major component, and hence not be subject to annual determination.

4.5 Taxation and imputation credits

Definition

Compensating for the costs of taxation and the benefits of imputation credits can occur through cost modelling (in a post-tax WACC) or alternatively through the WACC (in a pre-tax WACC). Imputation credits, or franking credits, are received by Australian resident shareholders for corporate tax paid at the company level when they are determining their personal tax liability. This occurs due to Australia's dividend imputation system, and is used to prevent double taxation of distributed corporate profits

Under the regulatory approach applied in Australia, the value of imputation credits as a proportion of their face value (gamma, γ) is defined as the product of the imputation credit 'distribution ratio' (F), and the 'utilisation rate' (theta or θ):

$$\gamma = F \times \theta$$

If the costs of taxation and benefits of imputation credits are compensated through the WACC, assumptions need to be made about the effective corporate tax rate and the value of franking credits.

Current Market Procedure and 2007 Review

The current Market Procedure provides for estimation of a pre-tax WACC on the basis of a taxation rate of 30 per cent and a gamma value of 0.5.

In advice provided for the 2007 Review, the Allen Consulting Group recommended a taxation rate of 30 per cent, equal to the statutory corporate income tax rate and a gamma value of 0.5 based on capital market evidence

supporting use of a gamma value of between 0.4 and 0.8 and regulatory precedent for a value of 0.5.

New developments

Taxation rate

Australian regulators that specify rates of return as a pre-tax WACC (including the Economic Regulation Authority) have continued to apply the corporate taxation rate as the cost of tax, which remains at 30 per cent.

It would be open to the IMO to estimate an effective rate of tax and apply that rate rather than the corporate tax rate. In this regard, it is observed that a recent study of new entry and generation costs in the National Electricity Market assumed an effective tax rate of 22.5 per cent.[19] To apply an effective tax rate of less than the corporate tax rate would, however, depart from Australian regulatory practice.

Imputation credits

Extensive consideration was given to the value of imputation credits by the AER in its review of WACC parameters that was concluded in May 2009.[20]

The AER concluded that a value of 0.65 is the most reasonable estimate of gamma, based on:

- adoption of a distribution ratio of 1, which was held to be consistent with the Officer WACC framework; and
- a utilisation rate (theta) of 0.65 determined as the average of a lower bound estimate of 0.57 based on a 'dividend drop-off' study[21] and an upper bound estimate of theta of 0.74 based on a study of the utilisation of imputation credits from Australian Taxation Office statistics.[22]

This determination of the AER has been bought into question by an appeal to the Australian Competition Tribunal ('the Tribunal') by Energex Limited, Ergon Energy Corporation Limited, and ETSA Utilities.[23] In the determination of the Tribunal:

- the AER conceded that it had erred in assigning a value of 1 to the distribution ratio and accepted that the distribution ratio of 0.71 derived from

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19 ACIL Tasman, April, 2009, *Final Report – Fuel resource, new entry and generation costs in the NEM*, Report prepared for the Inter-Regional Planning Committee (AEMO), p. 22.

20 AER, May, 2009, pp. 393-469.

21 D. Beggs and C.L. Skeels, September, 2006, 'Market arbitrage of cash dividends and franking credits,' *The Economic Record*, Vol. 82, No. 258.

22 John C. Handley and Krishnan Maheswaran, March, 2008, 'A measure of the efficacy of the Australian imputation tax system,' *The Economic Record*, Vol. 84, No. 264.

23 Application by Energex Limited (No 2) [2010] ACompT 7, 13 October 2010.

Hathaway and Officer (2004) is the average annual ratio of the amount of credits distributed in a year to the amount of credits created in a year;[24] and

- the Tribunal came to the view that there is persuasive evidence to justify a departure from the AER's value of 0.65 for the utilisation ratio on the basis that the AER made a material error of fact and exercised its discretion incorrectly.

The Tribunal did not correct the errors, but directed the AER to re-examine the values of the distribution ratio and utilisation ration, and hence the value of imputation credits. The AER has not published any further determination as of the date of this report.

Recommendation

PwC recommends that a tax rate of 30 per cent be applied in determination of a pre-tax WACC, consistent with the current Market Procedure.

PwC recommends that a gamma value of 0.50 should continue to be applied consistent with the current Market Procedure pending the AER's redetermination of this value in accordance with the direction of the Australian Competition Tribunal.

[24] N. Hathaway and B. Officer, November, 2004, *The Value of Imputation Credits – Update 2004*, Capital Research Pty Ltd.

5 Cost of capital – project specific parameters

5.1 Introduction

This chapter addresses the second group of WACC parameters – project-specific parameters. These parameters must be estimated taking into account the risks and characteristics of the project or asset in question.

The project-specific parameters refer to the following parameters:

- gearing and credit rating;
- cost of debt; and
- equity beta.

The project specific parameters either comprise or reflect benchmark assumptions about the generic power station project. Determining values for these parameters involves determining settings for these benchmark assumptions informed by current practices in financing similar projects and relevant capital market data.

Determination of each of these parameters is addressed below. The review of each of the parameters comprises:

- definition of the parameter;
- a summary of the method of determination adopted from the 2007 Review and incorporated in the Market Procedure;
- new developments in regulatory and finance theory and practice, and market conditions, that are relevant to the determination of these parameters; and
- PwC's recommendation on either maintaining or changing the current method of determination.

5.2 Gearing and credit rating

Definition

The financial structure of the investment in the generic power station project refers to the proportions of debt and equity finance in the funding of the investment. More specifically, gearing is the proportion of debt to total asset value, typically determined as the ratio of the book value of debt to the sum of the book value of debt and market value of equity. The level of gearing is determined as a benchmark assumption for an efficient business undertaking the investment.

The credit rating of the generic power station project refers to the notional credit rating that would be expected to apply to the owning business by a reputable credit rating agency if that business were geared at the benchmark level of gearing.

Current Market Procedure and 2007 Review

The current Market Procedure provides for an assumed financial structure of 40 per cent debt to assets and for determination of a debt margin based on an assumed credit rating of BBB+.

In the advice provided for the 2007 Review, the Allen Consulting Group recommended these parameter values on the basis of:

- an average of observed levels of gearing for listed generation businesses of 35 per cent and a range of credit ratings of B to BBB+; and
- a judgement that the total risk associated with investment in capacity for sale under the Reserve Capacity Mechanism would be less than for a typical generation business that only sells into an energy market, thus supporting a higher level of gearing and higher credit rating than a typical generation business.

New developments

PwC has reviewed the assumptions of financial structure and credit rating by examining evidence from entities comparable to the business of the generic power station project.

A sample of 38 electricity generation businesses has been compiled, drawn from a number of western economies. The main characteristics of each business are described in Appendix C. The sample is divided into baseload and intermediate/peaking groups. Gearing levels and average current credit rating were determined for pre and post GFC periods. The summary of results is provided in Table 5.1, and full results provided in Appendix D.

Table 5.1 Gearing estimates and credit rating

Type of generator	Average credit rating	Pre-GFC		Post-GFC
		10 yr average	5 year average	
Baseload	BBB-	36%	36%	35%
Intermittent / Peaking	BBB	36%	30%	23%

Source: Bloomberg

The results show that prior to the global financial crisis (defined as post July, 2007), both baseload and intermediate/peaking plants had the same average gearing levels of 36 per cent. Post-global financial crisis, intermittent/peaking generators have a lower gearing level (being only 23 per cent). This is to be expected, given that intermittent/peaking generators are likely to have less contracted loads and therefore less stable revenue streams than baseload generators, and hence be less capable of supporting greater debt. It is intuitive that in the post GFC period, the gearing of intermittent/ peaking generators has fallen, reflecting the less stable revenue streams.

Credit ratings were available for 23 of the sample businesses and indicate average credit rating levels of BBB- for baseload generators and BBB for intermediate/ peaking generators.

PwC considers that firms receiving 10 years of contracted revenue under the Reserve Capacity Mechanism will have cash-flow characteristics closer to baseload than intermediate/peaking generators. Current evidence suggests a level of gearing of approximately 35 per cent, rather than 40 per cent as applied under the current Market Procedure, and a credit rating of BBB- rather than BBB+ as applied under the current Market Procedure. However, there is a wide range in gearing levels for the baseload generators of 5 to 69 per cent and the view could be taken that the data compiled for this study do not warrant a shift from the current gearing assumption of 40 per cent.

Recommendation

PwC recommends changing the assumptions for gearing and credit rating in accordance with the market evidence presented in this report to a gearing of 35 per cent and a credit rating of BBB. A credit rating assumption of BBB (rather than BBB-) is recommended taking into account the availability of data from Bloomberg for estimating the debt margin (see below).

5.3 Cost of debt

Definition

The cost of debt refers to the return investors require to provide debt finance to the business. The cost of debt is typically expressed as a margin above the risk free rate.

For regulated entities and long-term investments, such as the generic power station project, the cost of debt is typically estimated as the cost of long-term debt instruments, such as fixed coupon bonds with a 10 year term to maturity.

Current Market Procedure and 2007 Review

The current Market Procedure provides for determination of the debt margin as the margin (the debt risk premium) between the observed annualised Australian benchmark corporate bond rate for corporate bonds which have a BBB+ (or equivalent) credit rating from Standard and Poor's 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 and Bloomberg yields averaged over the same 20-trading day period.

In advice provided for the 2007 Review, the Allen Consulting Group recommended this method for determining the debt margin, and estimated a debt risk premium of 159 basis points.[25]

[25] Allen Consulting Group, November, 2007, p.38.

New developments

Since the 2007 review, there have been two developments in estimation of debt margins.

First, Bloomberg has ceased providing an estimate of the 10 year fair value curve for bonds in the BBB range. The longest term data available from Bloomberg is for 7 year BBB bonds. A possible alternative source of data, CBASpectrum, ceased publishing fair value yield curves in September 2010. In response to the limitations on data from Bloomberg, Australian regulators have derived estimates of yield bonds in the BBB range by various methods of extrapolation of the fair value curve for 7 year BBB.

Secondly, there has been a substantial increase in estimates of the cost of debt, with fair value yield estimates derived from Bloomberg data indicating debt margins over the risk free rate for a BBB rated entity of approximately 450 basis points at the current time, compared with approximately 150 basis points at the time of the 2007 Review. The increase in estimates of the cost of debt reflect tighter markets for debt capital and perceptions of greater risk of debt finance subsequent to the onset of the global financial crisis.

In response to limitations on the data available from Bloomberg and concern over the high estimates of the cost of debt, regulators have examined alternative approaches to estimating debt margins.

The AER has recently estimated the debt margin for a 10 year BBB+ bond by a weighted average of an estimate derived from Bloomberg fair value yields and the yield of a single corporate bond:

- 75 per cent weight to the 7 year Bloomberg BBB debt risk premium extrapolated to 10 years using the rise in the Bloomberg AAA bond from 7 to 10 years; and
- 25 per cent weight to the observed debt risk premium for the recently issued Australian Pipeline Trust (APT) BBB rated (approximately) 10 year bond. [26]

While the AER reaffirmed that the Bloomberg fair value yields are 'a reasonable source of information' that can be used in setting the debt risk premium, the AER considered that the observation of a lower debt risk premium on the APT bond indicated that the 7 year BBB Bloomberg fair value yield is likely to overstate the debt margin.

In Western Australia, the Economic Regulation Authority has proposed ceasing to use fair value yield estimates published by Bloomberg as a basis for estimating the debt margin and instead determining a debt margin as a weighted average of observed yields on BBB-/BBB/BBB+ rated bonds of various terms to maturity, with weights corresponding to either the term to maturity of the bonds (with greater weights applied to longer term bonds) or the

[26] Australian Energy Regulator, October, 2010, Final Decision - *Victorian electricity distribution network service providers, Distribution determination 2011 - 2015*, p.509.

value of individual bonds issued (with greater weights applied to bonds with relatively greater value issued).[27]

PwC does not support the AER's approach of weighting an estimate of the debt margin from Bloomberg data with the observed yield of a single corporate bond, considering that there is no demonstrated justification for scaling the Bloomberg data on the basis of an observed yield of another single bond, there is no particular reason to select the APT bond as a source of yield data as opposed to any other bond of similar rating; and there is no justification for the particular weightings applied to the Bloomberg data and the APT bond.

PwC also does not support the Economic Regulation Authority's approach of determining the debt margin by a weighted average of Bloomberg reported yields of individual bonds. The Authority's critique of the Bloomberg estimates of fair value yields is based only on a single test of comparison of Bloomberg fair value yields with yields of individual bonds and does not test the validity of Bloomberg's derivation of yield curves.[28] Moreover, the Authority's proposed method does not produce an estimate of a debt margin for a 10 year c.BBB rated bond, but rather produces an estimate for a bond with a substantially shorter term to maturity.

Recommendation

PwC's task in this study is to recommend a method to determine the debt risk premium that can be reapplied by the IMO on an annual basis.

PwC recommends that the debt risk premium be estimated by extrapolation from fair value yield curves published by Bloomberg. The best method of extrapolation may vary from time to time depending on the nature of fair value yield curves published by Bloomberg. For this report, PwC has estimated the debt risk premium by extrapolation from the 7 year Bloomberg BBB debt risk premium extrapolated to 10 years using the rise in the Bloomberg AAA bond from 7 to 10 years for the most recent 20 day period for which Bloomberg published yields on the 7 year and 10 year A rated bonds (20 trading days to 22 June 2010). For an average of the 20 trading day period to 31 January 2011, this derives a debt risk premium of 465 basis points.

PwC also recommends that the "debt margin" be re-defined in the WACC formulae as the sum of the debt risk premium and the debt issuance costs.

PwC recognises the concerns expressed by the AER and the Economic Regulation Authority that the derivation of a debt risk premium by extrapolation of Bloomberg estimates fair value yields may give rise to a value of the debt risk premium that may overstate the true cost of debt. However, PwC considers that these concerns should diminish as trade in corporate bonds continues to

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27 Economic Regulation Authority, 1 December 2010, Discussion Paper measuring the Debt Risk Premium: a Bond-Yield Approach.

28 For example, relevant further tests could comprise consideration of whether the data that Bloomberg relied upon, being the bond yield input feeds of a number of financial institutions, is sufficiently uniform for Bloomberg to be able to derive a reasonable estimate of the market rate; whether Bloomberg's own estimate of the yield of bonds in its sample a statistically unbiased reflection of the bank feeds provided to it; and whether Bloomberg's fair value curve pass through the centre of its own yield estimates.

become re-established after the global financial crisis and the quality of data used, and estimates published, by Bloomberg improve.

5.4 Equity beta

Definition

The systematic risk (beta) of a business is the measure of how the changes in the returns of the business's stock are related to changes in the returns of the market as a whole. The beta reflects the business's exposure to non-diversifiable risk.

The asset beta of a stock refers to the systematic risk of the firm if it had no gearing. It is estimated by de-levering the equity beta through a de-levering formula.

Current Market Procedure and 2007 Review

The current Market Procedure provides for an equity beta value of 0.83.

These value were based on asset beta data estimated by the Allen Consulting Group for 12 Australian and internationally listed generation businesses with asset beta values ranging from 0.06 to 0.95 and averaging 0.50, and a corresponding average equity beta (at 40 per cent gearing) of 0.83. The asset beta was obtained from equity beta estimates by de-levering through the simple form of the Harris and Pringle formula:

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

Where,

β_a is asset beta

β_e is equity beta

$\frac{E}{V}$ is the value of equity as a proportion of total asset value.

New developments

PwC has reviewed the equity beta value by examining evidence for the same sample of 28 companies that was used in estimating the gearing level. As with consideration of the gearing level, the sample has been split into pre and post global financial crisis periods, and into intermittent/peaking and baseload generation businesses.

The summary of results is provided in Table 5.2, and full results are provided in Appendix E.

Table 5.2 Asset beta estimates

Type of generator	Pre-GFC[1]		Post-GFC
	10 yr average	5 yr average	
Baseload	0.44	0.49	0.51
Intermittent/Peaking	0.66	0.63	0.47

[1] Pre-GFC is defined as before July 2007.

Source: Bloomberg and PwC's analysis

Recommendation

PwC considers that the systematic risk characteristics of a business whose capacity is procured by the IMO will be closer to that of a baseload generator than an intermittent/peaking generator. Taking account of both the post-GFC and pre-GFC beta data PwC recommends that an asset beta of 0.50 be adopted, consistent with the outcome of the 2007 Review.

At a gearing of 35 per cent, the asset beta of 0.50 corresponds to an equity beta of 0.77.

The recommended equity beta of 0.77 is lower than that recently determined for electricity generation in the National Electricity Market by the New South Wales Independent Pricing and Regulatory Tribunal (IPART)[29] (equity beta of 0.9 to 1.1 at 50 per cent gearing) and Acil Tasman[30] (equity beta of 1.75 at 60 per cent gearing). PwC considers that the lower value recommended in this report based on observed asset beta values for baseload generators is appropriate for the purpose of determining a MRCP given that the provider of generation capacity receiving the MRCP would face substantially lower revenue risk than a generator in the National Electricity Market by virtue of the effective guarantee of revenue for a 10 year period.

29 Independent Pricing and Regulatory Tribunal, March 2010, Review of Regulated Retail Tariffs and Charges for Electricity 2010 – 2013.

30 Acil Tasman, April 2009, Final report Fuel Resource, New Entry and generation Costs in the NEM, report prepared for the Inter-Regional Planning Committee.

6 Compensation for financing costs during construction

6.1 Introduction

The final element of the scope of PwC's engagement is to consider how the WACC should be applied in calculating the amount of compensation within the MRCP for costs incurred in the 'construction phase' of the generic power station project.

The construction phase of the generic power station project is the time period commencing when investors first commit significant funds to the project and ending when revenues from the project commence. Although revenues are not received during the construction phase, there is still a cost of equity and debt funds committed to the project. An amount of compensation to investors for this cost is typically referred to as the "allowance for funds used during construction" (AFUDC).

In this chapter, a first-principles approach is taken to estimation of AFUDC consistent with common practices applied in project finance. The method for determination of AFUDC thus derived is compared with the method applied under the current Market Procedure and a 'rule-of-thumb' method for a reasonable assumption of the length of construction period for the generic power station project.

6.2 Current method of determining the allowance for funds used during construction

The current Market Procedure allows for AFUDC in the MRCP by including two years of return on the total investment cost of the generic power station project in the capital cost of the project, derived by escalation of the total investment cost by the factor "(1+ WACC)^2" in the following formula:

CAPCOST[t] = (PC[t] x (1 + M) x CAP + TC[t] + FFC[t] + LC[t]) x (1+ WACC)^2

Where:

PC[t] is the capital cost of an open cycle gas turbine power station in year t, expressed in Australian dollars in year t per MW;

M is a margin to cover legal, approval, and financing costs and contingencies;

CAP is the capacity of the power station in MW;

TC[t] is the cost of electricity transmission assets required to connect an open cycle gas turbine power station to the SWIS, plus an estimate of the costs of augmenting the shared network to facilitate the connection of the open cycle gas turbine power station, expressed in Australian million dollars in year t;

FFC[t] is the fixed fuel costs and must represent the fixed costs associated with an on-site liquid storage tank with sufficient capacity for

24 hours of Liquid Fuel including the cost of keeping this tank half full at all times expressed in Australian million dollars in year t;

LC[t] is the cost of land purchased in year [t]; and

WACC is the Weighted Average Cost of Capital.

Where the total investment cost, TIC, is defined as:

TIC = (PC[t] x (1 + M) x CAP + TC[t] + FFC[t] + LC[t])

then

CAPCOST[t] = TIC x (1 + WACC)^2

The AFUDC provided in this formula is the amount of escalation, which is the difference between CAPCOST[t] and the unescalated value of expenses:

AFUDC = TIC x [(1 + WACC)^2 – 1]

This method for determining the AFUDC implicitly assumes that investors in the generic power station project have incurred the full cost of the generic power station project two years prior to the commencement of revenues from capacity payments.

6.3 First principles approach to determining the allowance for funds used during construction

Construction assumptions – the 'S curve'

Construction costs for the generic power station project would include costs to acquire and prepare the land for the power station; the cost of materials and plant; and costs of labour.

The key parameters of construction costs that determine the requirements for funds are:

- the total value of the construction costs,
- the total time taken for construction; and
- a time path of cumulative expenditures.

The time path of cumulative expenditures for a construction project typically (for a construction project) follows an 'S-curve' form. That is, costs are incurred at a relatively low rate at the commencement of construction (typically in a phase of planning and design), at a higher rate in the middle of the construction period (as most equipment is purchased and work is undertaken), and at a lower rate at the end of the construction period (typically in a phase of testing and commissioning).

For an open cycle gas turbine, construction times have been indicated in a range of reports and studies of generation costs as six to nine months,[31] eight and a half months,[32] one year,[33] and between 24 and 30 months.[34]

With a construction time of, say, one year, an open cycle gas turbine has a short construction period. With such a short period, a typical project financing assumption for the time path of costs is for a linear time path rather than an S-curve.

Types of financing costs

The financing costs that would typically be incurred in the construction phase of a project comprise;

- debt and equity issuance costs and debt commitment fees – the cost charged by debt and equity arrangers for the amount of finance required, and the costs charged by debt issuers for making funds available to borrowers to use; and
- the financing cost during construction – the return investors require for committing capital before the asset is fully constructed and is being utilised, and hence before revenues commence.

The current Market Procedure provides for the notional investor in the generic power station project to recover 'financing costs' as part of the capital cost of the project (as parameter 'M' in the CAPCOST function). This is assumed to include the costs of initial raising of debt and equity finance. As such, in this study the estimation of AFUDC is concerned only with the financing cost during construction. This is estimated as a rate of return equal to the WACC on accumulated costs.

Estimation of AFUDC

The first principles approach to estimating AFUDC assumes that construction costs are incurred in a smooth manner over the construction period. Since the cumulative value of costs incurred increases as construction progresses, the return on costs incurred at the start of the construction period will be considerably lower than the return on constructed assets at the end of the construction period.

$$\text{AFUDC} = \sum_{t=1}^{n} \left(C_t \times (1 + \text{WACC})^{\frac{(n-t)}{p}} \right) - \sum_{t=1}^{n} C_t$$

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31 McLennan Magasanik Associates, 19 March 2009, *Rule Change #35 Re-imposition of Seasonal Caps on Capacity Payment Refunds*, Report to Independent Market Operator of Western Australia, p. 6

32 Creamer Media's research Channel, 18 May 2007, *OCGT Stations Fuel Eskom's Winter Fire* (http://www.researchchannel.co.za)

33 Acil Tasman, April 2009, *Fuel resource, new entry and generation costs in the NEM*, report Prepared for the NEMMCO Inter-Regional Planning Committee, p. 56.

34 IEA ETSAP - Technology Brief E02 – April 2010 (www.etsap.org), *Gas-Fired Power*, p. 4.

Where:

- C_t is the cost incurred in construction sub-period t and $\sum_{t=1}^{n} C_t$ is the total investment cost across n construction sub-periods;
- p is the periodicity of the analysis undertaken, for example, if the analysis is undertaken in months, then the periodicity is 12;
- t refers to one sub-period of the construction period based on the periodicity used.

6.4 Rule-of-thumb approach to determining the allowance for funds used during construction

A simple "rule of thumb" to determining the AFUDC for a project is to determine a return on the construction cost for half of the construction period. That is:

AFUDC = TIC x [(1+ WACC)^(n/2) – 1]

Where n is the length of the construction period in years.

This is equivalent to an assumption that all investment costs are incurred at the half-way point of the construction period.

6.5 Comparison of methods

The three methods for determination of the AFUDC are compared below on the assumptions of:

- the total investment cost of the generic power station project is $150 million, incurred in even incremental amounts over the 12 month period immediately preceding the first reserve capacity year; and
- the value of the WACC is 8.60 per cent.

Values of the AFUDC derived by each method are indicated in Table 6.1.

Table 6.1 Illustrative comparisons of AFUDC values derived by alternative methods for a total investment cost of $150 million, a construction period of one year, and a WACC of 8.60 per cent

Estimation method	AFUDC estimate
Current Market Procedure	$26.91 million
First-principles method	$5.82 million
Rule-of-thumb method	$6.31 million

The AFUDC values derived by the first-principles method and rule-of-thumb method are substantially less than the value that would be derived under the current Market Procedure. This is an expected result given that the first-principles method and rule-of-thumb method provide for a return on investment costs over a substantially shorter period.

The rule-of-thumb method gives a value close to the first principles method, which is an outcome of an assumption of the “linear S curve” for construction costs.

6.6 Recommendation

It is PwC’s view that, for the purposes of simplicity in the Market Procedure, the rule-of-thumb method provides a reasonable estimate of the AFUDC for the generic power station project given that the project would be characterised by a short construction period. This rule of thumb method can be implemented in the Market Procedure by a change to the CAPCOST formula to:

$$CAPCOST[t] = (PC[t] \times (1 + M) \times CAP + TC[t] + FFC[t] + LC[t]) \times (1+ WACC)^{\wedge 1/2}$$

Appendices

Appendix A Recommended revisions to the Market Procedure

This appendix sets out recommended revisions to sections 1.13 and 1.14 of the *Market Procedure for: Determination of the Maximum Reserve Capacity Price Version 2*.

The recommended revisions to section 1.13 are drafted on the presumption that the IMO determines to maintain application of a real pre-tax WACC.

The recommended revisions to section 1.4 address the change in method used to compensate the investor in generation capacity for costs of finance during construction.

1.13. Weighted Average Cost of Capital

1 The IMO must determine the cost of capital to be applied to various costing components of the Maximum Reserve Capacity Price. This cost of capital shall be an appropriate WACC for the generic Power Station project considered, where that project is assumed to receive Capacity Credits through the Reserve Capacity Auction and be eligible to receive a Long-Term Special Price Arrangement through the Reserve Capacity Mechanism.

2 The WACC will be applied directly:

(a) In the annualisation process used to convert the Power Station project Capital Cost into an annualised capital cost; and

(b) To account for the cost of capital in the time period between when the Reserve Capacity Auction is held (i.e. when capital is raised), and when the payment stream is expected to be realised. To maintain computational simplicity, the nominal time for this period is ~~two years~~one year.

3 The methodology adopted by the IMO to determine the WACC may involve a number of components that require review. These components will normally be classed as those which require review annually (called Minor components) and those structural components of the WACC which require review less frequently (called Major components).

4 The IMO must determine the WACC for the purposes of calculating the Maximum Reserve Capacity Price.

5 In determining the WACC, the IMO:

(a) must annually review the Minor components; and.

(b) may review the Major components if, in the IMO's opinion, a significant economic event has occurred since undertaking the

last 5 yearly review of the Maximum Reserve Capacity Price in accordance with clause 4.16.9 of the Market Rules.

6 The IMO may engage a consultant to assist the IMO in reviewing the Major and Minor components of the WACC.

7 The IMO shall compute the WACC on the following basis:

(a) The WACC shall use the Capital Asset Pricing Model (CAPM) as the basis for calculating the return to equity.

(b) The WACC shall be computed on a Pre-Tax basis.

(c) The WACC shall use the standard Officer WACC method as the basis of calculation.

8 The pre-tax real Officer WACC shall be calculated using the following formulae

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

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

Where

(a) R_e is the nominal return on equity (determined using the CAPM) 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; and

MRP is the market risk premium.

(b) R_d is the nominal return on debt and is calculated as:

$$R_d = R_f + DM$$ ~~*DRP*~~

where:

R_f is the nominal risk free rate for the capacity year;

DM is the debt margin, which is calculated as the sum of the debt risk premium (*DRP*) and debt issuance cost (*d*).

~~*DRP* is the debt risk premium for the capacity year.~~

(c) *t* is the benchmark rate of corporate income taxation, established at either an estimated effective rate or a value of the statutory taxation rate;

(d) *γ* is the value of franking credits;

(e) *E/V* is the market value of equity as a proportion of the market value of total assets;

(f) *D/V* is the market value of debt as a proportion of the market value of total assets; and

(g) 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.

(h) 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 & Poors and a maturity of 10 years and the nominal risk free rate:

- using the predicted yields for corporate bonds published by Bloomberg for 10 year BBB rated bonds;
- using ~~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.

(i) If there are no Commonwealth Government bonds with a maturity of 10 years on any day in the period referred to in step~~s~~ (g) ~~and (h)~~, 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.

(j~~k~~) If the ~~methodology~~ methods used in ~~Step~~ steps (h) and (i) cannot be applied due to suitable bond terms being unavailable, the IMO may determine the nominal risk free rate and the *DRP* by means of an appropriate approximation.

(k~~l~~) *i* is the forecast average rate of inflation for the 10 year period from the date of determination of the WACC. In establishing a forecast of inflation, the IMO is to have regard to the forecasts of the Reserve Bank of Australia and, beyond the period of any such forecasts, the mid-point of the Reserve Bank's target range for inflation~~, the Western Australian Department of Treasury and Finance, and financial market participants~~.

9 The CAPM shall use the following parameters as variables each year.

CAPM Parameter	Notation/Determination	Component	Value
Nominal risk free rate of return (%)	R_f	Minor	TBD
Expected inflation (%)	~~π_e~~ i	Minor	TBD
~~Real risk free rate of return (%)~~	~~R_{f}~~	~~Minor~~	~~TBD~~
Market risk premium (%)	MRP	Major	6.00
~~Asset beta~~	~~β_a~~	~~Major~~	~~0.5~~
Equity beta	β_e	Major	~~0.83~~0.77
Debt ~~margin~~ risk premium (%)	~~DM~~DRP	Minor	TBD
Debt issuance costs (%)	d	Major	~~TBD~~0.125
Corporate tax rate (%)	t	Major	30
Franking credit value	γ	Major	0.5
Debt to total assets ratio (%)	D/V	Major	~~40~~35
Equity to total assets ratio (%)	E/V	Major	~~60~~65

1.14. Determination of the Maximum Reserve Capacity Price

1 The IMO shall use the following formulae to determine the Maximum Reserve Capacity Price:

The Maximum Reserve Capacity Price to apply for a Reserve Capacity Auction held in calendar year t is PRICECAP[t] where this is to be calculated as:

PRICECAP[t] = (ANNUALISED_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;

ANNUALISED_CAPCOST[t] is the CAPCOST[t], expressed in Australian dollars in year t, annualised over a 15 year period, using a Weighted Average Cost of Capital (WACC) as determined as part of the Maximum Reserve Capacity Price Market Procedure and updated as required;

CAP is the capacity of an open cycle gas turbine, expressed in MW, and equals 160MW;

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, estimated for an open cycle gas turbine power station of capacity CAP; and

ANNUALISED_FIXED_O&M[t] is the annualised 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.

The value of CAPCOST[t] is to be calculated as:

CAPCOST[t] = (PC[t] x (1 + M) x CAP + TC[t] + FFC[t] + LC[t]) x (1+ WACC)^~~2~~ $^{1}/_{2}$

Where:

PC[t] is the capital cost of an open cycle gas turbine power station in year t, expressed in Australian dollars in year t per MW;

M is a margin to cover legal, approval, and financing costs and contingencies;

TC[t] is the cost of electricity transmission assets required to connect an open cycle gas turbine power station to the SWIS, plus an estimate of the costs of augmenting the shared network to facilitate the connection of the open cycle gas turbine power station, expressed in Australian million dollars in year t;

FFC[t] is the fixed fuel costs and must represent the fixed costs associated with an on-site liquid storage tank with sufficient capacity for 24 hours of Liquid Fuel including the cost of keeping this tank half full at all times expressed in Australian million dollars in year t;

LC[t] is the cost of land purchased in year [t]; and

WACC is the Weighted Average Cost of Capital.

2 Once the IMO has determined a revised value for the Maximum Reserve Capacity Price, the IMO must publish a draft report describing how it has arrived at any proposed revised value **[MR4.16.6]**. In preparing the draft report, the IMO must include details of how it has arrived at any proposed revised values for the Major and Minor components used in calculating the WACC.

3 The IMO must publish the draft report on the Market Web-site and advertise the report in newspapers widely distributed in Western Australia and request submissions from all sectors of the Western Australian energy industry, including end users.

Appendix B Post tax Vanilla WACC Formula

The Vanilla 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).[35]

[35] Reproduced from Allen Consulting Group, November 2007, *Review of the Weighted Average Cost of Capital for the Purposes of Determining the Maximum Reserve Capacity Price*, Report to the Independent Market Operator.

Appendix C List of comparator companies

Table C.1 Comparator companies

Company name	Type of generator	Country	Market capitalisation ($millions of local currency)
Algonquin Power Income Fund	Intermittent/Peaking	Canada	461
Boralex Inc.	Baseload	Canada	325
Brookfield renewable power fund	Intermittent/Peaking	Canada	2,241
EDF Energies Nouvelles S.A	Intermittent/Peaking	France	2,325
EDP Renovaveis	Intermittent/Peaking	Spain	3,549
Energy Developments Ltd	Intermittent/Peaking	Australia	399
Greentech Energy Systems A/S	Intermittent/Peaking	Denmark	790
IdaCorp, Inc	Baseload	US	1,772
Infigen Energy	Intermittent/Peaking	Australia	491
Northland Power Income Fund	Baseload	Canada	1,170
Novera Energy PLC	Intermittent/Peaking	UK	N/A
Plambeck Neue Energien AG	Intermittent/Peaking	Germany	69
Renewable Energy Generation Ltd	Baseload	Guernsey	47
Renewable Energy Holdings PLC	Intermittent/Peaking	UK	11
Theolia	Intermittent/Peaking	France	123
AES Corporation	Baseload	US	8,882
Allegheny Energy Inc	Baseload	US	3,987
American Electric power	Baseload	US	17,285
Calpine Corp	Baseload	US	5,397
Constellation Energy Group	Baseload	US	5,873
Drax Group PLC	Baseload	UK	1,366
Dynegy Inc	Baseload	US	621
Electric Power Development	Baseload	Japan	429,916

Company name	Type of generator	Country	Market capitalisation ($millions of local currency)
Capital Power Income LP	Baseload	Canada	1,000
International Power PLC	Baseload	UK	6,610
NRG Energy Inc	Baseload	US	4,840
Pinnacle West Capital	Baseload	US	4,453
PNM Resources	Baseload	US	1,068
Progress Energy Inc	Baseload	US	12,919
RRI Energy	Baseload	US	1,297
Scottish and Southern Energy	Baseload	UK	10,872
AGL Energy	Intermittent/Peaking	Australia	7,102
Contact Energy	Baseload	NZ	3,641
Trust Power	Baseload	NZ	2,332
Fortum Oyj	Baseload	Finland	18,451
Centrica	Baseload	UK	16,981
Arendals Fossekomani	Baseload	Norway	3,584
Innergex Power Income Fund	Baseload	Canada	N/A

Source: Bloomberg

Appendix D Gearing and credit rating of comparator companies

Table D.1 Gearing pre and post GFC, and credit ratings of comparator companies

Company	Type of generator	Credit rating	Gearing		
			Pre-GFC		Post GFC
			10 year	5 year	
Algonquin Power Income Fund	Intermittent /Peaking	BBB-	45%	30%	23%
Boralex Inc.	Baseload	N/A	33%	29%	26%
Brookfield renewable power fund	Intermittent /Peaking	BBB	42%	38%	38%
EDF Energies Nouvelles S.A	Intermittent /Peaking	N/A	-	-	-
EDP Renovaveis	Intermittent /Peaking	N/A	-	-	-
Energy Developments Ltd	Intermittent /Peaking	N/A	43%	38%	34%
Greentech Energy Systems A/S	Intermittent /Peaking	N/A	19%	12%	7%
IdaCorp, Inc	Baseload	BBB	47%	47%	47%
Infigen Energy	Intermittent /Peaking	N/A	50%	-	-
Northland Power Income Fund	Baseload	BBB-	19%	13%	11%
Novera Energy PLC	Intermittent /Peaking	N/A	34%	-	-
Plambeck Neue Energien AG	Intermittent /Peaking	N/A	33%	30%	38%
Renewable Energy Generation Ltd	Baseload	N/A	9%	-	-
Renewable Energy Holdings PLC	Intermittent /Peaking	N/A	45%	-	-
Theolia	Intermittent /Peaking	N/A	38%	-	0%
AES Corporation	Baseload	BB-	60%	66%	69%
Allegheny Energy Inc	Baseload	BBB-	40%	51%	58%
American Electric power	Baseload	BBB	49%	50%	48%
Calpine Corp	Baseload	B	-	-	-

Company	Type of generator	Credit rating	Gearing		
			Pre-GFC		Post GFC
			10 year	5 year	
Constellation Energy Group	Baseload	BBB-	32%	37%	36%
Drax Group PLC	Baseload	N/A	9%	-	-
Dynegy Inc	Baseload	B-	62%	61%	68%
Electric Power Development	Baseload	AA	70%	-	-
Capital Power Income LP	Baseload	BBB	36%	23%	15%
International Power PLC	Baseload	BB	46%	37%	32%
NRG Energy Inc	Baseload	BB-	48%	-	-
Pinnacle West Capital	Baseload	BBB-	48%	47%	45%
PNM Resources	Baseload	BB-	61%	54%	50%
Progress Energy Inc	Baseload	BBB+	48%	49%	49%
RRI Energy	Baseload	B	41%	50%	64%
Scottish and Southern Energy	Baseload	A-	24%	21%	17%
AGL Energy	Intermittent /Peaking	BBB	15%	-	-
Contact Energy	Baseload	BBB	16%	20%	19%
Trust Power	Baseload	N/A	19%	11%	9%
Fortum Oyj	Baseload	A	22%	32%	31%
Centrica	Baseload	A-	11%	9%	10%
Arendals Fossekomani	Baseload	N/A	21%	11%	5%
Innergex Power Income Fund	Baseload	N/A	32%	-	-

Source: Bloomberg

Appendix E Asset betas

Table E.1 Asset betas pre and post GFC of comparator companies

Company name	Type of generator	Asset betas		
		Pre-GFC		Post GFC
		10 year	5 year	
Algonquin Power Income Fund	Intermittent/Peaking	0.63	0.56	0.31
Boralex Inc.	Baseload	0.61	0.62	0.52
Brookfield renewable power fund	Intermittent/Peaking	0.22	0.18	0.34
EDF Energies Nouvelles S.A	Intermittent/Peaking	-	-	-
EDP Renovaveis	Intermittent/Peaking	-	-	-
Energy Developments Ltd	Intermittent/Peaking	0.47	0.53	0.82
Greentech Energy Systems A/S	Intermittent/Peaking	1.66	1.37	0.95
IdaCorp, Inc	Baseload	0.25	0.29	0.36
Infigen Energy	Intermittent/Peaking	0.62	-	-
Northland Power Income Fund	Baseload	0.18	0.26	0.42
Novera Energy PLC	Intermittent/Peaking	0.49	-	-
Plambeck Neue Energien AG	Intermittent/Peaking	0.54	0.51	0.48
Renewable Energy Generation Ltd	Baseload	0.63	-	-
Renewable Energy Holdings PLC	Intermittent/Peaking	0.60	-	-
Theolia	Intermittent/Peaking	1.02	-	(0.08)
AES Corporation	Baseload	0.55	0.63	0.28
Allegheny Energy Inc	Baseload	0.53	0.47	0.38
American Electric power	Baseload	0.30	0.30	0.44
Calpine Corp	Baseload	-	-	-
Constellation Energy Group	Baseload	0.70	0.52	0.35
Drax Group PLC	Baseload	0.42	-	-
Dynegy Inc	Baseload	0.43	0.61	0.64

Company name	Type of generator	Asset betas		
		Pre-GFC		Post GFC
		10 year	5 year	
Electric Power Development	Baseload	0.16	-	-
Capital Power Income LP	Baseload	0.20	0.22	0.13
International Power PLC	Baseload	0.66	1.00	1.34
NRG Energy Inc	Baseload	0.43	-	-
Pinnacle West Capital	Baseload	0.31	0.32	0.45
PNM Resources	Baseload	0.38	0.45	0.40
Progress Energy Inc	Baseload	0.20	0.18	0.33
RRI Energy	Baseload	1.01	1.07	0.82
Scottish and Southern Energy	Baseload	0.29	0.19	0.08
AGL Energy	Intermittent/Peaking	0.40	-	-
Contact Energy	Baseload	0.79	0.76	0.84
Trust Power	Baseload	0.50	0.65	0.91
Fortum Oyj	Baseload	0.60	0.39	0.29
Centrica	Baseload	0.39	0.56	0.73
Arendals Fossekomani	Baseload	0.29	0.36	0.42
Innergex Power Income Fund	Baseload	0.24	-	-

Note: Some companies did not have a full 5 or 10 year set of asset beta figures, and as such were not represented in the sample. They however were useful in identifying the credit rating of the benchmark generator, and as such were left in the sample

Source: Bloomberg

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