Independent Market Operator

MRCPWG

Agenda

Meeting No.	7
Location:	IMO Board Room, Level 3, Governor Stirling Tower, 197 St Georges Terrace, Perth
Date:	Thursday, 17 February 2011
Time:	Commencing at 3.00 to 5.00pm

Item	Subject	Responsible	Time
1.	**WELCOME AND APOLOGIES / ATTENDANCE**	**Chair**	5 min
2.	**MINUTES OF PREVIOUS MEETING**	**Chair**	5 min
3.	**ACTIONS ARISING**	**Chair**	5 min
4.	**DEEP CONNECTION COSTS – DRAFT REPORT**	**IMO/SKM**	45 min
5.	**WEIGHTED AVERAGE COST OF CAPITAL METHODOLOGY – UPDATED DRAFT REPORT AND MEMBER FEEDBACK**	**IMO**	15 min
6.	**SUBMISSIONS FROM 2011 MRCP DETERMINATION**	**IMO**	30 min
7.	**GENERAL BUSINESS**	**IMO**	5 min
8.	**NEXT MEETING** Thursday 24 March 2011 (3:00-5:00pm)	**Chair**	5 min

Independent Market Operator

MRCPWG

Minutes

Meeting No.	6
Location:	IMO Board Room Level 3, Governor Stirling Building, 197 St Georges Terrace, Perth
Date:	Thursday 20 January 2011
Time:	Commencing at 3:00 to 5:30pm

Attendees	
Troy Forward	IMO (Chair)
Johan van Niekerk	IMO (Minutes)
Greg Ruthven	IMO
Monica Tedeschi	IMO
Corey Dykstra	Market Customer
John Rhodes	Market Customer
Steve Gould	Market Customer
Shane Cremin	Market Generator
Brad Huppatz	Market Generator
Neil Gibbney	Western Power
Ray Challen	Price Waterhouse Coopers (PwC) (3.00-4.35pm)
Geoff Glazier	Sinclair Knight Merz (SKM)
Chris Brown	Economic Regulation Authority (ERA) (Observer)
Duc Vo	Economic Regulation Authority (ERA) (Observer) (3.00-4:35pm)
Robert Pullella	Economic Regulation Authority (ERA) (Observer) (4.00-5:30pm)
Apologies	
Stephen MacLean (John Rhodes)	Market Customer

Item	Subject	Action
1.	**WELCOME AND APOLOGIES / ATTENDANCE** The Chair opened the 6th meeting of the Maximum Reserve Capacity Price (MRCP) Working Group (Working Group) at 3:00pm. An apology was received from Mr Stephen MacLean (Market Customer). Mr John Rhodes was welcomed in place of Mr MacLean. It was noted that Mr Nenad Ninkov was no longer employed by Pacific Energy, and that a nominated replacement would be	

Item	Subject	Action
	proposed to the Market Advisory Committee at its February meeting.	
2.	**MINUTES OF PREVIOUS MEETING** The minutes of the 5th MRCP Working Group meeting, held 15 September 2010, were circulated prior to the meeting. The following amendment to page 3 was agreed: • Mr Gibbney noted that even the smallest transmission lines displaying reasonable economies of scale have a capacity of 250MW, which is considerably more more capacity than required by a new 160MW generator. Further augmentations to the transmission network actually tend to be even more 'lumpy' in nature in that new transmission lines can quite easily have capacities around 750MW. Consequently, the most significant issue is not what a new line costs, but how you allocate the costs to each customer. Mr Gibbney noted that under the Access Code once a new transmission facility is added to Western Power's capital base then Western Power can no longer charge capital contributions for use of that facility and new generators can essentially get a free connection. The following paragraph on page 3 and 4 was removed as it was agreed it was unnecessary: • Mr Dykstra noted that load growth has been recently driving the need for increased connections. Application of the current regulatory provisions creates volatility around these costs which can have a significant effect on the viability of a project. Additionally Mr Cremin noted that there may be a situation where the market already has considerable generation available and an investor wants to add extra capacity which is not required. This would present the ERA with an interesting situation to consider. *Action Point: The IMO to make the agreed amendments and publish Meeting 5 minutes on the website as final.*	**IMO**
3	**ACTION POINTS** The actions arising were either complete or on the meeting agenda. Mr Greg Ruthven noted the following exceptions: • AP36: The IMO will present a draft updated Market Procedure, allowing for the inclusion of inlet cooling in the power station costs, to a subsequent meeting. • AP37: The IMO to initiate a review of the relationship between humidity rates and generator output across a range of locations. This review is still pending. • AP39: The IMO to seek clarification from SKM on the components included in its assessment and seek advice on whether they consider there is a better way to determine Margin M. This point would be discussed with Mr Geoff Glazier from SKM later in the meeting.	

Item	Subject	Action
4	**WEIGHTED AVERAGE COST OF CAPITAL METHODOLOGY – DRAFT REPORT** Mr Ray Challen from PwC presented the draft report including a review of the method of calculation of the Weighted Average Cost of Capital (WACC) and other elements used in the procedure to determine the Maximum Reserve Capacity Price (MRCP). The following comments were noted: • Mr Duc Vo of the ERA confirmed that the ERA's preference is for a real pre-tax WACC as this did not require a possibly complicated review of the tax characteristics of applicable industries and individual companies. Mr Corey Dykstra noted that the use of a pre-tax basis might lead to a possible over compensation for costs but that the use of the corporate tax rate to calculate a post-tax value was a reasonable proxy. Members generally agreed that the IMO continue with the use of a real pre-tax WACC. *Agreed Outcome: The IMO to continue using WACC on a real pre-tax basis.* • Mr Dykstra noted that the current Market Procedure provided a different approach to inflation with a possible conflict between the use of state versus federal numbers. Mr Challen stated that the use of Australia-wide numbers published by the Reserve Bank of Australia (RBA) is regarded as best practice as the intention was to calculate a WACC value for an Australian, and not just a Western Australian, investor. • Mr Shane Cremin questioned the relevance of using international gearing ratios which were heavily influenced by international tax regimes related to the treatment of debt. Mr Cremin and Mr Rhodes stated that a 0.40 gearing ratio was more representative of Western Australian developers and that a reduction in the gearing ratio might not sufficiently compensate investors. They believed that the case had not been sufficiently made for a reduction from 0.40 to 0.35. Mr Dykstra noted the potential difference in gearing between individual projects and on a corporate level. Mr Rhodes stated that there was potentially an increasing appetite for debt as a financing source particularly considering the increasing familiarity of the market with the Reserve Capacity process. Mr Challen stated that it was the intention to use best estimates based on established benchmarks in performing the WACC calculation rather than seeking to justify any changes. The Chair noted the validity of both arguments and requested that members comment on this and other aspects of the PwC report within 2 weeks. The IMO would take all views into account and would present a recommendation at the next meeting.	

Item	Subject	Action
	• Mr Vo noted that the ERA considers the debt risk premium to be too high, and confirmed that the ERA is working on an alternative methodology. Mr Robert Pullella advised that the ERA would provide further guidance in this regard once their investigation was finalised. Mr Pullella confirmed they would have an alternative proposal available for distribution within the next 2 months. The Chair questioned whether it might be prudent to revisit the methodology for this parameter on an annual basis based on professional judgment. Mr Dykstra stated that whatever methodology was used should signal boundaries to participants to allow for accurate planning. The Chair confirmed that the IMO would have a discussion with the ERA to ascertain the status of their investigation in order to provide feedback. *Action Item: ERA to provide details of proposed alternative Debt risk premium methodology to IMO.* • Mr Brad Huppatz questioned how the proposed methodology, based on a return on the construction costs for half of the construction period (PwC having suggested a nominal construction period of 12 months), would relate to the Reserve Capacity Cycle pointing out that such a revision would imply that the power station could be completed just in time to deliver capacity as required by the Reserve Capacity process, without allowing sufficient time for commissioning. • Mr Challen confirmed his belief that a revised procedure on this basis would better represent the financing costs if construction was undertaken in an economically efficient manner. • It was noted that there may be potential discrepancies between the calculation of the Margin cost (legal, insurance, financing, environmental approval costs) value between the PwC and SKM reports. *Action Item: IMO, in conjunction with SKM and PwC, to review potential discrepancies in the calculation of Margin cost.* Mr Ruthven requested that Working Group members provide any additional feedback by 5pm on Thursday 3 February 2011. *Action Item: Working Group members to provide feedback on the PwC report to the IMO by 5pm on Thursday 3 February 2011.*	**ERA** **IMO/SKM /PwC** **All Members**
5	**DEEP CONNECTION COSTS – PRESENTATION ON METHODOLOGY** Mr Geoff Glazier from SKM presented the draft report on Deep Connection Costs (DCC). The following comments were noted: • The question of the weighting of historical data versus forecasts was raised as an issue with Mr Dykstra proposing that more recent data should be weighted more	

Item	Subject	Action
	heavily. Mr Glazier indicated that this could be incorporated in any model with a view to finding a balance between short term volatility and historical costs. • Mr Cremin questioned the consistency of heavily weighting short run costs with the risk being that a period of generation shortage may co-incide with a shortage of transmission capacity resulting in short term upward pressure on DCC. • The Chair proposed that in order to progress further that SKM should obtain more data from Western Power to develop the model further. It was noted by Mr Neil Gibbney that there was an extremely small data set as there were a limited number of large transmission upgrades undertaken in recent years. It was agreed that Mr Glazier and Mr Gibbney would discuss this outside of the meeting. *Action Point: SKM and Western Power to discuss data availability in order to supply data to SKM with a view to further investigating option 2 (Forecast DCC based on Historic Connection Costs Data).* • It was noted that any model would be based on the constraint of a 160 MW plant as previously agreed and that SKM and Western Power would proceed on this basis. *Agreed Outcome: It was agreed that SKM's next report would contain more detail surrounding projections based on the agreed constraints of a 160 MW plant.* • Mr Dykstra questioned the impact that any Western Power assumptions on network tariff increases might have on outcomes. Mr Gibbney advised that changes in tariffs were difficult to forecast and that Western Power was not prepared to make forecasts in this regard. *Action Point: Working Group members to provide feedback on the SKM report to the IMO by 5pm on Thursday 3 February 2011.*	**SKM/Western Power** **SKM** **All Members**
5	**GENERAL BUSINESS** There was no general business raised.	
6	**NEXT MEETING** Mr Ruthven noted that the next meeting would be held on Thursday 17 February 2011.	
7	**CLOSED:** The Chair declared the meeting closed at 5.30 pm.	

Agenda Item 3: MRCPWG - Action Points

Legend:

Unshaded	Unshaded action points are still being progressed.
Shaded	Shaded action points are actions that have been completed

#	Meeting Arising	Responsibility	Action	Status/Progress
36	Meeting 5	IMO	The IMO to update the Market Procedure to allow for the inclusion of inlet cooling in the power station costs, with the ability for the Consultant to specify the cost-effective technology type.	Pending. The IMO proposes to present a draft updated Market Procedure at the 24 March 2011 meeting.
37	Meeting 5	IMO	The IMO to initiate a review of the relationship between humidity rates and generator output across a range of locations.	Pending.
38	Meeting 5	IMO	The IMO to seek clarification from SKM on the components included and excluded in its assessment and seek advice on whether they consider there is a better way to determine Margin M.	Completed.
39	Meeting 6	IMO	The IMO to make the agreed amendments and publish Meeting 5 minutes on website as final.	Completed.

#	Meeting Arising	Responsibility	Action	Status/Progress
40	Meeting 6	ERA / IMO	ERA to provide details of proposed alternative Debt risk premium methodology to IMO.	Pending further discussion between the ERA and IMO. Further details to be provided at the 24 March 2011 meeting.
41	Meeting 6	IMO	IMO, in conjunction with SKM and PwC, to review potential discrepancies in the calculation of Margin cost.	Completed. Outcomes discussed under Agenda Item 5.
42	Meeting 6	MRCPWG	Working Group members to provide feedback on the PwC report to the IMO by 5pm on Thursday 3 February 2011.	Completed.
43	Meeting 6	SKM / Western Power	SKM and Western Power to discuss data availability in order to supply data to SKM with a view to further investigating option 2 (Forecast DCC based on Historic Connection Costs Data).	Will be completed by 17 February. SKM and Western Power working together to populate SKM model.
44	Meeting 6	MRCPWG	Working Group members to provide feedback on the SKM report to the IMO by 5pm on Thursday 3 February 2011.	Completed.

Agenda Item 4: Deep Connection Cost Methodology – Research Report by Sinclair Knight Merz

1. BACKGROUND

The IMO appointed Sinclair Knight Merz (SKM) to undertake a review of the calculation methodology to be applied in determining Deep Connection Costs (DCC). SKM has prepared its research report, which is attached as Appendix A.

The research report builds on the interim discussion report prepared by SKM and presented at the 20 January 2011 meeting. The report provides detailed background commentary on the meaning and role of connection costs within the WEM, evaluation of the existing DCC methodology against a defined set of assessment criteria and comparison of the proposed alternative methodologies against the same assessment criteria. In particular, SKM describes its preferred methodology as an approach which calculates a weighted average of actual connection costs for liquid-fuel plant, with weights defined so that greater emphasis is given to more recent data.

An overview of the preferred methodology is provided including details on generators to be included, scope of connection costs, pro-rating capacity costs, escalation of capital costs, weighting of yearly cost to the calculated cost, forecasting margins, treatment of years with no relevant connections and integration into the Market Procedure.

No values have yet been included in the report for the connection cost estimates that would result from the preferred methodology. Discussions are still ongoing between SKM and Western Power surrounding the inclusion of relevant costs and the confidentiality of specific project data. A further update will be provided at the meeting.

The research report is provided to the MRCPWG for its evaluation and consideration.

2. RECOMMENDATIONS

The IMO recommends that the MRCPWG:

- **Discuss** the SKM research report and the recommendations contained within.

Calculation Methodology to be Applied in Determining Deep Connection Costs

RESEARCH REPORT

- Rev 1
- 11 January 2011

Calculation Methodology to be Applied in Determining Deep Connection Costs

RESEARCH REPORT

- Rev 1
- 11 January 2011

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Contents

Document history and status

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
Rev 0	13-1-2011	Geoff Glazier	David Healy		Interim Discussion Report
Rev 1	14 -1 -2011	Geoff Glazier	Scott Maves	14-1-2011	Final Report

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Name of project:	Calculation Methodology to be Applied in Determining DCC
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1. Executive Summary

This report follows a Interim Discussion Report provided to the Maximum Reserve Capacity Price Working Group and provides SKM's recommended Deep Connection Cost (DCC) calculation methodology.

The scope of this study was to undertake the following:

- Analyse any assumptions made by Western Power and the IMO in the estimation of the DCC used in the Maximum Reserve Capacity Price (MRCP) calculation for the 2010 Reserve Capacity Cycle and recommend adopting or replacing those assumptions. Where an assumption is recommended to be replaced, SKM will, if required, propose alternative assumptions. SKM will comment on both stated and implied assumptions; and
- If appropriate, propose an alternative methodology for estimating the DCC used in the MRCP, whilst also explicitly stating all assumptions made in the methodology.

In undertaking this review SKM analysed the assumptions made by Western Power in the estimation of the DCC against the following criteria:

- Accuracy – Extent to which the estimated DCC (as an input to the MRCP) drives the correct level of new capacity investment and supports the correct mix of generation technologies in the market.
- Certainty / Repeatability – Stability and repeatability of the methodology over time.
- Simplicity – Ease of understanding, management burden and cost associated with the calculation.
- Resilience – Extent to which methodology would be impacted by changes in Western Power's Access Arrangement or changes to other Market Rules or procedures.
- Flexibility – Extent to which the methodology can adapt to changes in technology and market conditions.

These criteria were selected as indicators of the extent to which the DCC calculation best meets the Market Objectives, consistent with work previously undertaken by MMA on issues to be addressed when considering Rule Changes. Different weightings were given to each criterion, these are:

Factor	Weighting
Accuracy	50%
Certainty	20%
Simplicity	20%
Resilience	5%
Flexibility	5%

This assessment has concluded that although the existing methodology seeks to accurately forecast the marginal cost of connecting peaking capacity to the network, the methodology introduces complexity associated with:

- identifying the next marginal point of connection.
- defining the minimum required works.
- estimating costs associated with these works.

In order to remain simple and cost effective the existing methodology introduces a range of assumptions and relies heavily on the experience of Western Power staff. These simplifying assumptions introduce significant inaccuracies to the calculation and undermine market certainty in the outcome. To address these shortfalls the report considers 3 alternative calculation methodologies, these being:

- A fixed annual allocation for the DCC based on an average cost of providing capacity on the network.
- A calculation of total connection cost based on a historic per MW connection cost for selected generators with different weightings on different years.
- A process that modelled a 160 MW new entrant generator as the number 1 queue applicant in which Western Power's Application and Queuing Policy and Capital Contribution Policy is accurately and fully applied, as if a real world connection.

In these options there is an inherent tension between accuracy, stability and simplicity. The report recommends a calculation methodology that uses a period-weighted average of historic DCC's to indicate a level of future connection costs which are then used as a proxy for setting an appropriate MRCP. This methodology is simple to implement and this report contends that the year to year movement in the marginal cost of connection will be less than the inaccuracy of the existing calculation methodology.

The recommended methodology produces a single connection cost that is intended to replace the Total Transmission Costs (TC) in the existing methodology.

The connection cost calculated by the recommended methodology spreadsheet yields a connection cost for the 2010 Reserve Capacity Cycle of XX. This represents an XX % reduction on the 2011 calculation for TC.

2. Introduction

2.1. Scope of Report

The IMO is currently reviewing the Market Procedure for: Determination of the Maximum Reserve Capacity Price (MRCP). As part of this review, it has been identified that the assumptions and methodology behind the calculation of the Deep Connection Costs (DCC) require further analysis. The intent of this report is to provide an analysis of the existing methodology used to calculate the DCC and recommend a methodology for moving forward. The review and the recommendations focus on the assumptions that underpin the calculation of the DCC and the extent to which these assumptions best support the Wholesale Energy Market (WEM) Market Objectives. The result of the analysis is a specific calculation methodology for Western Power to follow in future DCC reviews.

The calculation methodology is required to take into account:

1. Related legislation such as the Access Code, the Metering Code, the Technical Rules etc and any other relevant regulatory considerations;
2. Possible outcomes and implications of the application of the New Facilities Investment Test (NFIT);
3. Western Power's Capital Contributions Policy;
4. Appropriate tariff charges, such as those in the 2010 Western Power Price List;
5. Application of GST;
6. The appropriateness of applying an escalation for locations outside the metropolitan area;
7. The nature of the current capacity based market and the associated need for unconstrained network access; and
8. Any other considerations the Consultant deems should be taken into account.

2.2. Purpose of this Report

The purpose of this report is to:

- Analyse any assumptions made by Western Power and the IMO in the estimation of the DCC used in the MRCP calculation for the 2010 Reserve Capacity Cycle and recommend adopting or replacing those assumptions; and
- If appropriate, propose an alternative methodology for estimating the DCC used in the MRCP, explicitly stating all assumptions made in the methodology.

2.2.1. Report Deliverable

The main deliverables for this report are:

1. A document which plainly states each parameter that should be used by Western Power in calculating an estimate of DCC under both the Western Power methodology (including details of any amended assumptions and assumptions associated with the Western Australian regulatory regime) and the alternative methodology, the calculation methodology for each parameter, and the assumptions inherent in each calculation. This document will need to be worded such that it can either be incorporated directly into the Market Procedure or be used as a subsidiary document to the Market Procedure. This document will in effect provide a definition of DCC;

2. Details of the costs associated with the DCC that should be included in the MRCP, e.g. the capital contributions estimated by Western Power in the 2010 MRCP review or another cost variable to take into account potential changes to tariffs etc.; and

3. Details of the relevant recommendations and analysis undertaken in determining the information provided in the document referred to above.

2.3. Definitions and Interpretation of Terms

The definition of the terms within this report are as specified in the Market Procedure for the Determination of the Maximum Reserve Capacity Price and in the Western Power Contribution Policy and the regulatory frameworks that support these documents.

In support of the documents detailed above and the analysis in this report the terms Shallow Connection Costs and DCC are defined in section 4.3 of this report.

3. Background

The IMO provided the following background information as part of its Request for Quotation for the services relating to this report:

The Wholesale Electricity Market Rules[1] (Market Rules) and the Market Procedure for the Determination of the Maximum Reserve Capacity Price[2] (the Market Procedure) require the IMO to calculate a Maximum Reserve Capacity Price (MRCP) each year. The MRCP sets the maximum offer that can be made in a Reserve Capacity (RC) Auction and is used as the basis for determining an administered Reserve Capacity Price if no auction is required and capacity refunds.

The Reserve Capacity Mechanism is designed to incentivise the provision of a sufficient amount of reliable capacity within the SWIS. The MRCP is one of the elements of this mechanism which estimates the annualised cost of building a 160 MW OCGT that is entered into the RC Auction.

In particular, the Market Procedure outlines the principles to be applied and the steps to be taken by the IMO in order to develop and propose the MRCP. Section 1.8 details the methodology that Western Power must follow in determining the cost of connecting the Power Station to the SWIS.

Section 1.8.2(i) specifies that "An estimate of DCC must be included". However, the Market Procedure does not include either a detailed methodology for how this should be calculated or a definition of DCC. To date the IMO has defined DCC as the capital costs passed on to the connecting generator that are associated with upgrading/ augmenting the transmission system to allow for the generator to connect to the SWIS.

As part of the 2010 MRCP determination, Western Power provided an analysis in support of their calculation of transmission costs associated with the proposed power station. The estimates provided, and the methodology which supported them was a recurring topic in a number of the submissions the IMO received in response to the draft report. These submissions can be found on the IMO website[3].

In accordance with clause 4.16.9 of the Market Rules, the IMO is currently reviewing the Market Procedure. As part of this review it has been identified that the assumptions and methodology behind the calculation of the DCC require further review.

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[1] Available on the IMO website: http://www.imowa.com.au/market-rules
[2] Available on the IMO website: http://www.imowa.com.au/f711,482994/482994_Market_Procedure_for_Maximum_Reserve_Capacity_Price.pdf
[3] Available on the IMO website: http://www.imowa.com.au/mrcp

To guide this review this report provides a methodology including the appropriate definition (including the reasons for inclusion and exclusion of each cost), parameters, assumptions and calculation of estimates of deep connection charges associated with connecting a Power Station to the SWIS. This report is consistent with the context of the Western Australian Wholesale Electricity Market and is intended to be followed by Western Power in calculating this estimate of deep connection charges.

The IMO anticipates that the outcomes of this work will feed into its wider five year review of the determination of the MRCP.

4. Connection Costs and the Wholesale Market

A review of the assumptions and methodology behind the calculation of DCC ultimately requires an understanding of the term, including its meaning, purpose and use within the market and regulatory arrangements. While the term conveys a general meaning that is common across many jurisdictions, its precise definition and required interpretation is affected by the manner of its use within the functions and processes of the Market Rules, and given the related procedures, systems and guiding objectives that together give direction and effect to these Market Rules.

This section therefore considers the meaning, purpose and use of the term DCC within the market and regulatory arrangements. It defines the required basis of an assessment framework that will be used to assess the effectiveness of Western Power's Capital Contributions Policy, insofar that it provides an appropriate input into the operation of the Reserve Capacity Mechanism of the Market Rules.

4.1. A general understanding of the term 'Connection Cost'

The term connection cost generally covers the costs associated with infrastructure or supporting services that facilitate the connection of an electric facility, such as a generator or load, to a network, in a manner that maintains system reliability and other applicable standards, that is consistent with good practice and that is least cost.

Recognised cost components typically include the design, procurement and installation costs for three classes of investment:

1. Direct costs that provide for the physical connection of a new facility with the existing assets of the network.

   Examples of costs include: Substations; transmission / distribution lines; and communication and control infrastructure.

2. Indirect costs associated with the reinforcement of existing network assets, or service levels, to accommodate the load characteristics, or to support the deliverability of supply, as the case may be, of the connecting electric facility.

   Examples of costs include: Reinforcement or upgrade of existing transmission / distribution line, substations or terminal stations. Installation of new lines, substations or reactive power support at sites removed from the electric facility.

3. Indirect costs associated with upgrading or augmenting the network, or service levels, such that the costs facilitate actual or anticipated load growth, load patterns, or other changes in the network that are not specific to the connecting facility.

   Examples of costs are similar to those in item 2 above.

4.2. Connection Costs in the Physical and Market Systems

The SWIS is the major interconnected electricity network in Western Australia (WA). It supplies the bulk of the South West region, extending to Geraldton in the north, Albany in the south, and Kalgoorlie in the east.

The network assets of the SWIS are owned and managed by Western Power, and facilitate the physical operation of the power system. Electric facilities that connect with the SWIS are subject to Western Power's Capital Contributions Policy that specifies the extent and nature of costs that are payable to facilitate a physical connection to the SWIS. The Capital Contribution Policy is part of Western Power's Access Arrangement which is to meet the requirements of the Electricity Network Access Code 2004 (ENAC).

The Wholesale Electricity Market of Western Australia (WEM) is a feature of the SWIS, providing for the organised dispatch and trade of electricity, and electricity related services, between industry participants that operate in the energy supply sector. The organised markets of the WEM, together with bilateral contract markets for capacity, define the market relations that facilitate transactions in capacity and related services.

Although the connection costs of a new electric facility do not directly feature in the trading arrangements of the WEM, they do indirectly feature as a component of the MRCP, which operates as a calculated cap on offers and on prices in the market for Reserve Capacity.

The market and regulatory arrangements of the WEM can be defined as the market rules, procedures, systems and related regulatory provisions that together give effect to the trading arrangements and operations of the wholesale market, and the behaviour of its participants.

4.3. Deep Connection Costs vs Shallow Connection Costs

The IMO Market Procedure for the calculation of the MRCP includes a requirement for the calculation of a "Transmission Connection Cost Estimate" (item 1.8). In the calculation of this estimate the procedure calls for the cost estimate to consider 9 items, the last of these items is that an "An estimate of Deep Connection Costs shall be included". The other 8 items define the nature of the connection of the generator to the network and the technical assumptions that should be made in calculating the estimate.

The existing Western Power Access Arrangement does not make a distinction between Deep and Shallow Connection Costs. It should also be noted that the definition of Deep vs Shallow Connection Costs do not necessarily with align with Western Power's definition of Connection Assets and Shared Network Assets in all circumstances.

In jurisdictions where the definition is widely used, DCC's typically pertain to the costs described in items 2 and 3 of section 4.1 of this report, however the costs in item 3 are often rolled into the broader tariff base.

The purpose of using an estimate of connection costs in the mechanisms of an organised market for capacity is to provide a price signal that reflects the scarcity of network capacity at a given location. When featured as a input into a pricing mechanism or constraint, this investment signal is considered important in driving economically efficient investment in generation and load development on a network.

Shallow Connection Costs typically represent the costs associated with network assets required to connect the user to the existing or planned network assuming adequate network capacity at the point of connection. In this report, the sum of the Deep and Shallow Connection Costs represent the Transmission Connection Cost Estimate consistent with the Market Procedure.[4]

For the purposes of this report, shallow connection costs will be defined by the 2 km of transmission line and the 330 kV breaker and a half substation specified in items 1.8 a-h of the Market Procedure for the calculation of the MRCP. Deep Connection Costs will be defined as the total connection costs established by the existing methodology applied by Western Power minus the shallow connection costs.

It is noted that using this definition of the calculation of shallow connection costs places technical bounds around the calculation of the broader connection costs that may result in a technical outcome that is removed from the efficient technical solution for a given location. This is particularly the case where connection costs calculations are undertaken for locations that are significantly removed from the existing 330kV network requiring significant extension of the 330kV network in the DCC Calculation (such as at Kalgoorlie). However, by defining the Shallow Connection Costs in this manner the consideration of DCC in effect becomes a study of the determination of Total Connection Costs by Western Power.

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[4] Some jurisdictions defined Deep Connection Costs as inclusive of Shallow Connection Costs. For example a pure Deep Connection Cost policy would result in the network user paying all attributable network reinforcement costs (as is the case with the Western Power Capital Contribution Policy). To remain consistent with the MRCP Market Procedure this report defines Deep Connection Costs as separate costs to the Shallow Connection Costs.

As a result, this review of DCC determination methodology effectively becomes a review of the manner in which Western Power is applying its Capital Contribution Policy in response to the bounds provided by the IMO Market Procedure.

4.4. The Regulatory Context

The existing DCC calculation methodology applied by Western Power occurs at the intersection of two major regulatory regimes defining actives in the WEM, the Electricity Network Access Code 2004 (ENAC) and the WEM Market Rules. The following summarises the impact of these market and regulatory arrangements.

4.4.1. Arrangements relevant to the physical networks

4.4.1.1. The Electricity Network Access Code

The ENAC governs the activities of any Covered Network in Western Australia, including that provided by Western Power. The ENAC defines the bounds under which a Network Operator can levy connection costs through the definition of the requirements for a Capital Contribution Policy. In effect, this policy describes the extent to which the cost of infrastructure required to facilitate a connection can be recovered from a user as an upfront charge (connection cost) and the extent to which the cost is rolled into the regulated asset base to be recovered through regulated tariffs. In defining this division, the ENAC states that any Capital Contribution Policy

(a) must not require a user to make a contribution in respect of any part of new facilities investment which meets the new facilities investment test; and

(b) must not require a user to make a contribution in respect of any part of noncapital costs which would not be incurred by a service provider efficiently minimising costs; and

(c) may only require a user to make a contribution in respect of required work;

and

(d) without limiting sections 5.14(a) and 5.14(b), must contain a mechanism designed to ensure that there is no double recovery of new facilities investment or non-capital costs

The above dictates that any DCC charged by Western Power must be on the basis of infrastructure developed in an efficient manner and not include infrastructure to the extent that it meets the requirements of the New Facilities Investment Test.

The ENAC does not require Western Power to differentiate between deep and shallow connection costs.

Also of note is that the ENAC defines that all Access Contracts for capacity services be for a defined capacity and that under normal operation a user will not be restricted below this capacity. This requirement is otherwise referred to as unrestricted access.

4.4.2. Capital Contribution Policy

The Western Power Capital Contribution Policy has been determined by the Economic Regulation Authority of Western Australia (ERA) to be consistent with the requirements of the ENAC. The Capital Contribution Policy defines the capital contribution as the Allocated Forecast Costs minus Network Access Charges plus Other Applicable Costs.

Where allocated forecast costs include:

- Minimum practical works to provide the connection
- Shared networks costs
- Future applicants
- Current applicants
- Costs brought forward
- Temporary supplies

4.4.3. Arrangements relevant to the Wholesale Market

4.4.3.1. The role of Connection Costs in the design of the WEM

DCC ultimately contribute to the design and implementation of the organised wholesale market via their contribution to the determination of the MRCP that is a feature of the Reserve Capacity Mechanism. Indeed, it is this context that guides the focus of this review.

A review of the WEM Market Rules identifies that the MRCP undertakes the following roles

1. Provides for the mitigation of actual or potential market power (Clause 2.26.3)
2. Provides for the management of commissioning risk specific to a new electric facility that is assigned Certified Reserve Capacity (Clause 4.13). This process underpins the Security of the Reserve Capacity.
3. Defines an upper bound for the Reserve Capacity Price (Clause 4.16)
4. Defines an upper bound for Reserve Capacity Offers in the Reserve Capacity Auction (Clause 4.18)

5. Defines a settlement price for Capacity Credits in the absence of a Reserve Capacity Auction (Clause 4.29.1)

6. Defines the financial implications of failing to satisfy Reserve Capacity Obligations in the absence of a Capacity Auction (Clause 4.26.1)

7. Sets bounds for administrative processes related to Long Term Special Price Agreements (Clause 4.22.2)

The Market Rules are also clear that the MRCP is to act a market signal with a general requirement to be published (Clause 10.5.1.e) and a requirement to be included in the information that forms the Expression of Interest in the Reserve Capacity Auction (Clause 4.3.1).

This review of the Market Rules indicates that the general function of the MRCP is to provide a benchmark or reference price to facilitate the management of risk, market power or other administered market processes. Moreover, it is defined as one unique benchmark or reference price that is applied commonly across the reach of the Market Rules; it therefore does not differentiate in application or calculation with respect to location, time or technology.

The role of the MRCP in the market design is also indicated via the associated Market Procedures, in particular, the *Market Procedure for: Determination of the Maximum Reserve Capacity Price. Version 2*. Specifically:

1. Section 1.5 defines the technical characteristics of a hypothetical Power Station that is to be used in the calculation of the MRCP;

2. Section 1.6 defines the cost factors that are to be used in the calculation of the MRCP; these explicitly include costs associated with the connection of the Power Station to the bulk transmission system (Clause 1.6(d));

3. Section 1.14 defines the formulae to determine the MRCP, for which no precise methodological detail is provided for the determination of connection costs; and

4. Section 1.15 defines requirements for the periodic review of the methodology that is used to determine the MRCP.

A review of the Market Procedure therefore indicates that the calculation of the MRCP is to be based on a hypothetical generation asset using contrived assumptions that are deemed to be reasonable by virtue of the consultative provisions of the Market Rules, and of the periodic reviews that are required by the Market Procedure.

4.4.3.2. The Role of Connection Costs in the Bilateral Market

As a published metric and instrument of the market for Reserve Capacity, the MRCP represents a significant market signal for the installation and procurement of capacity. The direct impact is via the operation of the organised market for Reserve Capacity, including the Reserve Capacity Auction and arrangements for the procurement of Supplementary Reserve Capacity. It has indirect impact on the bilateral contract market for capacity, insofar that the organised market complements the contract market by providing alternative facilities for the procurement of capacity, for trading out of contractual exposures, for the refinement of contracted positions, and as a price reference in the negotiation and operation of bilateral contracts. Moreover, the performance of both the bilateral and organised markets provide price and dispatch signals that feature in decisions to invest in physical capacity, or in associated services.

4.4.3.3. Interaction of the MRCP with the Energy Market

In the broader context of the WEM, the Reserve Capacity Mechanism represents one of two major revenue streams for generators. The second major stream of revenue is the sale of electricity, whether through the bilateral market, the short term energy market (STEM) or as a balancing or ancillary service. The Reserve Capacity Mechanism is intended to cover a portion of the fixed cost associated with installing new capacity. The portion of that cost depends on the generation technology being installed as the fixed and variable cost base of generation technologies vary widely, from diesel generators (with low fixed and high variable costs) to wind and other renewable generation (with high fixed and low variable costs).

As a metric not largely determined by market mechanisms[5] the MRCP has limited ability to respond dynamically to incentivise efficient outcomes within the market. This suggests that the portion of participating generators revenue met by the MRCP through the Reserve Capacity Mechanism should be periodically reviewed via consultative processes that engage industry. However, the WEM market is a day before market and therefore cannot respond dynamically (in real time) to periods of generation shortfall. This is reflected by the low Maximum Energy Price Limits on the WEM compared to those in real time energy markets such as the NEM. The impact of this is that peaking generation technologies, that form and integral part of an efficient energy solution, do not see the high energy price that incentivise their participation in real time energy markets. Thus, the MRCP must be set high enough to incentivise the participation of low fixed cost peaking technologies.

[5] Notwithstanding the scaling made by the Excess Capacity Adjustment that is linked to the relationship between supply and demand for Capacity Credits.

5. Assessment Approach

5.1. An Assessment Framework to support the evaluation task

5.1.1. What is the subject of the assessment?

The subject of the assessment is defined by the IMO in its terms of reference for this review. In particular, the IMO requests the following:

To guide this review the IMO requires a report on the appropriate definition (including the reasons for inclusion and exclusion of each cost), parameters, assumptions and calculation of estimates of deep connection charges associated with connecting a Power Station to the SWIS. This report will need to be in the context of the Western Australian Wholesale Electricity Market and be able to be followed by Western Power in calculating an estimate of deep connection charges.

SKM therefore interprets the subject of the assessment as the substance and application of the calculation methodology for DCC, as prescribed by the Capital Contributions Policy of Western Power.

5.1.2. Benchmark criteria and attributes that should inform the assessment

The IMO requires the assessment to consider what is ‘appropriate’ with respect to the substance and application of the calculation methodology for DCC.

A consideration of what is appropriate necessarily requires reference to the Market Objectives, insofar that they prescribe what is required for an effective and appropriate set of rules to guide the operation of the WEM in the context of the SWIS.

In determining what is appropriate, however, SKM recognises that the Market Rules, including their Market Objectives, are but one element of a suite of market and regulatory arrangements that ultimately influences the operation of the market. Other elements include related systems, procedures, guidelines, regulatory instruments, institutions, assets and processes of change and reform. Together these shape decisions, implement processes and guide the behaviour of participants in the market. Accordingly, while the Market Objectives can provide some specific guidance of what is appropriate in the context of the WEM, on their own they are not sufficient. For a market design to best achieve the Market Objectives, additional and more general attributes also guide what is ‘appropriate’. Examples include the following:

- Resilience to anticipated scenarios of change, reform, investment and innovation.
- Consistent with the realities of operational practices, technological constraints and prevailing contracts.

- Consistent with the broader market and regulatory arrangements that influence market behaviour and outcomes.
- Processes of change are manageable in terms of time, cost and risk.

SKM has therefore broadened the set of criteria and attributes that it considers relevant to the assessment and development of the calculation methodology for DCC.

Appendix A describes how SKM has developed a set of assessment factors to assist the review.

The following summarises the assessment factors that have been used in this review.

5.1.3. Summary of Selected Assessment Criteria

The following summarises the criteria that SKM has utilised to assess Western Power's calculation of DCC:

Criteria 1: Accuracy

For the purpose of this review, we define accuracy as the extent to which the DCC calculation methodology drives the correct level of new capacity investment and supports the correct mix of generation technologies in the market as prescribed by the Market Objectives. The level of new capacity must therefore achieve the Market Objectives, for example, economic efficiency, reliability and fair competition.

As a component in the calculation of the MRCP, the estimate of DCC should represent an upper limit on the connection cost of Reserve Capacity, estimated in marginal cost terms for application across the SWIS. Ultimately the economic intent of the MRCP is to provide a price constraint that is approximately consistent with the system marginal cost of new peaking (liquid fuelled) capacity when the market is in long-run equilibrium. It follows that the DCC estimate should similarly reflect the system marginal connection cost for new peaking capacity in this long-run equilibrium state. With respect to this ideal, the following clarifying observations are made:

- The long-run equilibrium state refers to circumstances when the market is in a long-run equilibrium, meaning that in the context of the Market Rules, the market best achieves the Market Objectives. In part, this requires the market to achieve ideals of economic efficiency, competitiveness and non-discrimination, in circumstances when system assets exactly deliver the requirements of the reserve margin, and associated reliability and system security objectives. When actual capacity varies from the exact requirements of the reserve margin, it is not in a long-run equilibrium. If the market is performing well, this will then cause system marginal prices to incentivise changes to market behaviour towards the achievement of the requirements of the long-run equilibrium. When actual capacity is in excess of the requirements of the Reserve Margin, for example, a competitive market would produce energy and capacity price outcomes that are less than the long-run total cost of new capacity, thereby acting as a disincentive for new investment. Conversely, when actual capacity is short of the requirements of the Reserve Margin, the MRCP combines with higher energy prices to reflect a scarcity of capacity, thereby resulting in prices at or above the marginal cost of new capacity in this long-run equilibrium state, and encouraging increased investment.

- As a system marginal cost, the DCC estimate in the MRCP should reflect the cost of the last increment of new capacity that just achieves the requirements of the Reserve Margin for the SWIS. The appropriate size of this increment is 1 MW, with costs measured on an annual basis. It follows that estimates of DCC should similarly reflect an annualised measure of the additional total cost of connecting the last MW of new capacity that is required to achieve the system's Reserve Margin.

Criteria 2: Simplicity

The calculation methodology represents an overhead burden ultimately borne by customers on the SWIS. Further, more complicated methodologies may introduce uncertainty or modelling difficulty amongst potential investors. For these reasons it is necessary that any methodology be simple to understand, implement, manage and be repeatable. To the extent that it is feasible, participants other than Western Power should be able to independently apply the methodology, therefore supporting their own investment modelling.

Criteria 3: Certainty

The methodology must be stable over time, therefore promoting regulatory certainty, and as a consequence, minimal investment risk.

Because the MRCP is both a default price, and a price cap that affects payments to assets with long-lives, this volatility can be the cause of revenue risk in investment decisions. The consequence is that the market may delay new investment longer than is optimal and/or, the technology of the ultimate capacity investment may be inappropriate given the needs of an economically efficient system and market.

Criteria 4: Resilience

The methodology is expected to continue to deliver the intent of the Market Rules given anticipated scenarios of industry change, development and reform.

Criteria 5: Flexibility

The methodology must accommodate variations in the character of connection costs, and in the scenarios that may be used to establish the benchmark.

5.1.4. Weighting of Criteria

The above criteria are not considered of equal importance within the assessments in this report. Criteria that directly support multiple Market Objectives (as discussed in Appendix A) are given a greater weighting than criteria that support more general attributes. Table 1 provides a weighting out of 100% as a guide to the relative importance of each criteria.

Table 1 Weighting of Assessment Criteria

Factor	Weighting
Accuracy	50%
Certainty	20%
Simplicity	20%
Resilience	5%
Flexibility	5%

5.2. The assessment approach

The assessment will undertake the following steps:

1. Summarise existing methodology.
2. Review existing methodology and assumptions against criteria.
3. Review interactions or complexities with other market and regulatory requirements.
4. Propose a range of options.
5. Consider the proposed methodology options against Criteria.
6. Recommend a methodology

6. Summary of Existing Methodology

6.1. Our approach

This section summarises the existing DCC methodology by considering the following aspects of the DCC:

1) How the DCC is used in the broader MRCP calculation.
2) The context prescribed by the IMO to Western Power for the calculation of the DCC.
3) The methodology and assumptions used by Western Power to apply the Capital Contribution Policy to the context prescribed by the IMO.

The methodology and assumptions summarised in this section form the basis of the analysis in Section 7 of this report.

6.2. Documents Referenced in the Review

The summary outlined in this section references the following documents:

- Interview with Western Power by SKM on 28 October 2010.
- Western Power Capital Contribution Policy Summary[6].
- Appendix 3 of the current Western Power Access Arrangement[7].
- Spreadsheet from the IMO titled "MRCP_CALC_2012_2013 - OPTIMISED V5 -Including easements and updated WACC and updated M and updated transmission costs".
- Spreadsheet provided by Western Power titled "MRCP - Capital Contribution Calculator - Collie Shared Assets Only.xls".
- Wholesale Electricity Market Rules[8] (Market Rules).
- Market Procedure for: Determination of the Maximum Reserve Capacity Price[9].
- Various submissions to the IMO on the DCC calculation methodology[10].

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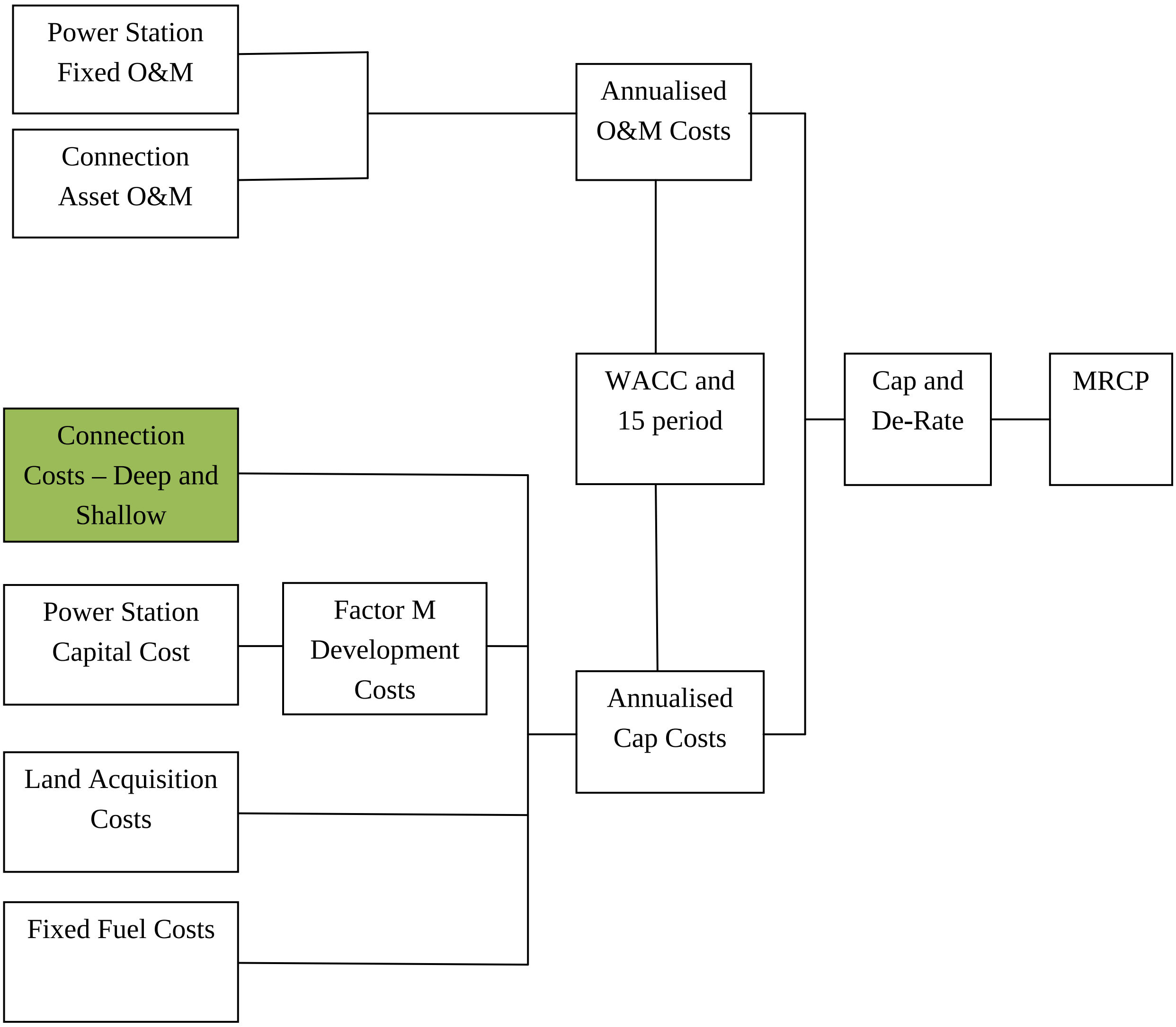
6 http://www.westernpower.com.au/documents/infoPacks/CapitalContributionPolicy.pdf
7http://www.westernpower.com.au/documents/aboutus/accessarrangement/2010/WE_n5012829_v14A_AA2_Appendix_3_-_Contributions_Policy.pdf
8 http://www.imowa.com.au/market-rules
9http://www.imowa.com.au/f711,482994/482994_Market_Procedure_for_Maximum_Reserve_Capacity_Price.pdf
10 Available on the IMO website: http://www.imowa.com.au/mrcp

6.3. DCC as part of the MRCP

The role of the DCC in the determination of the broader MRCP is detailed in the formulae contained with the Market Procedure for MRCP, this formulae is summarised diagrammatically in Figure 1 below. The DCC component of the MRCP is highlighted in green.

▪ **Figure 1 Components of the MRCP**



The IMO typically requests the parties that calculate the component parts of the MRCP determination to commence work in July of each year with the results to be with the IMO for compilation by October of the same year.

6.4. The prescribed context for the DCC calculation

The IMO, through the Market Rules and Market Procedures, prescribes the calculation scenario that Western Power is required to use in its estimation of DCC for input into the MRCP calculation. Specifically, the connection scenario considers the connection of the following generator to the SWIS:

a) 160 MW open cycle Gas Turbine.

b) Connected at 330 kV.

c) Costs associated with any staging works will not be considered.

The connection scenario also requires a consideration to the ollowing locations for connection:

- Pinjar
- Kwinana
- Kemerton
- Collie
- Geraldton
- Eneabba
- Kalgoorlie

These locations are consistent with the regions stipulated in section 1.8 of the Market Procedure.

This calculation is requested in current dollars and assumes a 2 year construction period. The steps Western Power currently takes to calculate the DCC within this scope are detailed below.

6.5. Western Power's application of their Capital Contribution Policy

In determining the DCC consistent with the preceding prescribed context, Western Power seeks to address the general requirements of the Western Power Capital Contribution Policy. These are:

- Allocated Forecast Costs, including:
  - Definition of minimal practical works.
  - Level of contribution to the connection costs from current and future third parties.
  - Extent to which the costs are an acceleration of investment that would have met the NFIT.
- Period (up to 15 years) and forecast quantum of the Network Access Charges.

- Other Applicable Costs, including:
  - Non capital costs.
  - Non standard construction.
  - Other costs incurred to ensure Western Power complies with all technical rules.

The current approach to each of these aspects, as determined through discussions with Western Power, is detailed below.

6.5.1. Determining Minimum Practical Works

6.5.1.1. Definition of Minimum Practical Works

In defining the required Minimum Practical Works for the DCC calculations, Western Power depends largely on studies undertaken for previous access applicants and experience and knowledge of what is likely to be the most effective arrangement for new facilities. For some connection points, like Kalgoorlie, the requirement for a 330 kV connection results in works that are significantly disconnected from that which would be considered efficient.

In determining the Minimum Practical Works Western Power does not follow the procedures for processing real new connections, most significantly:

1) Western Power does not undertake any specific steady state or dynamic analysis to determine the Minimum Practical Works for the model generators at each of the locations.
2) No specific options analysis is undertaken beyond the information drawn from previous connection studies.
3) Likely future users are not considered in determining the Minimum Practical Works requirement at each location.

The use of information from previous studies and experience in establishing the Minimum Practical Works for each of the connection points is a reasonable approach in the time frame provided for the study and the expected expenditure. To complete a comprehensive options analysis for each of the locations would require an extended program of work that would need to exist in parallel with Western Power's network planning process and processing of "real world" Access Applications.

6.5.1.2. Estimating the Cost of defined Minimum Practical Works

In determining the cost of the Minimum Practical Works, Western Power uses a cost "building blocks" approach consistent with the first stage of the Western Power estimating framework. This approach involves no application specific design and limited project definition. SKM believe this is consistent with a class 4 estimate under the Association for the Advancement of Cost Engineering international (AACEi) recommended practice of estimate classification (Refer

Appendix B). SKM believes the expected accuracy of this estimate would be in the order of ±30-50%, this is consistent with Western Power's view of this estimating process.

6.5.2. Level of contribution to the connection costs from current and future third parties

In defining the costs contribution by third parties, Western Power assumes that any "spare" capacity produced by the minimum practical works will be utilised by third parties, and therefore allocates a pro –rata cost to the model 160 MW. This pro-rata estimate uses as its basis the portion that the required 160 MW facility takes of the capacity created by the minimum practical works. This approach represents what would be a "best case" for a real connection.

6.5.3. Extent to which costs are an acceleration of investment that would have met the NFIT

Western Power have advised minimum required works developed for the DCC are not considered in the context of the Western Power 10 year plan for the SWIS network. In this way this aspect of the Capital Contribution Policy is not considered.

6.5.4. Calculation period

The calculation period of 15 years is used by Western Power in the calculation of the DCC.

6.5.5. Forecast quantum of the Network Access Charges;

Western Power use the existing Network Access charges with no escalation in real terms in their capital contribution model.

6.5.6. Other applicable costs

Western Power applies the operating and maintenance costs of the minimum practical works on the basis of:

- 3.1% of distribution asset capital cost.
- 2.1% of transmission asset capital cost.

SKM has not identified any other applicable costs applied by Western Power.

6.5.7. Payment Terms

Clause 6 of the Capital Contribution Policy allows provision for payment terms, and prescribes the circumstances when alternative payment terms are available. These payment terms are not applied in the determination of the DCC.

6.5.8. Western Power’s application of the applications and Queuing Policy

Western Power does not take into account any impact on the DCC from the Applications and Queuing Policy.

7. Review of Existing Approach and Assumptions against Criteria

This section reviews the methodology and assumptions summarised in section 6 against the criteria detailed in section 5 of this report.

7.1. Review of Existing Approach to Calculating the DCC

This section provides a review of the existing approach of basing the DCC calculation on an estimate of the actual cost of a model connection at various sites against the assessment criteria.

Factor	Impact of Assumption
Accuracy	The approach should produce a cost estimate that is consistent with the system marginal connection cost of the efficient new entrant capacity provider when the market is in a long-run equilibrium, and therefore when it is fully achieving the market objectives (eg. the new capacity exactly achieves the requirements of the reserve margin). The approach does not produce costs that are consistent with this requirement, in part because it considers the current context of the network, and not a context that reflects long-run equilibrium conditions. What this means is that the estimated costs may be volatile, and subject to current system constraints, and the effect of over or under network investment. When feeding through to the MRCP, this may then produce a price/bid cap that contributes to cycles of over or under capacity investment. Due to the constrained nature of the network there may be periods where this approach results in costs significantly higher than those seen by capacity providers using technologies that differ from the model connection size.
Certainty	The approach to a model connection provides certainty to market participants that the DCC should reflect the actual cost of new entrant capacity within the accuracy constraints introduced by the assumptions used discussed further in section 7.2.
Simplicity	The model connection is an approach that is easily understood by market participants. The resulting methodology could be very complicated and requires a range of detailed assumptions. Western Power has adopted a methodology that uses existing data and experience to simplify the approach. This approach represents a practical solution to what could be a significant time and resource intensive process. It does however introduce a range of repeatability concerns.
Resilience	The use of a model scenario for the Calculation of DCC is an approach that can be applied independently of changes in the regulatory context within the WEM. It does however make the calculation methodology subject to changes in both the ENAC and the WEM Market Rules. Therefore, although the approach is resilient the resulting methodology may be impacted by changes to a wide range of market mechanisms.
Flexibility	The current approach has flexibility to respond to the locations within the network that may represent the most cost effective connection site but cannot respond to changes in the nature of the efficient new entrant capacity provider over time.

7.2. Assumptions prescribed by the Market Procedure

This section reviews the following assumptions summarised in section 6.4 of this report against the assessment criteria.

160 MW Capacity Requirements

Factor	Impact of Assumption
Accuracy	The optimal scale for the efficient new entrant capacity provider will change over time. For example, embedded generation may have a lower connection cost but this may be offset by lower capital efficiency in the generation. Alternatively, larger scale generation may deliver a higher economy of scale. Fixing the size of the model new connection means that the DCC cannot adjust to reflect the changes in the nature of the efficient new entrant capacity provider. We note however that a medium-sized OCGT is a benchmark generator that is often used in similar markets around the world to estimate a capacity cost benchmark for the capacity market when in balance with the needs of the reserve margin.
Certainty	Fixing the model size to 160 MW should result in a relatively stable outcome for the DCC over time within a large network. However physical constrains in the SWIS may result in step change in costs as network connection opportunities at this size are consumed. This is discussed further in location assumptions.
Simplicity	The model 160 MW connection is an approach that is easily understood by market participants and simplifies the calculation methodology.
Resilience	The 160 MW connection assumption is resilient to changes in the market.
Flexibility	The efficient new entrant capacity provider will change over time. Fixing the size of the model new connection means that the DCC cannot adjust to reflect the changes in the nature of the efficient new entrant capacity provider.

330kV Connection Voltage

Factor	Impact of Assumption
Accuracy	Setting the voltage of the connection avoids the efficiencies that may be introduced by other approaches to connection. The most pressing example of this is the model connection in Kalgoorlie that results in the minimum practical works being a circa 400 km 330 kV transmission line. It is unlikely this is the most cost effective connection solution. This connection voltage assumption will likely drive the DCC calculation to overstate the cost of connection.
Certainty	Fixing the model voltage of connection to 330 kV should result in a relative stabile outcome for the DCC over time within a large network.
Simplicity	The model 330 kV connection is an approach that is easily understood by market participants and simplifies the DCC calculation methodology. It removes many of the options Western Power may have otherwise needed to consider from the calculation of the DCC.
Resilience	The 330 kV connection assumption is resilient to changes in the market.
Flexibility	Fixing the voltage of the model new connection means that the DCC cannot adjust to reflect the changes in the nature of the efficient new entrant capacity provider.

7 Connection Sites

Factor	Impact of Assumption
Accuracy	The seven sites selected represent a reasonable cross section of the likely connection sites on the SWIS and would likely therefore capture a site selected by an efficient new entrant capacity provider at the scales considered.
Certainty	In the 2009 MRCP calculation the Western Power calculations for MRCP varied between $35 million and $350 million across the 7 sites considered with an average of $129 million. This is a very wide range in costs that could have a significant impact on the stability of the DCC calculation.
Simplicity	Attempting to calculate the actual connection costs for 7 sites introduces a significant complexity. The DCC calculation for the 7 sites makes the management of the DCC calculation troublesome. Not only must the calculations be undertaken for each site, a consistent approach to the calculation must be maintained for each site. Western Power’s use of previous studies and experience makes this difficult to achieve. Further the interaction between the DCC and other components of the MRCP must be considered in the selection of the model lowest cost new entrant.
Resilience	The seven sites are selected independent of market arrangements.
Flexibility	The seven sites would likely effectively respond appropriately to changes in the network configuration over time.

7.3. Assumptions determined by WP to guide the application of the DCC calculation

This section reviews the following assumptions summarised in section 6.5 of this report against the assessment criteria.

Assumptions in the Definition of Minimum Practical Works

Factor	Impact of Assumption
Accuracy	In not using a dedicated options analysis or other planning activities, the existing approach introduces the possibility that the minimum practical works have not been identified. A sub optimal technical solution could significantly increase the cost associated with a particular connection site. To produce a cost estimate that corresponds to a long-run equilibrium state, then some form of network reference scenario would be desirable, to hypothesise the network state when it is in a long-run equilibrium, and therefore not subject to inefficient pockets of congestion or constraint that may otherwise introduce a transmission scarcity cost component to the DCC estimate that is used in the MRCP.
Certainty	The dependence on experience may undermine market certainty on the outcome of the DCC .
Simplicity	The existing approach is a simplification of the activities undertaken in a full access application process. However, it relies heavily on previous real access applications and the experience of Western Power's staff. This represents a risk to the ongoing repeatability of the existing methodology.
Resilience	Is directly linked to the Western Power capital contribution policy and would be directly impacted by changes in this policy.
Flexibility	Can respond to changes in the market and changes in the physical network. However, this response is based on historic access applications and the experience of Western Power staff.

Assumptions in Cost Estimation

Factor	Impact of Assumption
Accuracy	Estimate will likely be ±50% of the actual cost to build the connection assets.
Certainty	The accuracy of the estimating methodology has a direct impact on the market's certainty and confidence of the DCC.
Simplicity	This approach represents the simplest approach to cost estimating as detailed in Appendix B and utilises existing Western Power processes and does not therefore represent a significant management burden.
Resilience	The cost estimation process is based on Western Power's wider cost estimation process and would be impacted by changes in this process.
Flexibility	The estimating approach can respond to any defined Minimum Practical Works.

Assumed Contribution from Third Parties

Factor	Impact of Assumption
Accuracy	Represents the best case for an access applicant. Thus an actual applicant may see a cost above that determined under this approach by up to the pro rata amount.
Certainty	Represents a consistent approach to a complicated variable in the calculation of real access charges.
Simplicity	Is a simplifying assumption to a complicated variable.
Resilience	Could be heavily impacted by changes in management of Western Power's regulated network.
Flexibility	N/A

Lack of Integration with Western Power 10 Year Strategic Planning

Factor	Impact of Assumption
Accuracy	Introduces the possibility of significantly overstating the actual DCC.
Certainty	N/A
Simplicity	Is a simplifying assumption.
Resilience	Is in conflict with Western Power's existing Capital Contribution Policy and therefore the impact of any changes would be uncertain.
Flexibility	N/A

7.4. Summary Key of Issues / Gaps

From the analysis detailed above the following issues / gaps have been summarised:

7.4.1. Accuracy

The review of the DCC methodology, as it is applied to the context of determining the MRCP, has found that in some circumstances, the DCC calculation methodology will not correctly measure the system marginal connection cost of new capacity in an assumed state of long-run equilibrium, thereby possibly distorting efficient investment behaviour. The following details the basis of these concerns.

- The existing approach to calculating the DCC applies to real investments in the physical system. It then determines and allocates connection costs that are relevant for the time and place of that real investment. When applied to the context of the MRCP calculation, a contrived investment scenario is used, defining the technology and guiding the location of a hypothetical investment. This assumed investment scenario does not however require Western Power to estimate a connection cost in a circumstance when the system is assumed to be in long-run equilibrium. This means that the estimated connection cost will be reflective of short-run conditions in the system. In practice, this means that if transmission investment has been insufficient in the past, which in many jurisdictions is the case, then the DCC calculation methodology may over-estimate the connection and system augmentation costs for the hypothetical 160 MW generation investment. This means that the system marginal connection cost may capture costs that are required to recover from insufficient investment in the past (reflected as a cost of transmission scarcity), thereby over-measuring the estimate of MRCP. Such a circumstance would typically be coincident with higher energy prices, caused by higher marginal costs of system constraints and system losses, which when combined with a higher MRCP, may cause the combined market revenues to be inefficiently high, and potentially encouraging a cycle of over-investment in generation plant.

- The existing methodology represents an opportunity for significant inaccuracy in the order of ± 30-50% of the actual completed cost of the connection asset.
- The lack of integration with Western Power's 10 Year Planning introduces significant inaccuracies and further disconnects the DCC estimate from a long run equilibrium position.
- The lack of dedicated options analysis has the opportunity to introduce significant inaccuracies and disconnects the determination of the MRCP from a long run equilibrium position.
- Whether the hypothetical 160 MW and a 330 kV connection continues to be the correct scale for a least cost capacity provider given the cost impact of increasing DCC.

7.4.2. Simplicity

- The existing methodology is a simplification of the process that is undertaken for a real applicant that relies heavily on the experience of Western Power's technical staff and on historic analysis. This reliance means that the process cannot be completed by non Western Power staff and undermines the repeatability of the process.
- Modelling the Actual Connection Costs for 7 sites represents a significant management burden.

7.4.3. Certainty

- The DCC is becoming an increasing portion of the MRCP over time and under the current assumptions may change dramatically year to year due to increasing network constraints.
- In the 2009 MRCP calculation the Western Power calculations for MRCP varied between $35 million and $350 million across the 7 sites considered with an average of $129 million. The $35 million DCC represents 17% of the total capital cost whereas the average $129 million would represent 41%. As the more cost effective sites continue to be utilised and restrictions on medium and large scale generation in central areas continue to increase over time the DCC will likely trend toward the average. This trend will be supported by the increasing restrictions on medium and large scale generation in developed areas. This is reflective of a methodology that is disconnected from a long run equilibrium cost.

- Indeed this a key concern raised in responses to the 2010 MRCP determination. This has the effect of producing a DCC estimate that can be very different between Reserve Capacity Cycles, ultimately causing volatility in the measure of MRCP.

7.4.4. Resilience

- The current approach to calculating the DCC requires an implementation of Western Power's Capital Contribution Policy. Thus any methodology and associated assumptions must be framed with reference to this policy. This policy is reconsidered at each review of Western Power Access Arrangement (approximately every three years). Any methodology framed under the existing approach will be impacted by this review or by many other changes under the ENAC.

7.4.5. Flexibility

- Fixing the connection size and voltage undermines the ability of the methodology to respond to changes in the position of the technical nature of the efficient new entrant generator within the market.

8. Options Considered

8.1. Key Observations

Critical to our assessment of Accuracy, is the differential treatment of connection costs within the network regulatory and market arrangements, as they apply to either the trading arrangements of the WEM, or to physical investments that occur in the SWIS.

Currently, Western Power's Capital Contribution Policy is used to allocate the actual connection costs of real assets and services to industry participants, and is also used by the IMO to guide its estimate of DCC that feature as a component in the determination of the MRCP.

The critical distinction lies in between these two applications of the Capital Contribution Policy:

- The policy must calculate and allocate the costs of actual investments in real assets and services to industry participants.
- The policy is also used to calculate the expected costs of hypothetical assets to support a contrived MRCP mechanism using proxy data that is intended to provide an economic signal or reference benchmark to support administered purposes.

When considering the role of the MRCP, it becomes obvious that the logical requirements of a connection cost calculation methodology may at times depart from what is required to allocate the costs of real investments. Some of these departures may imply a need for contradictory outcomes.

In terms of real investments in physical assets, and the calculation and allocation of related connection costs, methodological requirements that define the calculation of connection costs accurately reflect the efficient cost of the connection. Indeed, this cost determination features a prudency assessment that links with formal planning processes, including the scenario modelling and options assessment that is included therein.

As a mechanism for setting the DCC, the Capital Contributions must seek to provide a pricing constraint or default price related to actual and potential investments in reserve capacity. For it to promote the achievement of economic efficiency, it must be set with reference to the investment signals that are needed to promote an equilibrium level of generation investment in the long-run, as discussed in section 5.1.3 of this report. This consideration of appropriate investment signals results in a calculation that necessarily varies from that required for the allocation of costs related to actual investments in real assets and services.

The use of a single estimate of a MRCP for a single region and multi-period market means that the calculation of connection costs will ultimately be static, approximate and representative based on what is deemed reasonable. Given that the MRCP is used primarily as a market constraint and default price in particular circumstances, the need for accuracy becomes less critical.

It follows therefore that the methodological requirements for the calculation of DCC may, under some options to be considered, become largely divorced from the methodology defined under the Capital Contributions Policy.

8.2. Options

To address the issues discussed in section 7.4 this section considers a range of options against the assessment criteria.

To determine the range of options to be considered, reference is made to the discussion section 8.1 of this report. From these discussions it is clear that the options, insofar that they produce a cost estimate for inclusion in the MRCP, must seek to produce appropriate investment signals that have the effect of promoting the achievement of the Market Objectives. In doing this the approach does not necessarily need to result in an application of the Capital Contribution Policy.

The Options proposed below are best considered on a continuum of increasing complexity.

Option 1

Calculate an "average cost" based on the cost of providing network capacity and the quantity of network capacity provided as the basis of the DCC and adjust this annually to capture market changes. This option is a reflection of the long run average (not marginal) cost of capacity on the network.

Option 2

Use historic connection cost data to forecast likely future DCC. This approach may place bounds around the historic connection cost data to only include connection costs for technologies consistent with an efficient new entrant capacity provider. The approach to forecasting may take into account trends over time or other market data. The extent to which historical data is used in the forecasting process should provide a balance of historic long run marginal costs and short run marginal costs.

Option 3

Continue with the existing methodology and revisit and adjust the main assumptions to attempt to address some issues.**Option 4**

Continue with the existing approach of the modelling of the connection of a model generator and reinforce the methodology to undertake analysis more consistent with that undertaken for an access applicant. This would include options analysis, integration with Western Power long term planning and perhaps consideration of the impact of the Applications and Queuing Policy.

This approach would most accurately reflect the short run marginal cost of connection.

8.3. Options Comparison

The pros of each option are compared with the existing approach (Option 3) in terms of the assessment criteria in section 5.1.3 of this report . This information is provided symbolically in Table 3 with a tick representing an improvement compared to Option 3 for that criteria and a cross representing a worse outcome against that criteria.

- **Table 2 Comparison of alternative DCC calculation methodology (Options 1,2 and 4) approaches against the existing methodology (Option 3) - Detailed**

Criteria	Average Cost (Option 1)	Forecast DCC based on Historic Connection Costs Data (Option 2)	Reinforced Existing Approach (Option 4)
Accuracy	This approach would not reflect short run or long run marginal costs and, as such, may disconnect from an appropriate outcome over time.	This approach would likely result in a more accurate outcome than the status quo as it does not include the opportunities for inaccuracies introduced by assumptions. It would also pick up changes in the optimal technology for the efficient new entrant over time.	On the basis that the appropriate investment was made to implement this approach, this approach should yield DCC that closely reflect that experienced by the efficient new entrant capacity provider using the modelled technology.
Certainty	This approach would provide significant certainty in the market of the likely outcome of the DCC calculation.	This approach would in effect "smooth" changes in the cost of connecting over time. The extent of the smoothing would be impacted by the forecasting mechanism used. This mechanism may impact market certainty.	This approach would respond appropriately to any network constraints that may impact the model generator size. The need for a sophisticated model and confidential data may make it difficult to anticipate results.
Simplicity	Will require limited management and could likely be undertaken independent of Western Power.	Will require Western Power to undertake calculations (as confidential data will be used) but the methodology can be automated with new data added in each year's review. This approach is significantly simpler than the existing approach.	This would be more complex than any that is used for any calculation currently undertaken by the IMO. It would likely require 1-2 technical staff full time to fully implement.
Resilience	Will disconnect the DCC from the major market mechanisms making the approach more resilient.	Will reflect changes in market mechanism albeit after a delay. The methodology will not be directly affected by changes in market and regulatory mechanisms.	This will result in an increased linking of the DCC calculation to the Access Queuing Policy and the Capital Contribution Policy increasing the impact of any change.
Flexibility	This approach would not effectively reflect changes in the market.	This approach could reflect changing trends in the market. Step changes in the market would be reflected on a year behind basis.	This approach could reflect changes in the market before they were experienced by market participants making the DCC a lead indicator for the market.

- **Table 3 Comparison of DCC Calculation Methodology Approaches against Option - Symbolic**

Criteria	Average Cost	Forecast DCC based on Historic Connection Costs Data	Reinforced Existing Approach
Accuracy	✗	✓	✓
Certainty	✓	✓	✗
Simplicity	✓	✗	✗
Resilience	✗	✓	✗
Flexibility	✓	✓	✓

From the summary provided in Table 2 and Table 3, Option 2 “Forecast DCC based on Historic Connection Costs Data” is the preferred option, the discussion below expands on this preference.

SKM are of the view that reinforcing the existing model connection approach (Option 4) will increase the accuracy of the DCC calculation against the short run “real world” connection costs. With a range of assumptions on the long term “stable” nature of the network taken from Western Power’s long term system planning information this approach may produce the most accurate investment signals. However, SKM are of the opinion that the increased complexity, management cost and certainty issues outweigh any benefit in accuracy that could be achieved through this approach. Moreover, the ultimate need for accuracy is via the pricing mechanism of the organised market for Reserve Capacity, making this issue a second-order concern from the perspective of the DCC calculation. Indeed, other jurisdictions that share a similar market design take this approach, allowing a more simplistic and approximate methodology for the determination of DCC estimates. Ideally, this issue should be picked up in the broader review of the RC mechanism.

The Average Cost (Option 1) approach significantly simplifies the existing approach. It is not however a reflection of marginal cost and cannot therefore be considered an accurate determinate of an efficient investment signal.

The option to forecast DCC based on historic connection costs (Option 2) will produce a more accurate outcome than the existing approach as it avoids many of the assumptions and simplifications the existing approach adopts. The method by which historic data is used in the forecasting process can be used to assist the DCC to better approximate appropriate investment signals by weighting recent and historic data. That is, a heavier weighting on more recent data would result in an increased focus on current investment conditions relative to historic conditions. This approach is also significantly simpler than the existing approach. For these reasons, Option 2 is the preferred approach.

8.3.1. Issues to be addressed with the preferred approach

SKM has identified the following issues with Option 2 that must be addressed in the methodology to effectively implement the approach:

1) Ability to Respond to Rapid Changes in Actual Connection Costs

   Western Power has indicated that they believe increasing constraints on the SWIS will result in a rapid increase in connection costs and have raised concerns that that using historic data may not be able to capture this. SKM is less concerned with this issue for reasons:

a) The requirement for applicants for Capacity Credits to have an Access Offer means that data will be available for the actual access offer costs for the year the capacity credits are required.

b) The requirement for the DCC to reflect the long run marginal cost of connection to best achieve market objectives means it need not respond to short term under investment in the network at a given location.

In developing the methodology it is intended that the Access Offer data for the year the capacity credits are required will be included in the calculation at an appropriate weighting.

2) Reflecting appropriate long run and short run conditions

Ultimately the MRCP should provide an appropriate investment signal for generation, such that the system tends towards the achievement of the reserve margin, with the installed capacity of generation reflecting an efficient mix of generation technologies. The achievement of appropriate investment signals is therefore more a challenge for the greater pricing mechanism of the market for Reserve Capacity, and less so for the DCC estimate that is merely a cost input. Given such, an appropriate setting for the DCC estimate is a stable estimate of transmission connection costs that are relevant when the installed capacity of generation just meets the level of the reserve margin; this may reflect a point when transmission capacity is either long or short. Obviously historic costs may be different from those in an equilibrium state. However, when noting that a forward looking method that embraces options analysis in a planning framwork is overly onerous, a method that uses historical data with weights to give greater emphasis to current conditions may be an adequate compromise, and may reveal emerging conditions.

3) Reflecting Connection Cost of Efficient Capacity Provider

As discussed in section 5.1.2, the DCC should be set to reflect the long run marginal cost of new peaking (liquid fuelled) capacity. The location of liquid fuelled peaking capacity is less dependent on the location of energy sources (coal, gas pipes, solar, and wind resources) than other generation technologies and as such these technologies are less constrained in their ability to avoid areas of network constraint. For this reason the methodology will only use historic capital contribution cost data for generators that are capable of liquid fuel operation.

4) Confidentiality of actual Connection Cost data

The historic access cost data held by Western Power is considered confidential information and cannot be released to external parties except in aggregate form. This represents a challenge in developing the details of the methodology that SKM and Western Power are working through.

- Selection of financial escalators

Given that the proposed methodology uses financial data across years, an appropriate discount rate will be required to provide an appropriate result in today's dollars. SKM believe that the WACC used within the MRCP calculation would be the most appropriate for this purpose.

- Consistent definition of "Total Connection Costs"

  The definition of the Total Connection Cost must include all network assets from the terminals of the generator step up transformer into the network

- Establishing a conservative forecasting error margin in the calculation

  The general practice by organised markets, when estimating or forecasting values for benchmark or reference prices, is to apply some conservatism in managing estimation or forecasting risks. This conservatism is often generous to market participants when these prices are used as a bid or price cap. This is particularly the case in the WEM where:

  a) The use of the Excess Capacity Adjustment to adjust the settlement cost of capacity credits in the case of oversupply partially mitigates the risk of conservatism in the calculation of the MRCP.

  b) A MRCP set too low in the event of a Capacity Auction could result in an undersupply of capacity in the market.

Given the above SKM will consider a margin in calculating the DCC in the context of other risk margins introduced elsewhere within the MRCP calculation.

9. Recommended Methodology

9.1. Preferred Option

SKM's preferred approach is Option 2, summarised in section 8.3. This approach calculates a weighted average of actual connection costs for liquid-fuel plant, with weights defined so that greater emphasis is given to more recent data.

9.2. Overview

The recommended methodology is implemented by a spreadsheet that takes in the cost of connection for a defined set of generation projects over time, using real costs for historic projects and access offers for projects that are yet to occur. An average annual connection cost per MW Certified Capcicity is calculated for each year and this nominal figure is converted to a real figure for the calculation year of the Reserve Capacity Cycle. These real figures are then entered in to a weighted average with the most recent projects weighted more heavily than older projects. The weighted average figure is then scaled by a forecasting error to provide a forecast connection cost. The following discussion pertains to aspects of this calculation that are intended to address many of the issues raised in section 8.3.1 of this report.

9.3. Generators to be included

The calculation methodology only seeks to include generators that have a liquid fuelled capability. This position is to exclude the increased connection costs associated with generators that must be located next to remote fuel / energy sources such as wind, solar and coal. It is not considered that these increased connection costs should be captured in the MRCP calculation as it seeks to estimate the costs of an efficient new entrant capacity provider.

9.4. Scope of Connection Costs

The spreadsheet includes specific instructions pertaining to the scope to be covered by the connection costs included for each project. This scope includes all transmission costs from the terminals of the generator step up transformer into the network (including costs of procuring land easements etc.). If Western Power's connection cost data does not include all of the costs within this scope these costs should be estimated using Western Power's estimating methodology.

9.5. Pro-rating Capacity Costs

As the generation projects under consideration are of various sizes the total connection costs for each project must be brought back to a common base. The base selected in the recommended calculation methodology is the certified capacity for each project. It is noted that this certified capacity can change marginally from year to year, for simplicity the most recent quantum of certified capacity for each connection has been used.

9.6. Escalation of Capital Costs

Converting the nominal cost data that represents the average for each year to real dollars for the calculation year requires an accurate escalation factor. This factor should reflect temporal movements in the cost of construction network assets. The sources of such an escalation factor could include:

1. Average change in the estimates for the scope of Clause 1.8 a-h of the Market Procedure for: Determination of the Maximum Reserve Capacity Price over the 5 year period considered

2. Escalation factors proposed by Western Power for their network assets and accepted by the Economic Regulatory Authority.

3. Escalation factors

The current draft of the report uses option 1 above as the basis for an escalation factor. The resulting escalation factor is calculated at 7.4% and is calculated based on the delta between the 2006 dedicated connection assets and the 2011 dedicated connection assets. ($9.182M vs $5.78M)

9.7. Weighting of Yearly Cost to the Calculated Cost

As discussed in section 9.1 of this report, the contribution each yearly average makes to the final forecast is weighted with the most recent years having a higher weighting. This weighting has been developed based on a consideration of the signalling role of marginal connection costs in the context of the MRCP calculation. The scaling used in the recommended solution is detailed in Table 4.

- **Table 4 Weighting of Annual Average Connection Costs**

Year	Weighting
MRCP Calculation Year	7
MRCP Calculation Year - 1	5
MRCP Calculation Year - 2	3
MRCP Calculation Year - 3	1
MRCP Calculation Year – 4	1

9.8. Forecasting Margin

As discussed in section 8.3.1 jurisdiction around the world typically include a level of conservatism in the calculation of market caps. In the context of the DCC calculation, Western Power have indicated that they expect connection costs to continue to rise as the available capacity on the transmission network is consumed. To ensure significant increases in the cost of connection do not undermine the ability of the methodology to reflect the short term imperatives of the MRCP calculation as a price cap a forecasting margin has been introduced. At this time this margin has been arbitrarily set at 10%, however this may be revisited if the year to year movement in actual connection costs proves to be higher than this.

9.9. Treatment of Years with no relevant connections

In some years no liquid fuel capable generation is connected to the SWIS. In the current 5 year window there is 1 year that does not have the connection of a liquid fuelled generator. For these years a proxy for the cost of connection is required. Two options were considered in establishing this proxy, using an average of surrounding years or using the cost calculated for Dedicated Connection Assets under Clause 1.8 a-h of the Market Procedure for: Determination of the Maximum Reserve Capacity Price. In the recommended methodology the Dedicated Connection Asset cost per MW Capacity Credit has been used on the basis that this cost is available and includes information on temporal movements in the cost of connection that may be lost using the averaging approach.

9.10. Integration into the Market Procedure

As the scope of the recommended calculation methodology includes all connection assets associated with connecting a generator the calculated metric would replace the Total Transmission Costs [TC] in the existing MRCP calculation. The change to Market Procedure could be as simple as altering the Market procedure as follows:

Clause 1.8.1 replaced with:

“Western Power will forecast the Total Connection Costs based on historic connection costs and relevant access offers for generators that are capable of being liquid fuelled. The forecasting methodology will be as approved by the ERA. For years that no suitable historic data is available a connection cost will be calculated on the basis defined in step 1.8.2.

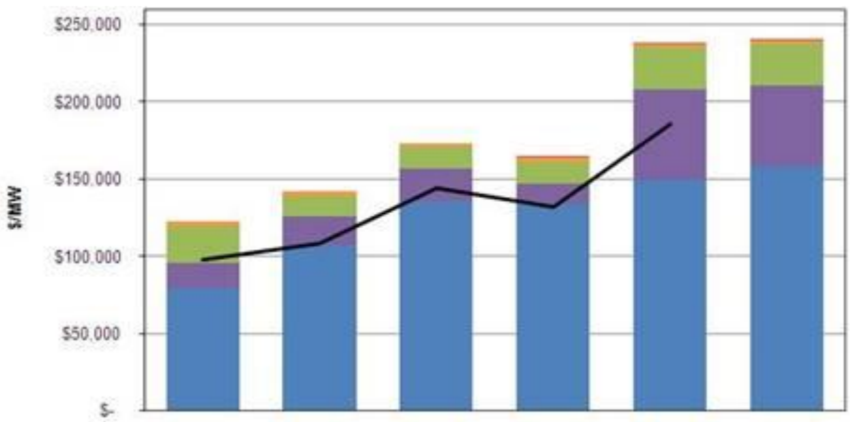
Delete 1.8.2h

SKM will work with the IMO to establish the preferred text to implement the recommended solution in the Market Procedure.

10. Impact of Methodology on Deep Connection Cost Calculation

As the recommended methodology produces an outcome that replaces Total Transmission Costs (TC) in the existing MRCP calculation the impact of the recommended methodology on the MRCP can be determined through a direct comparison between the historic TC and the TC calculated through the recommended methodology. In the 2011 Reserve Capacity Cycle the estimate for TC was $A48.798[11], or $304,875 per MW Capacity Credit. This compares to a figured calculated through the recommended methodology of XX

This represents an XX % reduction in the value for TC, a significant reduction. This does however bring the calculation more into line with the pre 2009 MRCP calculations as demonstrated in Figure 2. (note that the figures in Figure 2 are the contribution to the MRCP not the raw capital cost data discussed in previous paragraph)



Capacity Year	08/09	09/10	10/11	11/12	12/13	13/14
Power Station Cost	$ 79,110	$ 107,404	$ 135,701	$ 134,091	$ 149,306	$ 158,710
Transmission Costs	$ 16,558	$ 18,017	$ 20,672	$ 13,151	$ 58,493	$ 51,621
Fixed O& M	$ 23,900	$ 13,363	$ 14,392	$ 13,431	$ 27,335	$ 26,649
Fuel Costs	$ 2,907	$ 3,456	$ 2,631	$ 3,151	$ 2,615	$ 2,825
Land Costs	$ -	$ -	$ -	$ 293	$ 769	$ 818
MRCP (nearest $100)	$ 122,500	$ 142,200	$ 173,400	$ 164,100	$ 238,500	$ 240,600
Excess Capacity	6.43%	11.44%	2.19%	5.83%	8.99%	NA
Reserve Capacity Price (per yr)	$ 97,837	$ 108,459	$ 144,235	$ 131,805	$ 186,001	NA

Figure 2 Historic Movements in Components of the MRCP[12]

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[11] http://www.imowa.com.au/f175,877711/IMO_Final_Report_Max_Reserve_Capacity_Price_2013_14_final.pdf

[12] Source: http://www.imowa.com.au/mrcp

11. Conclusion

This paper has assessed the existing Deep Connection Cost calculation against the criteria of accuracy, certainty, simplicity, resilience and flexibility; these criteria have been determined and defined with reference to the Market Objectives. This assessment has concluded that although the existing methodology seeks to accurately forecast the marginal cost of connecting peaking capacity to the network, the methodology introduces complexity associated with:

- identifying the next marginal point of connection
- defining the minimum required works
- estimating costs associated with these works

In order to remain simple and cost effective the existing methodology introduces a range of assumptions and relies heavily on the experience of Western Power staff. These simplifying assumptions introduce significant inaccuracies to the calculation and undermine market certainty in the outcome.

The paper has considered a range of approaches to improve the DCC calculation methodology. The ideal methodology would forecast the long run marginal cost of the connection of peaking capacity to the network in a transparent and simple manner. Given the range of variables that impact connection costs, accurate forecasting requires either significant resources to determine the variables or the use of simplifying assumptions. This necessitates a trade-off between simplicity / cost and accuracy.

Given this trade off, an alternative methodology of using historic connection costs to indicate future connection costs has been recommended. This methodology is simple to implement and this report contends that the year to year movement in the long run marginal cost of connection will be less than the inaccuracy of the existing calculation methodology. This position is supported by the existing Reserve Capacity process that will allow the connection cost offers for the year the Reserve Capacity is required to be included in the calculation.

An excel spreadsheet has been developed to implement this methodology. Five years of connection cost history is used (including the offers for the current year) and the most recent years are weighted more heavily than historic years.

The output of the methodology is a single cost for connection per MW of Capacity Credit and a Chart demonstrating the trend of connection costs over time. If it is possible to publish this chart with the MRCP calculation, within the bounds of Western Power confidentiality requirements, the market certainty associated with this calculation would be reinforced.

The connection cost calculated by the recommended methodology spreadsheet yields a connection cost for the 2010 Reserve Capacity Cycle of XX. This represents an XX % reduction on the 2011 calculation for TC.

Appendix A Assessment Criteria

The following summarises the benchmark criteria and attributes that have been used to guide the assessment:

General Criteria and Attributes:

Criterion or Attribute	How we consider it as part of this assessment
Resilience to anticipated scenarios of change	We will consider the appropriateness of the methodology in terms of the current context of the market, and with respect to our view of how the market and industry may evolve given anticipated scenarios of change, reform, investment and innovation. A consideration of resilience to potential scenarios of change is of particular relevance to the planning process, especially with respect to the planning assumptions and options that contribute to the assessment of shared connection costs and system augmentation or reinforcement costs. **Criteria: Resilience**
Consistent with the realities of operational practices, technological constraints and prevailing contracts	Given that the starting point of our assessment is to review the existing DCC calculation methodology of Western Power, we will assume that it achieves this attribute unless we identify participant concerns indicating the contrary in industry submissions to the IMO's 2010 MRCP determination. Where we identify weaknesses in the existing calculation methodology, we will explicitly consider this attribute in our recommendation of improvements to the calculation method.
Consistent with the broader market and regulatory arrangements that influence market behaviour and outcomes	Given that the starting point of our assessment is to review the existing DCC calculation methodology of Western Power, we will assume that it achieves this attribute unless we identify participant concerns indicating the contrary in industry submissions to the IMO's 2010 MRCP determination. Where we identify weaknesses in the existing calculation methodology, we will explicitly consider this attribute in our recommendation of improvements to the calculation method.
Processes of change are manageable in terms of time, cost and risk	Given that the starting point of our assessment is to review the existing DCC calculation methodology of Western Power, we will assume that it achieves this attribute unless we identify participant concerns indicating the contrary in industry submissions to the IMO's 2010 MRCP determination. Where we identify weaknesses in the existing calculation methodology, we will explicitly consider this attribute in our recommendation of improvements to the calculation method.

Specific Criteria and Attributes:

Criterion or Attribute	How we consider it as part of this assessment
Market Objective # 1 *To promote the economically efficient, safe and reliable production and supply of electricity and electricity related services in the South West interconnected system.*	Economic Efficiency: Economic efficiency in the context of the power market is associated with the production of electricity and electricity related services at minimum cost, and in a manner that fully reflects the preferences of market participants and end-users. The calculation methodology used for determining DCC contributes to an assessment of economic efficiency in the power market via its effect on investment, and its contribution to the pricing and investment signals intrinsic to the MRCP determination. Connection, augmentation and reinforcement assets that are determined to be economically efficient will typically be unique to a particular location, technology and time-frame, they will have a particular usage profile, and they will be determined to be optimal given a particular expectation of current and future market operation. The IMO's consideration of what is 'appropriate' with respect to the substance and application of the calculation methodology for DCC, in the context of the MRCP determination, must therefore consider not just the quality of the calculation parameters and processes, but also the planning basis and choice of options and assumptions that together influence the locational, technology, temporal and usage aspects of related assets. As a cost component to the calculation of the MRCP, the methodology for calculating DCC can be a significant influence on reserve capacity prices. This influence acts directly through the definition of the settlement price in the Reserve Capacity Mechanism and indirectly as a market signal impacting bilateral trade negotiations. Thus, to support the economic efficiency of the market the DCC Calculation must establish a cost that supports the correct level of investment in generation over the long term. Safety and Reliability: In the context of this review, safety can be interpreted in a financial sense, given effect by the Maximum Reserve Capacity Price (MRCP) that in part protects the industry from excessive price outcomes that may raise market risk, and potentially weaken the solvency of some participants. Reliability can be interpreted in terms of the adequacy and availability of capacity, particularly via the reserve and availability margin that is achieved in the wholesale market. . ▪ Connection costs that are too high, may raise the MRCP, and therefore subject participants to potentially higher prices for reserve capacity; this can reduce solvency, raise financial risk, and diminish the achievement of the safety aspect of this Market Objective. ▪ Connection costs that are too low may weaken investment and market participation signals, thereby potentially reducing the reserve and availability margin over time, and also diminish the achievement of this aspect of the

	Market Objective. We consider that the following criteria can assist the achievement of this objective: ▪ **Accurately reflect the cost borne by the efficient new entrant capacity provider** - Costs that are too low may dampen investment and market participation signals by reducing the extent that prices will recover generation costs. This will discourage competition and distort market outcomes. Further, in the event that costs are too high, investment signals may be excessive, causing over-investment which in the future may pose solvency issues for investors, and/or cause prices to be lower than may be efficient.
Market Objective # 2 *To encourage competition among generators and retailers in the South West interconnected system, including by facilitating efficient entry of new competitors.*	The extent of competition in a market is in part determined by industry structure, which is beyond the scope of this review. However, the extent to which the market and regulatory signals encourage and provide for market participation and investment has a direct impact on the number of participants in the market and therefore the level of competition. In terms of this latter point, and given the constraints of this review, we therefore consider that the following criteria assist the achievement of this objective: ▪ **Accurately reflect the cost borne by the cheapest new entrant capacity provider** - As above **Certainty for Investors -** As a significant market signal the stability of the DCC over time drives investment confidence increasing the spectrum of investors prepared to participate in the market.
Market Objective # 3 *To including sustainable energy options and technologies such as those that make use of renewable resources or that reduce overall greenhouse gas emissions.*	The MRCP works alongside the energy based markets within the WEM as a package to incentivise appropriate generation development and dispatch. Given the low maximum energy prices and the day before nature of STEM the MRCP plays a major role in incentivising low fixed cost peaking plants that only sell energy during periods of constrained supply and/or high demand. Thus the DCC must be adequate to facilitate investment in this generation technology. However, if the DCC is set too high it is likely the MRCP will over encourage the installation of cheap fixed cost plant to the detriment of generation technologies that fulfil other roles within the market. This will result in a suboptimal economic outcome. We consider that the following criteria assist the achievement of this objective: **Accurately reflect the cost borne by the cheapest new entrant capacity provider**. As above **Be flexible enough to capture changes in the location and technology of the cheapest new entrant capacity provider over time** The most efficient manner of delivering new peaking capacity to the WEM is likely to vary in location and technology over time. Ideally the DCC calculation methodology would be flexible enough to capture this change in location and

	technology as it varies over time to ensure that new, more competitive, peaking generation arrangements are not incentivised beyond their efficient contribution to the generation mix. That is, efficient peaking generation does not displace renewable generation beyond that which is efficient in the generation mix.
Market Objective # 4 *To minimise the long-term cost of electricity supplied to customers from the South West interconnected system.*	Ultimately the long-term cost of electricity is minimised when investments in industry assets and infrastructure occur in a manner that is timely, and with a location and technology that is economically optimal, and that combines with a market structure that is competitive. In terms of the constraints of this review, we note that timely investments occur when investment risk is minimised, implying a need for accurate market signals, a competitive market context, and the minimisation of regulatory and market risk over time. We therefore interpret this market objective in terms of the following criteria: ▪ **Accuracy of the cost calculation methodology** –As above ▪ **Simplicity of calculation** – The calculation of the DCC represents a direct overhead burden on the long term cost of generation in the market. More simple methodologies cost less to undertake and administer reducing the impact of market overheads on the cost of electricity.
Market Objective # 5 *To encourage the taking of measures to manage the amount of electricity used and when it is used.*	Given that the review is constrained to the context of power generators connecting to the SWIS, and the costs thereof, we do not consider this Market Objective as part of our assessment.

Appendix B AACEi Cost Estimating Classes

The AACEi (Association for the Advancement of Cost Engineering) international recommended practice of estimate classification is outlined in the table below.

- **Table 5 Generic Cost Estimate Classification Matrix (Summary)**

	Class 4 Order of Magnitude/Concept	Class 3 Pre-Feasibility Study (PFS)	Class 2 Feasibility Study (FS)	Class 1 Definitive Estimate
Basis Of Capital Cost Estimate – Purpose & Criteria				
Purpose	Preliminary economic and technical Investigation. Project screening. Comparison of alternatives, configurations and options	Economic Feasibility of one or more chosen options.	Project Approval and basis of securing financing. "Bankable " study	Detailed Control. Target measurement. Change/Variation. Monitor and control of implementation phase.
Expected Estimate Contingency Range	25% to 40%	15% to 20%	10% to 15%	5% to 10%
Accuracy - Indicative Range	-30% to +100%	-20% to +25%	-10% to +15%	-5% to +10%
Level of Project Definition	0% to 5%	10% to 30%	30% to 70%	70% to 100%
Level of Engineering (% of total Eng.)	0% to 2%	2% to 5%	1. 15% to 30%	2. 30% to 100%

Agenda Item 5: Weighted Average Cost of Capital Methodology – Updated Draft Report by Pricewaterhouse Coopers

1. BACKGROUND

The IMO appointed Pricewaterhouse Coopers (PwC) to undertake a review of the methodology for determining the Weighted Average Cost of Capital (WACC).

The review by PwC builds on the similar review of the WACC by the Allen Consulting Group (ACG) in 2007[1]. In considering the constituent WACC parameters, PwC has noted any changes in the regulatory environment that have occurred since the 2007 review and, where deemed appropriate, has recommended revisions to the methodology. PwC has also considered the way in which the WACC is applied within the calculation of the Maximum Reserve Capacity Price (MRCP) to compensate investors for incurred costs. In its report, PwC includes proposed amendments to the *Market Procedure for: Determination of the Maximum Reserve Capacity Price*.

PwC presented its draft report at the 20 January 2011 meeting. MRCPWG members were then asked to provide feedback prior to the issue of a final report.

2. FEEDBACK FROM MRCPWG MEMBERS

Out of session submissions were provided by two MRCPWG members. Their comments are listed in the table below.

[1] The Allen Consulting Group, November 2007 (corrected September 2008), *Review of the Weighted Average Cost of Capital for the Purposes of Determining the Maximum Reserve Capacity Price*, available at http://www.imowa.com.au/f3326,857170/IMO01_WACC_Review_FinalCorrected080922.pdf

Submitter	Comment	IMO Response
Landfill Gas & Power (LGP)	LGP questions the outcome on the grounds that it is unreasonable for an increase in gearing to increase the WACC. Debt is typically cheaper than equity because debt has recourse to the collateral in the case of default whereas equity has no recourse. The intent in Project Financing is typically to quarantine the security for the debt to the actual project assets and then raise as much debt as the cash flows will allow. In my experience, projects proceed with an the expectation of Returns on Equity in the range 15 to 25+%. [Part of the broader issue is that distribution-connected diesel peakers are now exceeding 25%].	PwC has advised that a reduction in the gearing ratio from 40% to 35% leads to a reduction in the resulting WACC due to reductions in the equity beta and the cost of equity, reflecting the increased investment risk. PwC has updated its commentary for the gearing ratio in response to MRCPWG discussion about typical financing arrangements in the WEM, noting the wide variation in gearing levels for the comparator companies and the view that the data may not warrant a variation from the earlier value of 40%. However, PwC maintains its earlier recommendation to reduce the gearing ratio to 35%.
Alinta	Alinta supports the recommendation to retain the existing values for debt issuance costs, taxation rate, gamma and asset beta, which were determined by the Allen Consulting Group (ACG) for the 2007 Review.	The IMO notes Alinta's support.
Alinta	Alinta notes that reinstating debt issuance costs would require a procedure change in order to replace the DRP methodology with a Debt Margin (DM) methodology (i.e. DM = DRP + debt issuance costs).	As explained below, the IMO has reviewed the potential overlap of debt issuance costs in the WACC and the allowance for project financing costs in the margin M. The IMO recommends that debt issuance costs be excluded from the WACC, consistent with previous MRCP determinations.
Alinta	Alinta strongly supports adopting a methodology for deriving an inflation forecast that is consistent with standard regulatory practice. For this reason, Alinta supports the recommendation made by PwC to harmonise the approach in the MRCP market Procedure for deriving inflation with that adopted by other regulatory bodies, including the AER.	The IMO notes Alinta's support.

Submitter	Comment	IMO Response
Alinta	Alinta notes that PWC recommends retaining the existing methodology for calculating the DRP, which utilises the available observed data from Bloomberg fair yield curves and essentially extrapolating this data to provide a proxy 10 year bond with a BBB credit rating. Alinta notes that the preferred methodology for determining the level of the DRP is currently unresolved by economic regulators in Australia, and that in approving the recent MRCP the Economic Regulation Authority (the Authority) indicated that further consideration should be given to this matter as part of the MRCPWG's review of the Market Procedure. Alinta considers that the preferred approach might be to maintain the existing methodology (as applied by PwC), but for the Market Procedure to be amended to also allow the IMO, in consultation with, and subject to the approval of, the Authority, to adopt an alternative DRP methodology that represents accepted regulatory practice.	As indicated below, the IMO will be discussing the debt risk premium further with the Authority prior to the 24 March 2011 meeting and will recommend a method at that meeting.
Alinta	Alinta notes that PwC has recommended that the values for gearing and credit rating change to reflect most recent observations from a set of comparable businesses. However, it appears that because the asset beta is held constant at a specified level (and then the equity beta is derived based on the debt and equity components) a change in gearing does not materially affect the overall value that is derived for the WACC. While considering the most recent observations from a set of comparable businesses would, as proposed by PwC, lead to a change in gearing, a preferred approach	PwC has updated its commentary for the gearing ratio in response to MRCPWG discussion about typical financing arrangements in the WEM, noting the wide variation in gearing levels for the comparator companies and the view that the data may not warrant a variation from the earlier value of 40%. However, PwC maintains its earlier recommendation to reduce the gearing ratio to 35%.

Submitter	Comment	IMO Response
	might be to allow the existing values of the major parameters to be retained unless there was persuasive evidence that they should be changed.	
Alinta	Alinta supports PwC's proposal to change the manner in which financing costs during construction are taken into account.	The IMO notes Alinta's support.
Alinta	It is also noted that the MRCP calculation is based on recovering the capital costs over a 15-year period, which may relate to the period over which tax depreciation is permitted. However, Alinta understands that the likely economic life a generation facility will be in the vicinity of 30 – 40 years. Given that there is already a misalignment between the period of the special price arrangement (10 years) and the analysis period for the MRCP (15 years), it is unclear why the period over which the MRCP is calculated should not more accurately reflect the economic life of the assets. The methodology would simply need to recognise that some costs (e.g. depreciation) would be recovered over a shorter period than other costs.	The IMO notes Alinta's comment. The period over which the capital cost is annualised is beyond the scope of PwC's review of the WACC. The IMO proposes that this be discussed by the MRCPWG in conjunction with Agenda Item 6 (Submissions from 2011 MRCP Determination).

3. POTENTIAL OVERLAP OF WACC AND MARGIN M

As discussed at the last meeting, the IMO has met with Sinclair Knight Merz (SKM), which has estimated the margin M for the last four MRCP determinations, and PwC to review the potential overlap of the debt issuance costs in the WACC and the allowance for project financing costs in the margin M. In previous MRCP determinations, debt issuance costs were not included in the WACC.

PwC had recommended in its draft report to include debt issuance costs in the cost of debt, thus ensuring consistency with common regulatory practice. PwC has now updated its recommendation, indicating that debt issuance costs should be included in the WACC "*subject to the IMO ensuring that there is no double counting of ongoing debt transaction costs in the initial capital cost of the generic power station project.*"

Following its discussion with PwC and SKM, the IMO proposes to include debt issuance costs in the WACC to ensure consistency with common regulatory practice. To avoid double counting, the IMO proposes to ask SKM to remove the overlapping portion of the allowance for project financing costs in the margin M.

4. GEARING RATIO

Much of the discussion at the 20 January 2011 regarding the draft report by PwC centred on the recommendation to lower the gearing ratio (proportion of debt to total asset value) from 40% to 35%, based on observations of Australian and international comparator companies. PwC's approach was to use established benchmarks to determine the best estimate for use in the WACC calculation. Several MRCPWG members indicated that higher gearing ratios are prevalent among Market Participants in the WEM and contended that the case for changing from the previous value of 40% was not strong.

The IMO notes that PwC's recommendation was based on the gearing ratios of 20 comparator companies with baseload generators. The average Post-GFC (Global Financial Crisis) level of gearing for these entities is 35%, with a low of 5% and a high of 69%. The IMO also notes that the 2007 report by ACG recommended a gearing ratio of 40% based on an average gearing ratio of the assessed companies of 35%, with a low of 12% and a high of 64%.

PwC has updated its commentary for the gearing ratio in response to the MRCPWG discussion about typical financing arrangements in the WEM, noting the wide variation in gearing levels for the comparator companies and the view that the data may not warrant a variation from the earlier value of 40%. However, PwC maintains its earlier recommendation to reduce the gearing ratio to 35%. PwC has advised the IMO that such a reduction in the gearing ratio results in a lower WACC value due to reductions in the cost of equity, reflecting the lower investment risk, and the equity beta.

The IMO agrees that the case for changing the gearing ratio from the previous value has not been made, particularly given that the assessment of the gearing ratios of the comparator companies has yielded similar results to those presented in the 2007 ACG review. In light of this and the comments from MRCPWG members, the IMO proposes to retain a gearing ratio of 40%. The IMO notes that MRCPWG members and other stakeholders will have further opportunity to comment on this parameter through the Procedure Change process.

5. UPDATED DRAFT REPORT BY PwC AND IMO RECOMMENDATIONS

Following the review of the draft report at the last MRCPWG meeting, PwC has prepared an updated draft report, which is attached as Appendix A. The final report will be provided to the IMO upon the completion of PwC's internal review process and will be published on the IMO website.

Following PwC's review of the WACC, the IMO proposes that:

- the current WACC equations in the Market Procedure should be modified to include debt issuance costs in the cost of debt;
- the current methodology for determining the nominal risk free rate should be retained;
- the methodology for determining the inflation rate should be amended in line with PwC's recommendation and recent regulatory practice;
- the values of the market risk premium, debt issuance costs, taxation rate, gamma and asset beta determined in the 2007 review should be retained;
- the assumption for credit rating should be changed from BBB+ to BBB based on recent observations from comparable businesses and the availability of bond data;
- the values of the gearing ratio and equity beta determined in the 2007 review should be retained (see discussion in section 4 above); and
- the application of the WACC within the calculation of the MRCP should be changed in line with PwC's recommendation.

As was discussed at the 20 January 2011 meeting, the Economic Regulation Authority (ERA) released a discussion paper in December 2010 that sought feedback on its proposed future method for determining the debt risk premium in its regulatory roles. The IMO will be discussing the debt risk premium further with the ERA prior to the 24 March 2011 meeting and will recommend a method at that meeting.

6. RECOMMENDATIONS

The IMO recommends that the MRCPWG:

- **Discuss** the PwC updated draft report;
- **Discuss** the IMO's recommendations in Section 5 above; and
- **Note** that the IMO will recommend a methodology for determination of the debt risk premium at the 24 March 2011 meeting.

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Maximum Reserve Capacity Price - WACC methodology

Independent Market Operator of Western Australia

Draft report

10 February 2011

pwc

What would you like to grow?

Contents

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

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 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 of 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.

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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.

- 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.

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 (%)	$R_{fr} + \beta_e \text{ x MRP}$	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 of 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 determining 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:

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

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:

$$\text{PRICECAP}[t] = (\text{ANNUALISED\_FIXED\_O\&M}[t] + \text{ANNUALISED\_CAPCOST}[t] / (\text{CAP} / \text{SDF}))$$

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 determine 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 and that that 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]

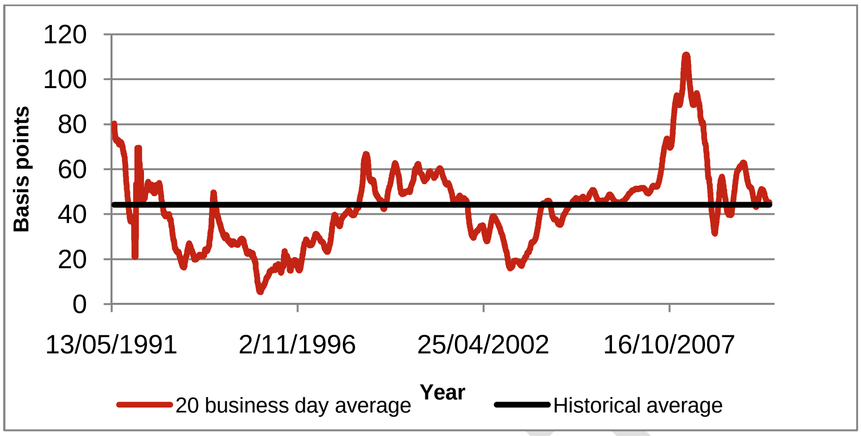
During the past year Government bond yields have risen to levels that are comparable with yields that existed prior to the global financial crisis. During the global financial crisis the convenience yield (measured as the difference between the yield on 10 year Commonwealth Government Securities and 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

[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 CGS yield less Credit Default Swap (CDS) yield for 10 year maturity



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 issue 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 Maximum Reserve Capacity Price 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 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 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

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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.

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 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

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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.

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

- 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.

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. It is notable, however, that there is a wide range in gearing levels for the baseload generators of 5 to 69 per cent and that 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

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[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 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.

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

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.

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.

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,[29] eight and a half months,[30] one year,[31] and between 24 and 30 months.[32]

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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29 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

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

31 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.

32 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:

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

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.

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

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

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

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 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_{fr}~~	~~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).[33]

[33] 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
Caital Power Income LP	Baseload	Canada	1,000

Company name	Type of generator	Country	Market capitalisation ($millions of local currency)
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 10 year	Pre-GFC 5 year	Post GFC
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	-	-	-

Gearing and credit rating of comparator companies

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%	-	-
Caital 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 comparatorcompanies

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
Electric Power	Baseload	0.16	-	-

Development				
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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pwc.com.au

Agenda Item 6: Submissions from 2011 Maximum Reserve Capacity Price Determination

1. BACKGROUND

The IMO published the *Final Report: Maximum Reserve Capacity Price Review for the 2013/14 Reserve Capacity Year*[1] on 28 January 2011. In responding to the issues raised in submissions, the IMO committed to present various issues to the MRCPWG for consideration.

In addition, in responding to the PwC draft report, Alinta has separately questioned the validity of the 15-year period over which the capital cost of the power station is annualised in determining the MRCP.

These specific issues have been extracted and are presented in Appendix A for discussion by the MRCPWG.

In considering the suggestion to explore possible cost escalation factors based on forward estimates, the IMO sought advice from Sinclair Knight Merz (SKM) on the availability of suitable measures for such escalation. SKM has advised the IMO that it regularly develops such escalation factors for other regulatory authorities and can similarly provide forward cost escalation factors for use in future MRCP determinations. The memorandum presented in Appendix B shows the escalation factors that SKM would have provided were such a methodology in place for the 2011 MRCP determination. The file note presented in Appendix C provides details of the methodology employed by SKM in determining the escalation factor for the power station capital cost.

2. RECOMMENDATIONS

The IMO recommends that the MRCPWG:

- **Discuss** the issues raised in submissions, including SKM's suggested development of cost escalation factors based on forward estimates.

[1] Available at http://www.imowa.com.au/mrcp

Agenda Item 6 Appendix A: Issues Raised in Submissions for Further Consideration by the MRCPWG

Submissions from the 2011 MRCP Determination

Submitter	Component/Issue	Comment/Change Requested	IMO's response
Infratil Energy Australia	Escalation Factors	The determination of escalation factors through simple extrapolation of previous year's indices is a weak methodology. Observable forward prices for these commodities could provide a better estimate.	The IMO notes Infratil's comment. The IMO will investigate options for the use of observable forward prices for the purpose of cost escalation and will present these to the Maximum Reserve Capacity Price Working Group (MRCPWG).
Infratil Energy Australia	Fixed O&M	Infratil notes that the cost of insurance has been omitted and estimates this cost to be in the order of $1m per annum.	Step 1.12.1(c) of the Market Procedure for: Determination of the Maximum Reserve Capacity Price, specifies that the Insurance cost must be accounted for in the calculation of the WACC, however there is no aspect of the prescribed WACC formula in the Market Procedure where this is included. Additionally, operational insurance is seen as a variable O&M cost as it will depend upon how the plant is run and as such is considered to be a Short Run Marginal Cost. Therefore the insurance cost is not included in the calculation of the MRCP. The IMO will present Infratil's comment to the MRCPWG for its consideration.

Submitter	Component/Issue	Comment/Change Requested	IMO's response
Infratil Energy Australia	Volatility of RCP	The RCP is the only visible price for capacity available to investors and financiers. Year on year volatility in this price can undermine confidence in the allocation of capital to new capacity in the SWIS, Infratil recommends that the IMO give thought to methods for smoothing the annual price (without blunting price signals). These might include a rolling 3 year price or limiting the move (down) in price by, say, 5% from one year to the next.	The IMO notes Infratil's comments and suggestions. Concern around price volatility has been noted by the MRCPWG. Infratil's suggestion will be presented to the MRCPWG when it considers this issue in 2011.
Tesla Corporation	Land	It is noted in the MRCP Landgate report that the minimum lot size within the Kemerton Industrial Park is 5 hectares. The land cost is based upon a lot size of 3 hectares. This is inconsistent with the estimate of transmission line distance. The lot size should be calculated on the basis of 5 hectares if Kemerton is to be used as the reference site as it is not possible (due to planning restrictions) to obtain a site smaller than 5 hectares within a 2km distance of any substation in the Kemerton region. Alternatively the 2km distance should be increased to a meaningful distance that allows a 3 hectare site to be utilised. The costs should reflect a model plant that is to build. It is not possible to build this model plant as planning rules (acknowledged by Landgate) prevent this from occurring.	The Market Procedure stipulates that the land size must be 3 hectares (where no buffer zone is required) and the transmission line must be 2km in length. Consequently, revision of these costs can not be considered for the 2013/14 MRCP. However, the IMO notes Tesla's comment and will refer this to the MRCPWG for its consideration.

Submitter	Component/Issue	Comment/Change Requested	IMO's response
Perth Energy	Fixed O&M	Perth Energy notes that there remains no allowance for insurance costs in the MRCP. Insurance costs for a 160MW OCGT would be in the order of $1m per annum, or just over $6,000 per MW. Insurance is a necessary component for any prudent power station operator and Perth Energy suggests that such costs be explicitly provided for in any future MRCP reviews.	Step 1.12.1(c) of the Market Procedure specifies that the Insurance cost must be accounted for in the calculation of the WACC, however there is no aspect of the prescribed WACC formula in the Market Procedure where this is included. Additionally, operational insurance is seen as a variable O&M cost as it will depend upon how the plant is run and as such is considered to be a Short Run Marginal Cost. Therefore the insurance cost is not included in the calculation of the MRCP. The IMO will present Perth Energy's comment to the MRCPWG for its consideration.
Perth Energy	Escalation Factors	Perth Energy notes that some indices to be applied to escalate certain cost parameters have been based on the actual movement in base metals prices between 2009 and 2010. This resulted in a decrease in these cost parameters. The MRCP is forward looking and is meant to reflect the cost of providing generation capacity in future years. Perth Energy would therefore suggest that historical price movements in base metal prices are not relevant for cost escalation purposes and suggests the IMO investigate the potential use of forward estimates for base metal prices for the next MRCP review.	The IMO notes Perth Energy's comment. The IMO will investigate options for the use of observable forward prices for the purpose of cost escalation and will present these to the MRCPWG.

Submission in relation to PwC Draft Report

Submitter	Component/Issue	Comment/Change Requested	IMO's response
Alinta	MRCP Calculation	It is also noted that the MRCP calculation is based on recovering the capital costs over a 15-year period, which may relate to the period over which tax depreciation is permitted. However, Alinta understands that the likely economic life a generation facility will be in the vicinity of 30 – 40 years. Given that there is already a misalignment between the period of the special price arrangement (10 years) and the analysis period for the MRCP (15 years), it is unclear why the period over which the MRCP is calculated should not more accurately reflect the economic life of the assets. The methodology would simply need to recognise that some costs (e.g. depreciation) would be recovered over a shorter period than other costs.	The IMO notes Alinta's comment. The period over which the capital cost is annualised is beyond the scope of PwC's review of the WACC. The IMO proposes that this be discussed by the MRCPWG in conjunction with Agenda Item 6 (Submissions from 2011 MRCP Determination).

Memo

To	Greg Ruthven | Senior Analyst, System Capacity Independent Market Operator Level 3 Governor Stirling Tower, 197 St Georges Terrace, Perth WA 6000	**Date**	24 December 2010
From	Anuraag Malla (SKM)	**Project No**	HA01479
Copy	Ben Williams (IMO), Geoff Glazier (SKM), Alex Lambe (SKM), Emranjeet Malhi (SKM)		
Subject	**June 2010 to June 2011 Nominal Escalation Indices**		

Limitation Statement

Forecasts are by nature uncertain. SKM has prepared these projections as an indication of one possible outcome it considers likely in a range of possible outcomes. SKM does not warrant or represent the selected outcome to be more likely than other possible outcomes and does not warrant or represent the forecasts to be more accurate than other forecasts. These forecasts represent the authors' opinion regarding the outcomes considered possible at the time of production, and are subject to change without notice.

SKM has used a number of publicly available sources, other forecasts it believes to be credible, and its own judgement and estimates as the basis for developing the cost escalators contained in this report. The actual outcomes will depend on complex interactions of policy, technology, international markets, and multiple suppliers and end users, all subject to uncertainty.

Hi Greg,

Following our discussion during the week starting 20/12/2010, please find the forecasted June 2010 to June 2011 nominal escalation factors for the following base indices:

CPI	2.8%
Australian Electricity Water Gas Labour Price Index	4.4%
WA Labour Price Index	4.1%
Steel Price Index	21.5%
Copper Price Index	30.5%
Cement Price Index	4.7%

Capital Cost Escalation Factors

The forecasted June 2010 to June 2011 nominal escalation factor for the following capital costs are shown in the following table:

Switchyard	6.4%
Overhead Transmission Line	8.6%
Power Station	12.1%

The escalation factors in this table are the resulting averages of the base indices weighted by the makeup component of the respective capital costs. For example, the makeup components of the Power Station capital cost appears in Table 2-1 of the Power Station Element report. Each of the listed makeup components is influenced by multiple base indices in different proportions[1].

Fixed O&M Cost Escalation Factors

The forecasted June 2010 to June 2011 nominal escalation factor for the following fixed O&M costs are shown in the following table:

Switchyard	4.4%
Overhead Transmission Line	4.4%
Power Station	3.6%

The fixed O&M cost escalation factors for the Switchyard and the Transmission Line follows the Australian Electricity Water Gas Labour Price Index. The fixed O&M cost escalation factor for the Power Station is the resulting average of the base indices weighted by its makeup component. The makeup components of the Power Station fixed O&M cost appears in Table 3-1 of the Power Station Element report. Each of the listed makeup components is influenced by one of the base indices[2].

Regards

[by email]

Anuraag Malla
Analyst (Power & Energy)
Phone: 02 9032 1614
E-mail: amalla@skm.com.au

[1] For Power Station capital cost, the 'Main Plant Equipment' component is 50% affected by Australian EWG Labour Price Index, 30% affected by Steel Price Index and 20% affected by Copper Price Index. Similarly, the 'Building' component is 50% affected by WA Labour Price Index, 25% affected by Steel Price Index and 25% affected by Cement Price Index.

[2] For Power Station fixed O&M cost, the 'Fire' component is affected by the CPI and the 'Security' component is affected by WA Labour Price Index.

File Note

Date	17 January 2011
Project No	HA01479
Subject	**SKM Cost Escalation Methodology**

The following is a summary description of the SKM methodology underlying the development of the 12.1% June 2010 to June 2011 weighted capital cost escalation rate for the IMO.

1. Background

SKM has been actively researching the increasing cost of capital infrastructure works, particularly in the electricity industry, for a number of years, and has developed a cost escalation modelling process which captures the impact of forecast movements of specific input cost drivers on future electricity infrastructure pricing, providing robust cost escalation rates.

The SKM model develops forecast costs of plant and equipment through the modelling of predicted movements in the underlying drivers of plant and equipments cost, these drivers are:

- CPI
- Labour
- WA Labour
- Steel
- Copper
- Cement

The escalation factors developed for the IMO were based on the most up-to-date information available at the time of compilation.

2. Weighting of Drivers

An understanding of the appropriate application of weighting for each cost driver to each item of plant and equipments has been developed over time, and as a result of a series of strategic surveys of Australian electricity industry plant and equipment cost, in-depth discussion with the manufacturers and suppliers, a detailed understanding of rise and fall clauses in client procurement contracts, as well as advice from SKM's team of professional estimators, economists and engineers.

3. Individual escalation component forecasts

Table 1 identifies the individual components of the Generation Plant weighted capital cost escalation rate, as well as the calculated escalation rate between June 2010 and June 2011 for each element.

- **Table 1 Components of the cost escalation rate**

Base escalation indices from June 2010 to June 2011 (Nominal)

	CPI	Labour	WA Labour	Steel	Copper	Cement
Nominal Index	2.8%	4.4%	4.1%	21.5%	30.5%	4.7%

A description of the methodology for developing each of the individual escalation rates now follows:

3.1 CPI

SKM applies a method of forecasting the position of CPI as accepted by the AER in several recent Final Decision for Distribution Utilities, including the NSW, QLD and VIC distribution businesses.

This method adopts the following process:

- Plot two years of forecasts from the most recent RBA Monetary Policy Statement—(the August 2010 Monetary Policy Statement, forecasts were used); and
- Thereafter plot CPI as the RBA inflation target's midpoint of 2.5%.

The CPI figures used during SKM modeling are presented in Table 2.

- **Table 2 Forecast CPI figures**

Year to June	2010	2011	2012	2013	2014	2015	2016	2017
CPI Forecast	3.05%	2.75%	2.75%	3.0%	2.5%	2.5%	2.5%	2.5%

Therefore SKM adopted a Year to June 2011 CPI rate of 2.75%

3.2 Labour

The first of the two labour components of cost escalation captures the change in the cost of labour for Electricity Gas and Water (EGW) or Utilities sector type workers. As this workforce has been in a position to demand greater than average wage rates in recent times, SKM deemed it necessary to separate these costs from General Labour.

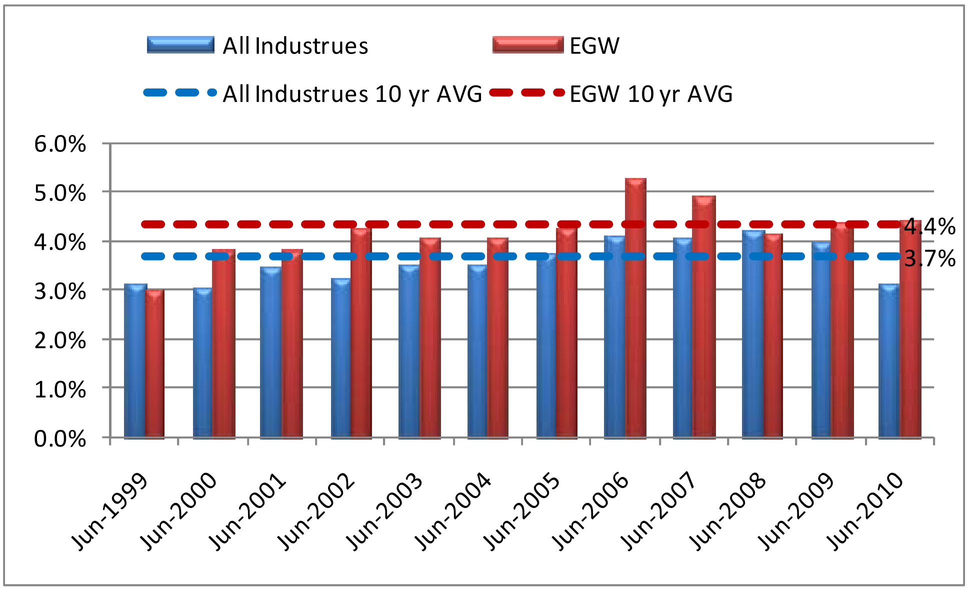
SKM used ABS data to develop this cost escalation component , specifically the ABS 6345.0 Labour Price Index, Australia; Total Hourly Rates of Pay Excluding Bonuses: Sector by Industry, Original (Financial Year Index Numbers for year ended June quarter);Financial Year Index ; Total hourly rates of pay excluding bonuses ; Australia ; Private and Public ; Electricity, gas, water and waste services ; series ID A2705170J

Table 3 and Figure 1 provide further details of the background data

- **Table 3 Annual change in EGW LPI index**

Year to:	EGW index	Annual Change
Jun-1998	63.8	
Jun-1999	65.7	1.030
Jun-2000	68.2	1.038
Jun-2001	70.8	1.038
Jun-2002	73.8	1.042
Jun-2003	76.8	1.041
Jun-2004	79.9	1.040
Jun-2005	83.3	1.043
Jun-2006	87.7	1.053
Jun-2007	92.0	1.049
Jun-2008	95.8	1.041
Jun-2009	100.0	1.044
Jun-2010	104.4	1.044
10 year average		1.044

- **Figure 1 EGW compared to all industries**



SKM used the most recent 10 year average annual rate increase of 4.4%

3.3 WA Labour

The second of the two cost escalation rates related to labour was included as a means to account for changes in general labour. The rate for WA was separated from the national rate as it was considered important to differentiate WA labour rate increases from the national average as a means to more closely reflect actual costs.

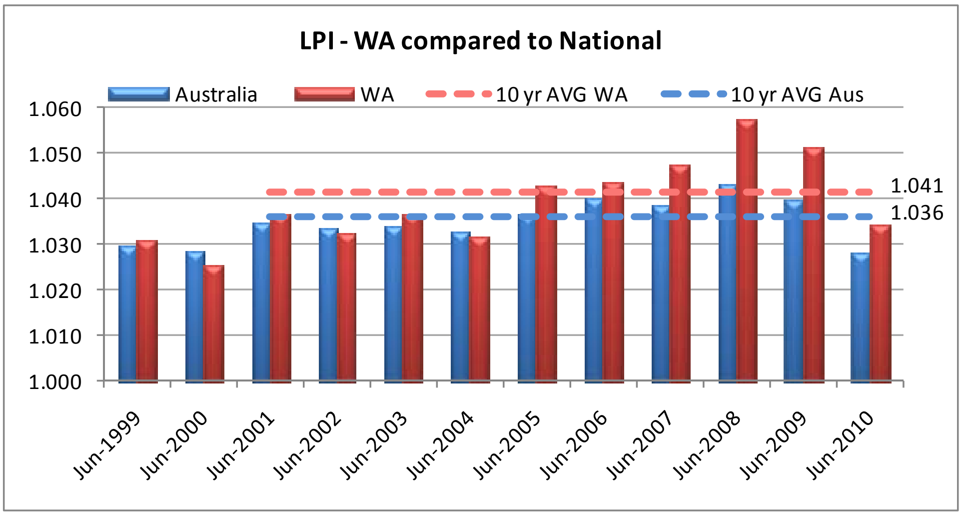
SKM again used ABS data to develop this rate. Specifically ABS 6345.0 Labour Price Index, Australia; All WPI series: Original (Financial Year Index Numbers for year ended June quarter); Financial Year Index ; Total hourly rates of pay excluding bonuses ; Western Australia ; Private and Public ; All industries ; Series ID. A2705992V.

Table 4 and Figure 2 provide further details regarding the background data.

- **Table 4 WA wage price index annual changes**

Year to:	WA WPI	Annual Change
Jun-1998	65.2	
Jun-1999	67.2	1.031
Jun-2000	68.9	1.025
Jun-2001	71.4	1.036
Jun-2002	73.7	1.032
Jun-2003	76.4	1.037
Jun-2004	78.8	1.031
Jun-2005	82.2	1.043
Jun-2006	85.8	1.044
Jun-2007	89.9	1.048
Jun-2008	95.1	1.058
Jun-2009	100.0	1.052
Jun-2010	103.4	1.034
10 Year average		1.041

- **Figure 2 Changes in LPI – WA compared to national**



SKM used the most recent 10 year average annual rate increase of 4.1%

3.4 Copper

When developing forecasts for the future annual market price position of the various materials Key Cost drivers, SKM will apply the AER accepted methodology of interpolation between the spot market prices, all available forward contract prices, and credible forecast for future pricing developed by reputable sources specialising in the analysis of the cost driver in question.

The emphasis within this process is to include as much recent and credible information as is available at the time of developing the forecast cost driver movements.

An example of the application of SKM's methodology is the process for developing future price positions for commodity based cost drivers such as Aluminium, Copper and Oil, within the SKM model.

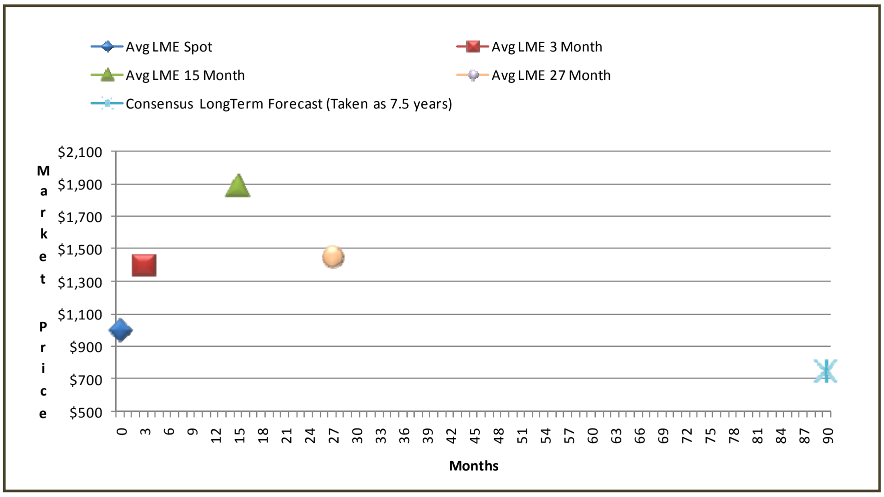
In this instance the process applied by SKM entails a 7 (seven) step approach. This approach is followed in order to produce specific data points between which a simple method of interpolation is able to be applied, in order to fill in any missing data points and arrive at the required market pricing positions.

Because of the volatility in daily spot and futures markets, SKM uses monthly averages of such prices as the basis for developing its forecasts. The use of monthly averages assists to ensure that future prices are neither unnecessarily inflated, nor deflated, through the application of a daily peak, or trough, during the interpolation of prices for the commodity in question. The 7 (seven) steps involved are:

1) Plot the average of the last 30 days of LME Spot prices
2) Plot the average 3 month LME contract price
3) Plot the average 15 month LME contract price
4) Plot the average 27 month LME contract price
5) Plot the most recent Consensus Long-Term Forecasts position (taken as 7.5 years from survey date[1])
6) Apply linear interpolation between plot points.
7) Identify the Corresponding June points in the interpolated results, take implied Year to June points from these June points, and feed these prices into the model.

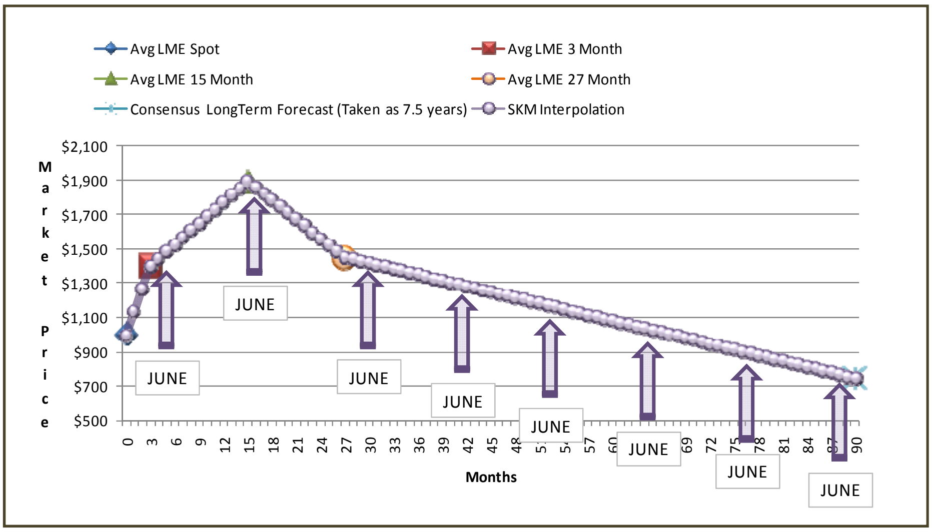
This methodology is represented in Figure 3 and Figure 4.

- **Figure 3 Diagram of SKM methodology (Steps 1-5)**



[1] The Consensus Long-term forecast is listed in the publication as a 5 – 10 year position. In an attempt to apply this in a reasonable manner, SKM consider the position to refer to the mid-point of this range, being 7.5 years, or 90 months hence.

- **Figure 4 Diagram of SKM Methodology (Steps 6 & 7)**



(***Note that all figures are illustrative only and do not refer to the actual position/price of any particular commodity***).

3.4.1 The influence of exchange rates

The SKM methodology for developing cost escalation rates also accounts for the effect on the market price of any cost driver influencing the costs incurred by an *Australian Utility*, by transferring the historic and future prices into Australian Dollar terms from whichever foreign currency they have been quoted in on the markets.

As many of the forecast prices for cost drivers appear on world market quoted in a foreign currency (typically US$) the Australian Dollar's relative position to the currency in which the product is traded will, in itself, influence the cost of finished goods to a Australian Utility.

3.4.2 Expected Price movements for commodities

With average annual commodity prices having fallen so dramatically during 2009 and then displaying significant volatility through early 2010, the markets are now being forecast to continue some price recovery in the short term, before levelling out, reflecting more consistent annual supply and demand conditions.

This move toward increased consistency in supply and demand patterns is widely thought to emerge somewhere around the year to June 2013 period.

Figure 5 shows the predicted movements in the AUD equivalent market prices of the various commodities that influence the price of network plant and equipment.

■ **Figure 5 Forecast Annual Commodity Price Movements (REAL- AUD)**

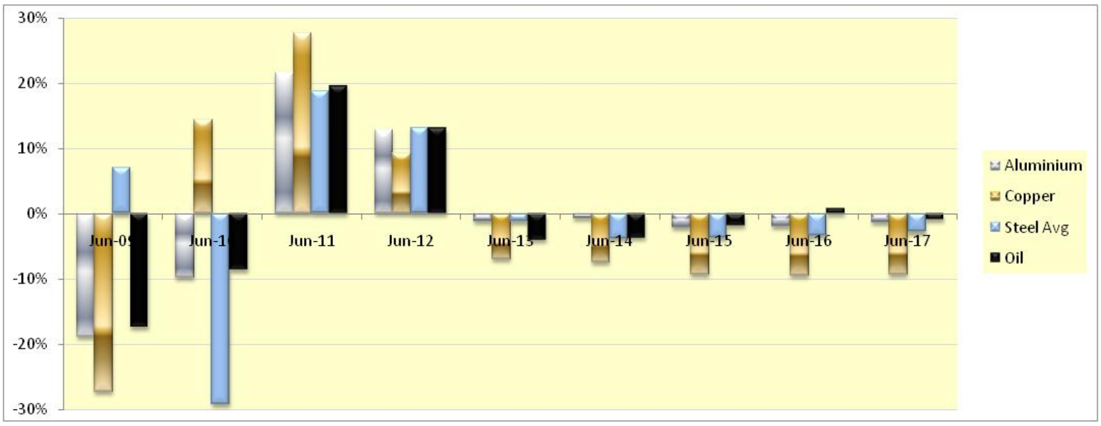
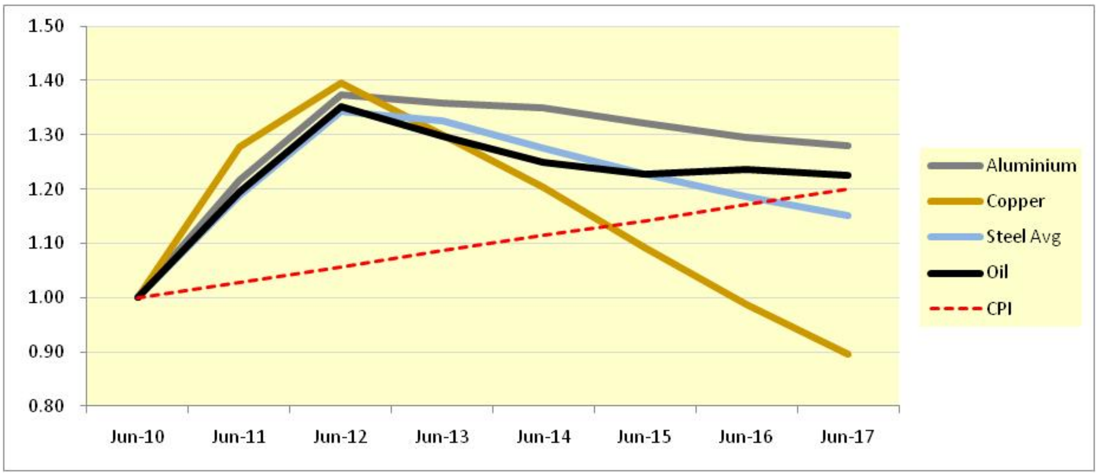


Figure 6 presents the affect of the cumulative real average annual movements of these commodities (against CPI) indexed to their average year to June 2010 position.

■ **Figure 6 Indexed annual REAL AUD Commodity Price Movements (indexed to June 2010 base)**



The average year to December input numbers used during SKM's modelling of the Copper market prices are presented in Table 5

■ **Table 5 Relative Real AUD based price of Copper**

	Jun-09	Jun-10	Jun-11	Jun-12	Jun-13	Jun-14	Jun-15	Jun-16	Jun-17
Copper	$ 6,693	$ 7,657	$ 9,783	$ 10,694	$ 9,957	$ 9,214	$ 8,357	$ 7,568	$ 6,862
Annual Change	-27%	14%	28%	9%	-7%	-7%	-9%	-9%	-9%

The year to June 2011 *real* escalation rate for copper of 27.8% together with the 2.75% CPI rate provides a nominal escalation rate for the period of 30.5%.

3.5 Steel

An application of the SKM methodology used for developing forward market positions for Copper and other commodities (as described in 3.4 above) is not currently possible for steel, due to the lack of a liquid Steel futures market. SKM note that the LME commenced trading in steel futures in February 2008.[2] However, the LME has communicated that this relatively new steel futures market is undergoing a purposely planned "soft launch", and its liquidity is still being built up.

SKM therefore uses the Consensus Economics forecast as the best currently available outlook for steel prices. Consensus provides quarterly forecast prices in the short term, and a "long term" (5-10 year) price.

Steel prices for all historical periods are taken from an average of the Bloomberg US and EU steel prices.

The most recent Consensus Survey available at the time of compiling this report was their Oct 2010 Survey. This publication provided quarterly forecast market prices for steel from December 2010 to March 2013, as well as a Long-term forecast pricing position.

Consensus Economics provides two separate forecasts for Steel, both being for Hot Rolled Coil (HRC) variety, with the first being relative to the USA domestic market and the other the European domestic market.

The Consensus Economics US HRC price forecasts are presented US$ per *Short Ton*. As historical prices are all quoted in US$ per *Metric Tonne*, it is necessary to convert these prices into their Metric Tonne equivalent. This is a simple operation with the US HRC prices multiplied by a factor of 1.1023, being the standard conversion rate for the number of short tons per Metric Tonne.

An example of this process is shown in Table 6.

Once converted to their Metric Tonne pricing position, SKM uses the average of these two forecasts (US HRC and EU HRC) as its Steel price inputs to the cost escalation modelling process.

The figures used as inputs to SKM's modelling are presented in Table 7.

SKM's methodology of integrating Consensus Steel price forecasts into the development of cost escalation factors adheres to the methodology for cost escalation as accepted by the AER in the NSW Distribution Business's Final Decisions.

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2 http://www.lme.co.uk/5723.asp

- **Table 6 Conversion of Short tons to Metric tonnes. (USD nominal)**

	Sep-10	Dec-10	Mar-11	Jun-11	Sep-11	Dec-11	Mar-12	Jun-12	Sep-12	Dec-12
HRC US in Short tons	676	649	666	684	691	688	689	707	717	704
Equivalent HRC US in Metric tonnes	745	716	734	754	762	759	760	779	791	776

- **Table 7 Relative Real AUD Pricing position of average HRC steel prices**

	Jun-09	Jun-10	Jun-11	Jun-12	Jun-13	Jun-14	Jun-15	Jun-16	Jun-17
Steel Avg	$ 990	$ 701	$ 833	$ 942	$ 930	$ 895	$ 861	$ 831	$ 808
Annual Change	7%	-29%	19%	13%	-1%	-4%	-4%	-3%	-3%

The 18.7% *real* escalation rate together with the 2.75% CPI provides a nominal Steel escalator of 21.5% for the year to June 2011.

3.6 Cement

SKM applied the Construction Forecasting Council's as a proxy for the forecast movement in the cost of Cement.

The Australian Construction Industry Forum (ACIF)[3] is the peak consultative organisation of the building and construction sectors in Australia. The ACIF has established the Construction Forecasting Council (CFC)[4] through which it provides a tool kit of analysis and information.

In commenting on activity in construction related to the electricity industry, the Construction Forecasting Council (CFC) notes that for this sector,

> *"Electricity and pipeline construction activity reached a very high $12 billion in 2008/09 and 2009/10, due to the start of several new projects, including many wind farms. Electricity and pipeline construction is forecast to ease back over the short term as future climate change policy direction needs to be made clearer in this sector. Electricity and pipeline construction is forecast to remain stable at a high level over the medium term"* [5].

3 http://www.acif.com.au/

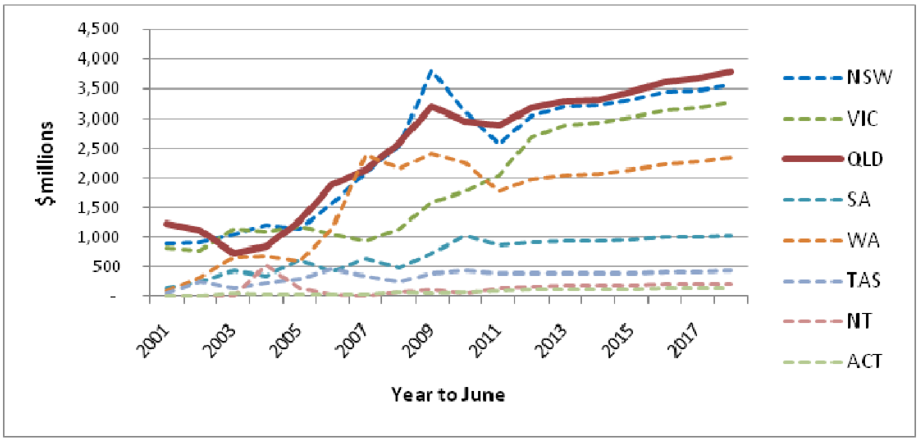
4 http://www.cfc.acif.com.au/cfcinfo.asp

5 http://www.cfc.acif.com.au/summary.asp

This outlook is likely to sustain the market demand for related construction materials, and thus the resultant market prices.

Figure 7 illustrates the CFC's outlook for electricity and pipeline construction demand out to 2017-18. This illustrates how when compared to NSW, VIC and QLD, WA is expected to experience a comparatively lower forward program of construction in this sector, with QLD expected to have the largest program.

- **Figure 7 CFC Electricity and pipeline construction outlook**[6]



The CFC also provides a forecast of related construction costs going forward, through which annual growth rates in the cost of construction are able to be developed. These figures are provided through KPMG Econtech forecasts.

As the CFC considers electricity and pipeline construction to fall within the sector it presents entitled as "Engineering", SKM has adopted these movements presented as Australian National "Engineering" construction cost forecasts as the likely movements in the Construction cost component of relevance to the IMO project within cost escalation modelling.

Engineering construction is forecast to continue rising as new large projects commence. Mining is forecast to be solid as new LNG and iron ore projects commence in Western Australia and Queensland. Road and rail construction are expected to remain at a solid level due to continued government infrastructure spending. The National Broadband Network (NBN) will also boost activity levels.

- **Table 8 CFC Forecast of Engineering construction costs (nominal)**

CFC forecast title	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Long-term - Engineering - Price Index (seasonally adjusted% change)	-5.5%	4.2%	2.2%	-0.4%	0.9%	3.5%	5.3%	5.4%	4.7%

[6] http://www.cfc.acif.com.au/forecast_results.asp Downloaded 26/11/2010

SKM identified that the CFC *nominal* rate of 4.2% first needed to be made *real* in order to allow for consistent application of CPI assumptions.

The CFC forecasts provide underlying macro economic assumptions, and stated that the YTJ 2011 CPI used in developing the forecasts was 2.2%.

SKM therefore restated the real CFC number using a consistent RBA forecast CPI rate of 2.75%.

The calculation applied was:

- 4.2% (nominal CFC rate) **-** 2.2% (KPMG's CPI assumption) = 2% real escalation in costs.
- 2%real escalation in costs + RBA CPI of 2.75% = **4.75%** nominal escalation in costs.

Trusting this clarifies the methodology employed in developing the 12.1% escalation factor for the generation capital cost from June 2010 to June 2011.

Regards

ALambe
Senior Business Analyst