

Independent Market Operator



Draft Report: Maximum Reserve
Capacity Price Review for the 2010/11
Reserve Capacity Year

November 2007

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EXECUTIVE SUMMARY

Each year, the IMO is required to conduct a review of the Maximum Reserve Capacity Price. This Draft Report details the outcome of the review conducted in 2007 to determine the Maximum Reserve Capacity Price for the 2008 Reserve Capacity Cycle. The value used for the 2008 Reserve Capacity Cycle will be effective from 1 October 2010 through to 1 October 2011.

The 2008 Maximum Reserve Capacity Price has been proposed by the IMO to be **\$173,400** per MW per year. The review process has included a technical costing of the following components:

- Developing and constructing a 160MW Open Cycle Gas Turbine (OCGT) power station.
- Technical connection to the 330kV transmission system.
- Operations and maintenance costs associated with the OCGT power station and the transmission components.
- Developing and constructing liquid fuel storage facilities.
- Legal approval and financing costs.

The Maximum Reserve Capacity Price determined for the 2007 Reserve Capacity Cycle is approximately 22% higher than the Maximum Reserve Capacity Price determined for the 2007 Reserve Capacity Cycle. The main cost increases have resulted from:

- Increases to the costs associated with developing and constructing the 160 MW OCGT power station.
- Increases in the transmission connection and O&M costs.

A number of cost components have reduced this year, namely the fixed fuel costs and the margin allowed for legal, approvals and financing costs. Each of these components has been reviewed by an independent consultant, however each of these components only contribute a small percentage to the total Maximum Reserve Capacity Price.

The IMO seeks submissions on this Draft Report. Information on the public submission process is included within the report and can also be found in the Reserve Capacity section of the IMO website (www.imowa.com.au)

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1. INTRODUCTION

The Maximum Reserve Capacity Price sets the maximum bid that can be made in a Reserve Capacity Auction and is used as the basis to determine an administered Reserve Capacity Price if no auction is required. Each year the IMO is required to conduct a review of the appropriateness of a number of the components that are used to determine the Maximum Reserve Capacity Price. The results of this review, and the proposed revised value for the Maximum Reserve Capacity Price, are to be published in the form of a Draft Report.

This Draft Report is produced in accordance with clause 4.16.6 of the *Wholesale Electricity Market Amending Rules (September 2006)* (Market Rules).

The IMO is required to assess the appropriateness of the following values:

- a) The optimum size of an open cycle gas turbine (OCGT) for the SWIS.
- b) The capital cost of an OCGT power station.
- c) The level of electricity transmission connection costs.
- d) The cost of acquiring and installing fuel tanks for sufficient liquid fuel storage to accommodate 24 hours of operation.
- e) The capital cost of a gas pipeline lateral to allow for dual fuel capability.
- f) The estimate of the fixed operating and maintenance costs for the power station and the transmission facilities listed above.
- g) A margin for legal, approval, financing costs and contingencies.

This Draft Report reviews the appropriateness of each of these values for the 2008 Reserve Capacity Cycle. To do this, the IMO uses publicly available information, together with advice from independent engineering and economics consultants to review the various input parameters that are used in calculating the Maximum Reserve Capacity Price.

In addition to the annual review process, the IMO has recently submitted a Market Rule Change Proposal (RC_2007_24) to clarify the updating of the Maximum Reserve Capacity Price. Information on this rule change proposal can be found by visiting the IMO's website (www.imowa.com.au)¹. The proposed rule change is discussed in this Draft Report together with the impact the rule change would have on the Maximum Reserve Capacity Price.

The Draft Report is published on the IMO website (www.imowa.com.au) and a public consultation process will be held so that comments from stakeholders and other interested parties can be taken into consideration prior to publishing the Final Report. The Final Report on the Maximum Reserve Capacity Price is then submitted to the Economic Regulation Authority (ERA) for approval.

¹ http://www.imowa.com.au/Attachments/RuleChange/RuleChange_2007_24.htm

1.1 *Reserve Capacity Cycle Timing*

This Draft Report has been prepared for the 2008 Reserve Capacity Cycle and the Maximum Reserve Capacity Price will be effective from 1 October 2010 through to 1 October 2011.

1.2 *General Costing Methodology and Structure of this Draft Report*

There are a number of main components to this review. These include:

- The capital cost of an OCGT power station.
- The costs associated with connection of the OCGT power station to the transmission system.
- An estimation of O&M costs associated with the transmission connection and the OCGT plant.
- A review of the costs associated with building liquid fuel storage and handling facilities for the OCGT peaking power station.
- An assessment and recalculation of the Factor K, which takes account of the payment stream should a Market Participant receive Capacity Credits through the Reserve Capacity Auction and be awarded a Long-Term Special Price Agreement.

The method of estimating the cost of developing an OCGT power station, is specified in Appendix 4 of the Market Rules. However, the prescriptive method by which the OCGT cost is calculated has been found to significantly underestimate the actual costs that could be expected when developing an OCGT power station of this nature. Therefore, the IMO commissioned a consultant to estimate a more cost reflective price. Both the existing methodology and the alternate costing methodology are presented in this report.

Transmission connection costs associated with connecting an OCGT to the transmission system have been estimated by Sinclair Knight Merz (SKM), who were retained by the IMO for this purpose. The IMO has published the SKM report in the Reserve Capacity section of the IMO website (www.imowa.com.au).

Operations and Maintenance costs associated with the OCGT and the Transmission assets were also analysed by SKM. This is a similar methodology to that adopted in a similar review conducted in previous years.

This year, the IMO commissioned GHD to conduct a review of the costs associated with building liquid fuel storage and handling facilities for the power station.

The Allen Consulting Group has conducted an analysis of the calculation of the Factor K, which is used to take account of the escalation methodology in the case

where a Market Participant is successful in the Reserve Capacity Auction and is eligible to receive a Long Term Special Price Arrangement.

1.3 *Maximum Reserve Capacity Price Outcome for the 2008 Reserve Capacity Cycle*

Following the review of the Maximum Reserve Capacity Price for the 2008 Reserve Capacity Cycle the IMO proposes the Maximum Reserve Capacity Price to be **\$173,400** per MW per year.

The IMO also proposes this Maximum Reserve Capacity Price outcome in light of the Fast Track Rule Change that was progressed. At the time of publishing this report, the rule change has been accepted through the public consultation process and is now proceeding through Ministerial Approval processes.

Other than the increase in OCGT power station costs, the main upward cost drivers have been costs increases associated with connecting to the transmission connection.

Smaller downward pressures have resulted from the revision of the costs estimates of constructing the liquid fuel storage and handling facilities. The margins allowed for legal, approval and financing costs have also been reviewed this year and are revised downwards. Finally, the Factor K also has been revised down this year.

2. THE MAXIMUM RESERVE CAPACITY PRICE AND WHOLESALE ELECTRICITY MARKET RULE CHANGES

Over the past twelve months, the IMO has been working with industry participants to assess the general methodology of determining the Maximum Reserve Capacity Price. The IMO established an industry advisory group to consider a number of the more strategic issues surrounding this process along with the specific methods used to determine the Maximum Reserve Capacity Price.

In conducting an assessment of the various components that contribute to the Maximum Reserve Capacity Price, the IMO, in consultation with the advisory group retained SKM to review the expected costs of developing an OCGT power station. These costs are captured in the PC[t] term in Appendix 4 of the Wholesale Electricity Market Rules.

The analysis conducted by SKM used all available costing information and found that the methodology outlined in Appendix 4 of the Market Rules significantly underestimates project costs that would normally be expected when developing an OCGT power station.

In order to provide the IMO with the ability to use an alternative costing approach for some of the components that comprise the Maximum Reserve Capacity Price, the IMO recently proposed a Fast Track Rule Change, a copy of which is provided in Appendix A. Full details of the rule change can be found on the IMO website².

The Fast Track Rule change proposed by the IMO fulfils two functions. It:

- Allows for the results of the review conducted in accordance with Market Rule 4.16.4 to be considered when the IMO produces this Draft Report.
- Allows the IMO to adopt a modified methodology to that provided in Appendix 4 of the Market Rules when the existing method creates an outcome which is significantly different to that which would be reasonably expected to occur in normal practice.

The first point above provides for a clear linkage between conducting the review and using the outcome of the review in the newly determined Maximum Reserve Capacity Price. The second point allows the IMO to use an alternate methodology in cases where a significant change to the methodology would result in a more appropriate Maximum Reserve Capacity Price outcome.

As a consequence of the Market Rule change, the review conducted in preparation for the publication of this Draft Report has found that one such methodology change should be made. The change is in respect of the method used to calculate the OCGT power station cost, which results in the PC[t] term.

² http://www.imowa.com.au/Attachments/RuleChange/RuleChange_2007_24.htm

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To show the impact this change has on the PC term both costing scenarios are presented in this Draft Report, one using the existing methodology provided in Appendix 4 of the Market Rules and an alternate methodology, which is described in an accompanying report by SKM.

At the time of producing this Draft Report, the Rule change has progressed through the public consultation stage and has been approved by the IMO. Clause 4.16 is a protected provision under the Market Rules and requires approval by the Minister for Energy. An application for approval of the Market Rule change has been lodged with the Minister.

3. ESCALATION OF COSTS

One of the outcomes from the reviews conducted in previous years was the apparent increase in construction related costs that have been experienced over the past few years. These are substantially higher than the CPI so in determining the Maximum Reserve Capacity Price, the IMO uses a range of engineering and construction escalation rates which are estimated by SKM.

This section details the various escalation parameters used throughout the remainder of the report.

3.1 CPI

The following CPI values are quoted by the Australian Bureau of Statistics for the period June 2005 and June 2006.

CPI June 2006 154.3

CPI June 2007 157.5

Where the CPI is the weighted average of eight capital cities.

These values indicate an inflation rate of 2.07% over the period of June 2006 through June 2007 and are provided here as a reference for the Industry Escalation discussion below.

This year, the IMO has also obtained forecasts of CPI which will be used in the calculation of the Factor K. The CPI forecasts, shown in Table 1, were sourced from long term forecasts developed by BIS Shrapnel.³

Table 1 Inflation Rates used to Determine Factor K

Financial Year	CPI
2007estimated	2.1
2008	3.0
2009	3.2
2010	3.0
2011	2.5
2012	3.3
2012-2022	2.9

Note: 2012 onwards are the average compound forecast CPI

³ BIS Shrapnel (2007) Long Term Forecasts Australia, 2007-2022, 33rd Edition.

3.2 Industry Escalation

The IMO requested that SKM provide an assessment of the cost escalation for the transmission capital and O&M costs between 2005 and 2006. SKM conducted an analysis of a number of publicly available indices, and compared the impact of these to increases in actual component and construction costs. This approach was also used in the determination of the Maximum Reserve Capacity Price for the 2007 Reserve Capacity Cycle.

SKM determined that the transmission costing outcomes between 2006 and 2007 should be indexed at 5.11% for the switch yard assets and 9.70% for the transmission line assets.

A similar analysis was conducted for the generator asset and O&M costs that were provided in the SKM report titled "Review of the Maximum Reserve Capacity Price 2007". This analysis showed an increase of 3.45% in costs between 2006 and 2007. A copy of the SKM report can be found on the IMO website (www.imowa.com.au).

The IMO proposes to use cost escalations of 5.11% and 9.70% for the various transmission related components and 3.45% for generation related components when translating 2007 costs into to June 2008 costs.

4. INPUT PARAMETERS TO THE MAXIMUM RESERVE CAPACITY PRICE CALCULATION

4.1 US CPI

The Market Rules require the OCGT costs to be based on data published by Gas Turbine World Magazine. This information is provided in US dollars and must be escalated to current US dollars and then converted to Australian dollars. In accordance with Appendix 4 of the Market Rules, CPI values have been sourced for the United States. CPI information was sourced from the following US Bureau of Labor Statistics website:

<ftp://ftp.bls.gov/pub/special.requests/cpi/cpi.ai.txt>

This information shows the following CPI information:

June 2005:	194.5
June 2006:	202.9
June 2007:	208.4

Appendix 4 of the Market Rules indicates that the US CPI must be forecast to June of the year in which the Reserve Capacity Auction would take place, in this case June 2008. The IMO is not in a position to provide detailed forecast on the future level of this value. The IMO therefore proposes to use a simple linear extrapolation of the CPI from June 2007 to June 2008 using the period June 2006 to June 2007. This approach is in accordance with that adopted in the 2007 review. This results in the following equation:

$$\frac{\text{USCPI}[2007]^2}{\text{USCPI}[2006]}$$

The extrapolated CPI for June 2007 becomes:

June 2008:	214.0
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Therefore, the terms used in the Maximum Reserve Capacity Price calculation are:

USCPI[2006]:	202.9
USCPI[2008]:	214.0

4.2 Exchange Rate

The Market Rules indicate that the Australian/US exchange rate to be used “is the forecast Australian dollar to United States of America dollar, made in year t-x, for midway through year t, based on the Australian Federal Government’s budget forecasts.” The IMO considers that given the speculative nature of an exchange rate

forecast, it is appropriate in this case to adopt the most recent exchange rate available.

The Australian/US exchange rate as quoted by the Reserve Bank of Australia for 22 October 2006 (the date at which the price was calculated) was 0.8882. This information can be found on the Reserve Bank of Australia website⁴. Therefore, for the purposes of the Maximum Reserve Capacity Price calculation:

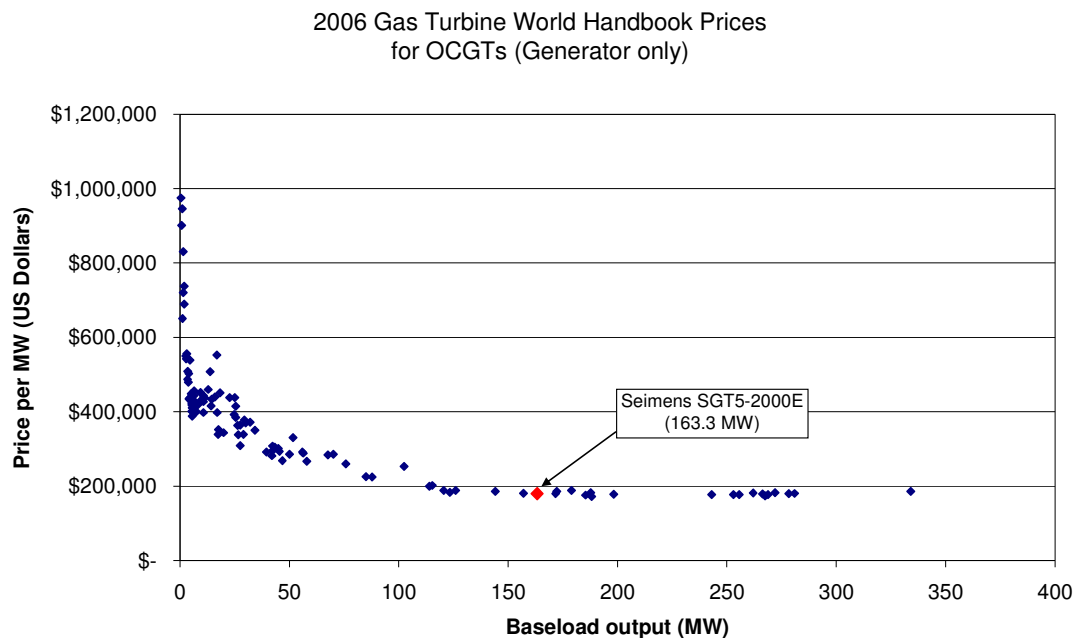
ER[2008]: **1/0.8882**

4.3 Capacity Parameter CAP

For each of the three previous Reserve Capacity Cycles, the capacity parameter CAP has been 160 MW. An OCGT of this size appears to be a reasonable option for the SWIS. This is of a similar size to the OCGTs installed at Pinjarra (Units 1 and 2) and Wagerup by Alinta, and under development by NewGen Power at Kwinana and Neerabup. While a number of these developments have been multi-machine power stations, the single unit size is in the same order as the CAP parameter.

When the OCGT prices listed in the Gas Turbine World Handbook are assessed, a capacity of 160 MW represents a reasonably cost-efficient single-unit power station (see Figure 1). Reducing CAP below around 100 MW results in substantial increases to the OCGT cost.

Figure 1 Gas Turbine World Handbook Prices of OCGTs



⁴ <http://www.rba.gov.au/Statistics/HistoricalExchangeRates/2007.xls>

Therefore, the IMO considers the appropriate capacity for an OCGT is approximately 160 MW and there is no basis for changing the size, therefore:

CAP: 160 MW

4.4 Gas Turbine Price

As at the time of this review, the 2007 version of the of Gas-Turbine World (GTW) Handbook is not yet available, so the most current version is the 2006 edition. The lowest quoted price of the three open cycle gas turbines with capacities closest to 160MW is US\$180,000/MW for a Siemens SGT5-2000E machine. Under the method provided in Appendix 4 of the Market Rules, this price is then doubled to account for balance-of-plant items and other ancillary costs. The power station cost becomes:

GTP[2006]: US\$360,000/MW

4.5 Capital Cost of an OCGT

Using the methodology defined in accordance with Appendix 4 of the Market Rules, the capital cost of an open cycle gas turbine in Australian dollars is expressed as PC[t] and is calculated by the following formula.

$$PC[2008] = GTP[2006] \times (USCPI[2008]/USCPI[2006]) \times ER[2008]$$

It is still appropriate to include an allowance for low Nitrous Oxide (NOx) burners which are commonly specified to meet environmental standards. A margin of 5% is included in the Margin M for this purpose. Using the term *NOx* to represent the low nitrous-oxide emissions component, PC[t] is now represented by the following equation:

$$PC[2008] = GTP[2006] \times (USCPI[2008]/USCPI[2006]) \times ER[2008] \times (1 + NOx)$$

Using this method, PC[2008] would therefore become A\$448,862 per MW.

However, as discussed previously, work conducted SKM for the Maximum Reserve Capacity Price advisory group has shown a disparity between the above calculation and prices that would be expected for generation projects of the kind contemplated by the Maximum Reserve Capacity Price.

Using the methodology presented by SKM in their report entitled "Review of the Maximum Reserve Capacity Price 2007", the term PC has been estimated to be A\$104,400,000, or A\$652,500 per MW in 2007 terms. Escalating this by 3.45% results in a cost of A\$675,011 per MW in 2008 terms.

However SKM were not required to cost low NOx burners, so it is reasonable to further increase this cost by 5%, as would be applied under the existing methodology. Therefore the final OCGT power station cost is estimated to be

A\$708,762 per MW. This represents a substantial difference in the value of this term, a change in the order of 60%.

4.5.1 Discussion

The process of doubling the OCGT unit price to calculate an OCGT power station price as indicated in the Market Rules significantly underestimates the cost of balance-of-plant items. This outcome was identified previously by work conducted by the Maximum Reserve Capacity Price Advisory Group. The underestimation of the OCGT power station costs as estimated by the method detailed in Appendix 4 of the Market Rules is likely to reflect the buoyant conditions experienced in the engineering and construction environment in Western Australia over the past few years. To achieve the same price outcome as determined by SKM, a multiplier of approximately 3.2 would be required.

The second contributing factor to the difference in cost is the availability of the GTW Handbook. At the time of writing this report (the end of November 2007), the 2007 edition of the GTW Handbook was not yet available in Australia. This means that the prices contained in the 2006 GTW are escalated from mid-2006 to mid-2008 values at the *USCPI* rates. This may not reflect the actual increase in gas turbine costs that have occurred since 2006.

As a consequence, it was considered more appropriate to use the cost-reflective methodology which had been agreed within the Maximum Reserve Capacity Price Advisory Group. This approach takes account of actual project development costs specific to the construction and engineering environment in Western Australia.

The IMO is continuing with the structural review of the costing methodology to provide a clear and transparent basis by which the Maximum Reserve Capacity Price can be determined each year.

If the IMO is required to source new capacity through a Reserve Capacity Auction, it is critical that proponents can make offers that are high enough to cover their expected development costs. If the Maximum Reserve Capacity Price is less than the actual costs of developing a new OCGT power station, the IMO may not receive offers in the auction. A Maximum Reserve Capacity Price that is unrealistically low could lead to insufficient capacity being procured.

The difference in the PC term impacts on the Maximum Reserve Capacity Price by approximately \$50,000 per MW per year, or 40% of the total value. In consideration of the above discussion, the IMO proposes to use the value determined by SKM as this represents a more cost reflective outcome for this component. Therefore PC[2008] becomes:

PC [2008]: A \$708,762 per MW

4.6 *D – Real Interest Rate*

The real interest rate has been calculated in accordance with Appendix 4 of the Market Rules by estimating the Commonwealth 10 Year Bond Rate (real) plus a

Margin for Debt of 1.5%. The Real Commonwealth 10 Year Bond Rate for 30 June 2017 was found by interpolation between the Indicative Mid Rates of Commonwealth Government Securities with maturity dates of 20 August 2015 and 20 August 2020 respectively. This information was current as at 9 October 2007. The data used in this calculation are included at Appendix B for reference.

The Real Commonwealth 10 Year Bond Rate is calculated as 2.67%. The parameter D is:

D: 0.0417

4.7 Fixed Fuel Costs

In the past, the Fixed Fuel Costs component of the Maximum Reserve Capacity Price used historical estimates as the basis for the costing. This year, the IMO retained GHD to conduct an analysis of the costs that could be expected when constructing the liquid fuel storage and handling facilities. A copy of the report produced by GHD can be found on the IMO Website⁵.

The cost of installing liquid fuel storage tanks, handling facilities and the cost of keeping them full at all times has been estimated by GHD to be A\$2.548 M in 2007 terms. It is reasonable that this value be escalated to 2008 monetary terms and the IMO proposes to use an escalation factor of 3.45%, that used for the generation plant components. Therefore FFC becomes:

FFC[2008]: A\$2.636 M

The review conducted in under clause 4.16.4(e) of the Market Rules requires the IMO to consider the capital cost of a gas pipeline lateral, however the methodology outlined in Appendix 4 of the Market Rules does not include any allowance for the costs associated with the installation and maintenance of a gas pipeline lateral.

In the past IMO has taken the view that such costs should not be included in the determination of the Maximum Reserve Capacity Price. The IMO contends that this is not a requirement of the peaking OCGT power station contemplated in the Maximum Reserve Capacity Price. This view was generally supported by the members of an industry advisory group established to assess the Maximum Reserve Capacity Price mechanism.

4.8 Transmission Connection Costs

SKM were retained to provide estimates of connecting a 160MW OCGT to the 330KV transmission system. For the review conducted in 2006/07, the total transmission connection cost was estimated at A\$16.909M (for the 2009/10 Reserve Capacity Year). This included an allowance of A\$10.8M for deep connection costs.

⁵ http://www.imowa.com.au/max_rc_price.htm

The total transmission cost has risen by approximately 22% for the 2008 Reserve Capacity Cycle. This is due in part to a change to technical connection scenario used this year, but also in response to the escalation applied to convert 2007 costs to mid 2008 costs. Deep connection costs have also been increased by approximately 5% to reflect the escalation effect from 2007 to 2008 figures.

Western Power have provided comment on the transmission costing components. A copy of their letter is included in Appendix C.

4.8.1 Direct Connection Costs

Comments were also received in the 2007 review about the appropriateness of the transmission connection arrangements used as the basis for cost estimates. SKM had proposed that costing should be based on using a switched mesh arrangement as this represented the lowest cost option.

Western Power indicated that such arrangements represent a reasonable connection option in some cases but that this does not provide for economic expansion of the connection arrangement to accommodate additional generation. At locations where additional capacity maybe required in the future, Western Power nominate an alternative arrangement of using a switched mesh, configured in a breaker and a half arrangement, to be the minimum requirement.

Therefore the IMO commissioned SKM to provide cost estimates for two connection options for the 2008 Maximum Reserve Capacity Price. The first option, Option 1 in Table 2, was the same simple meshed switchyard connection arrangement used previously. The second option (Option 2 in Table 2) is the slightly more complex meshed switchyard configured in a breaker and a half arrangement which would allow for future expansion. SKM provide a full description of each scenario including line diagrams in their report.

Given the current capacity issues that have been identified by Western Power previously⁶, the IMO considers it appropriate that the more complex connection arrangement is used. This arrangement leads to some increase in costs. In addition, connection costs have risen since last year reflecting the current buoyant project development environment.

Notwithstanding the selection of a more complex arrangement, all other factors are the same as were used previous years:

Line Length:	2km
Terrain:	50% Flat/50% Undulating
Urban/Rural:	50% Urban/50% Rural
No Road Crossings per km:	1

⁶ See the 2007 Statement of Opportunities Report for more details.

Direct transmission connection costs for both 2008 options, together with estimates used in previous years are shown in Table 1.

Table 2 Direct Transmission Connection Costs

Item	Cost Estimate	Cost Estimate	Cost Estimate	Cost Estimate
	(2007)	(2008)	(2007)	(2008)
	Option 1	Option 1	Option 2	Option 2
Site Establishment	\$ 1,497,503	\$ 1,572,378	\$ 1,843,379	\$ 1,937,576
Switchyard	\$ 3,486,526	\$ 3,660,852	\$ 3,712,775	\$ 3,902,498
Tie Line	\$ 1,207,740	\$ 1,323,683	\$ 1,712,430	\$ 1,876,823
Connection Point	\$ 100,000	\$ 105,000	\$ 100,000	\$ 105,110
Subtotal	\$ 6,291,769	\$ 6,661,913	\$ 7,368,584	\$ 7,822,007
EPCM@15%	\$ 943,765	\$ 999,287	\$ 1,105,288	\$ 1,173,301
WA Factor	\$ 283,130	\$ 299,786	\$ 331,586	\$ 351,990
Total	\$ 7,518,664	\$ 7,960,986	\$ 8,805,458	\$ 9,347,298

The 2007 costs have been escalated to 2008 figures by applying the 2006 to 2007 escalation rates estimated by SKM and shown in section 3.2 above. In addition, a Western Australia factor is specifically costed this year to take account of the engineering and construction environment in Western Australia.

The cost difference between Option 1 and Option 2 is approximately A\$1.4M in 2008 terms.

4.8.2 Deep Connection Costs

Discussions held between the IMO and Western Power in mid 2007 indicated that the transmission system is nearing full capacity and that most generation connections would be subject to significant network augmentation costs. Western Power is currently reviewing their capital asset pricing and capital contributions policy and is unable at this time to provide a revised estimate of the deep connection costs associated with the notional project considered under this review.

In light of this, the estimates used for the 2007 Maximum Reserve Capacity Price is escalated to provide 2008 figures. Table 3 lists the total connection costs comprised of the direct connection costs and the deep connection costs escalated at the SKM escalation parameter of 5.11% to 2008 figures.

Table 3 Total Transmission Connection Costs

Item	Cost Estimate (2007)	Cost Estimate (2008)
	Option 2	Option 2
Direct Connection Costs	\$ 6,098,826	\$ 9,347,298
Deep Connection	\$10,810,000	\$11,360,000
Total	\$16,908,826	\$20,707,298

4.8.3 Total Transmission Costs

Using the information presented in Sections 4.8.1 and 4.8.2 the TC therefore becomes:

$$TC[2008] = \text{A\$ } 20,707,298$$

$$TC[2008]: \text{A\$ } 20.7073M \text{ (rounded)}$$

The 22% increase in the transmission cost component is largely due to the increase expected in the direct connection costs.

4.9 Margin M

The margin M is included to cover legal, approval and financing costs and contingencies. This term was set in previous years at 15% on the basis that M is comprised of 5% for legal, approval and financing costs, and a 10% contingency margin. Part of the work program completed by SKM this year included an analysis of the expected legal, approval and financing costs that might be expected for such a project.

SKM indicate that legal, approval, financing and design costs would be in the order of approximately \$3.84M (2007 terms). Escalating this value to 2008 terms at the estimated CPI value of 2.1% gives an estimate of this figure of \$3.92M. As the margin is applied within the CAPCOST component, it is possible to estimate the \$3.92M as a percentage of the CAPCOST component, by setting M to zero. This leads to a percentage estimate of M for the legal, approval, financing and design costs of 2.72%.

In the past, an allowance of 10% has been applied as a contingency margin. Keeping the contingency margin constant and adding 2.72% for legal, approval and financing costs the margin M becomes:

$$M = 0.1272$$

4.10 Capital Cost

The term CAPCOST[t] refers to the total capital cost, expressed in million Australian Dollars in year t, assumed for a 160 MW OCGT. This is calculated using the following formula:

$$\text{CAPCOST}[t] = \text{PC}[t] \times (1+M) \times (1+1.5 \times D + 0.5 \times D^2) + \text{TC}[t] + \text{FFC}[t]$$

$$\text{CAPCOST}[2008] = \text{A\$159,276,503}$$

4.11 Fixed Operation and Maintenance Costs

4.11.1 Fixed Transmission O&M Costs

Fixed transmission operations and maintenance costs have been estimated by SKM. Details of the costing methodology used by SKM can be found in their report. Transmission O&M costs make up part of the total fixed O&M costs referenced by the term FIXED_O&M[t] in Maximum Reserve Capacity Price calculation of Appendix 4 of the Market Rules.

The direct O&M costs are determined by taking the average of the five-year cumulative transmission costs in SKM's report (Table 5-2) over the first 15 years and creating an annuity discounted at the real WACC (see Appendix D). The 2007 costs provided in the SKM report have been escalated to 2008 figures using an escalation of 5.11%. This results in a cost of A\$429 per MW per year.

Western Power access charges are then added to this and escalated from 2007 to 2008 figures at CPI. This results in a total combined O&M cost of:

Transmission O&M Costs: A\$1013 per MW per year.

4.11.2 Fixed OCGT O&M Costs

Fixed O&M costs for a 160 MW OCGT have been estimated by SKM. Again, an annuity is calculated taking the first 15 years of O&M costs provided by SKM. The SKM report details the total fixed O&M costs of the OCGT to year 15 as A\$23,400,000 in 2007 terms. This cost is then escalated at 3.45% to 2008 values which equates to A \$10,086 per MW per year.

Generation O&M Costs: A \$10,086 per MW per year.

4.11.3 Insurance Costs as an O&M Cost

The IMO considers it appropriate to fund insurance to a level required to cover replacement costs of the capital equipment but not insurance to provide cover for lost

income or the contractual and risk position of the proponent. Therefore, an allowance of 0.5% of the capital replacement cost has been included in the Fixed O&M costs. Table 4 shows the expected insurance costs derived from escalating the 2007 capital costs from the SKM report to 2008 terms.

Table 4 Insurance Costs

Item	Value (2008)
Transmission Capital Costs [2008]	\$ 5,884,431
Generation Capital Costs [2008]	
Main Plant Equipment	\$ 67,449,400
Balance of Plant/Other Equipment	\$ 2,379,350
Electrical Assembly and Wiring	\$ 1,655,200
Buildings and Structures	\$ 4,862,150
Total [2008]	\$ 76,346,100
Insurance Premium	0.005
Total Insurance Costs	\$ 2,570 per MW per year

Insurance Costs: A \$2,570 per MW per year.

4.11.4 Total Fixed O&M Costs

The total Fixed O&M Costs are presented in Table 5 below.

Table 5 Fixed Operation and Maintenance Costs

Item	Cost Estimate (per MW per year)
Transmission Fixed O&M [2008]	\$ 1013
OCGT Fixed O&M [2008]	\$10,086
Insurance as Fixed O&M [2008]	\$ 2,570
Total	\$13,669 per MW per year

FIXED_O&M: \$13,669 per MW per year

4.12 Annualised Capital Cost

The Weighted Average Cost of Capital (WACC) is calculated using the real Commonwealth 10 year bond rate of 2.67%, a margin for debt of 0.015 and a margin for equity of 0.151.

The resulting WACC is 0.0961.

The annualised capital cost, using a capital cost of \$159,276,503, a WACC of 0.0961 and a term of 15 years becomes:

ANNUALISED_CAPCOST[2008]: A\$ \$20,476,662 per year

4.13 Summer De-rating Factor

A summer de-rating factor of 1.18 is outlined in the Market Rules.

SDF: 1.18

4.14 Factor K

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

As part of a larger review of the Maximum Reserve Capacity Price process, the IMO retained the Allen Consulting Group to conduct an appraisal of the method used in 2006/07 to calculate the Factor K.

The Allen Consulting Group noted a number of minor discrepancies with regard to the way the Factor K was implemented and have also developed a new, more comprehensive methodology for the calculation of the Factor K.

The results from the review conducted by the Allen Consulting Group are available in their report⁷ published on the IMO website. The Factor K has been computed as:

K: 1.0529

While the method preferred by the Allen Consulting Group for computing K differs, a large proportion of the downward change occurs as a result of the revised CPI estimate.

⁷ Review of the Weighted Average Cost of Capital for the purposes of determining the Maximum Reserve Capacity Price – Supplementary report – the variable “k”

4.15 *Maximum Reserve Capacity Price*

The Maximum Reserve Capacity Price is calculated using the following equation from Appendix 4 of the Market Rules.

$$\text{PRICECAP}[2008] = K \times \left(\text{FIXED_O\&M}[2008] + \frac{\text{ANNUALISED_CAPCOST}[2008]}{\text{CAP/SDF}} \right)$$

Using the values determined by the IMO and presented in previous sections, PRICECAP for the 2008 Reserve Capacity Cycle is determined to be A\$173,396, which is rounded to:

PRICECAP[2008]: \$173,400 per MW per year

A Maximum Reserve Capacity Price of \$173,400 per MW per year is proposed by the IMO.

5. REQUEST FOR STAKEHOLDER INPUT

The IMO invites submissions from all sectors of the Western Australian energy industry, including end users, on the proposed Maximum Reserve Capacity Price for the 2010/11 Reserve Capacity Year. Following receipt of public submissions, the IMO will propose a final revised value of the Maximum Reserve Capacity Price to the ERA for approval.

5.1 *Submissions Guidelines*

Submissions must be made in writing and be no longer than five pages in length (12 point font). Claims regarding the appropriateness of the values used by the IMO to determine the Maximum Reserve Capacity Price for the 2008 Reserve Capacity Cycle must be accompanied by supporting evidence.

In keeping with the principle of open and transparent processes, all submissions will be published on the IMO website.

Submissions on the Market Rule Change have been considered through the relevant Market Rule Change consultation process and will not be considered as part of the Maximum Reserve Capacity Price consultation process.

5.2 *Maximum Reserve Capacity Price Consultation Workshop*

Following the close of submissions, the IMO will hold a workshop on the Maximum Reserve Capacity Price. Attendance at the workshop will be offered to those who have made a submission. The IMO will then discuss any issues that have arisen and will take into consideration the submissions and the outcome of the workshop when producing the Final Report to be submitted to the ERA.

The IMO will directly contact parties who make a submission with details of the workshop. When making a submission, please include details of one contact who will be nominated to attend the workshop.

5.3 *Details for Making a Submission*

Submissions should be addressed to:

Patrick Peake
Manager, System Capacity
Independent Market Operator

By post:
PO Box 7096, Cloisters Square
Perth, WA, 6850

By email:
imo@imowa.com.au

By facsimile:
+61 8 9254 4399

The deadline for submissions is:

4.00PM Western Standard Time on Wednesday, 12 December 2007.

General enquiries maybe directed to Troy Forward on (08) 9254 4304 or Patrick Peake on (08) 9254 4301.

6. CONCLUSION

The IMO has conducted a review of the main factors used to determine the Maximum Reserve Capacity Price. For the 2008 Reserve Capacity Cycle, the IMO proposes that the Maximum Reserve Capacity Price be set at \$173,400 per MW per year.

The Maximum Reserve Capacity Price of \$173,400 per MW per year represents an increase of 22% above the 2007 price. The main cost increases have been in the area of the OCGT power station cost and the transmission costs.

As a result of an ongoing review process, this year the IMO used an improved approach to determine the OCGT power station cost (termed PC[t] in Appendix 4 of the Market Rules). The prescriptive process used to calculate the OCGT power station cost in Appendix 4 of the Market Rules appears to significantly underestimate the actual costs that would be experienced in the marketplace today. Therefore the IMO commissioned SKM to use their extensive project costing database to provide a new estimate.

A change to the Market Rules to utilise this new approach to be adopted is currently being progressed.

The methodology prescribed under the Market Rules would have resulted in a Maximum Reserve Capacity Price being approximately \$50,000 per MW per year lower than the current estimate.

Transmission connection costs have also risen this year, in response to increasing prices and in response to a small change to the scenario used this year.

Downward cost pressure has been in the area of the margins used to account for legal, approval and financing costs, the costs associated with building liquid fuel storage tanks and the Factor K, which is used to account for the escalation terms applied to Market Participants who are eligible to receive a Long Term Special Price Arrangement if they are successful in the Reserve Capacity Auction.

The 2008 Maximum Reserve Capacity Price computation has been included in Appendix E and a comparison between the 2007 and 2008 Maximum Reserve Capacity Prices can be found in Appendix F.

As part of the review, the IMO calls for submissions from the Western Australian energy industry, including end users, on the proposed Maximum Reserve Capacity Price for the 2008 Reserve Capacity Cycle. The closing date for submissions is **Wednesday, 12 December 2007**.

APPENDIX A – RULE CHANGE PROPOSAL

Existing Rule 4.16.5

4.16.5 The IMO must propose a revised value for the Maximum Reserve Capacity Price using the methodology described in Appendix 4.

Proposed Rule Change

4.16.5 The IMO must propose a revised value for the Maximum Reserve Capacity Price using the methodology described in Appendix 4 after taking into account any significant modifications to the methodology resulting from the review conducted in accordance with clause 4.16.3 and 4.16.4.

APPENDIX B – COMMONWEALTH BOND RATES

Item	Issue Date	T1405	T1406
		Maturity Date 20-Aug-15	Maturity Date 20-Aug-20
1	25-Sep-2007	2.810	2.555
2	26-Sep-2007	2.805	2.550
3	27-Sep-2007	2.815	2.560
4	28-Sep-2007	2.800	2.550
5	1-Oct-2007	2.805	2.545
6	2-Oct-2007	2.805	2.550
7	3-Oct-2007	2.800	2.545
8	4-Oct-2007	2.800	2.545
9	5-Oct-2007	2.785	2.530
10	8-Oct-2007	2.835	2.580
11	9-Oct-2007	2.855	2.600
12	10-Oct-2007	2.850	2.595
13	11-Oct-2007	2.840	2.590
14	12-Oct-2007	2.850	2.600
15	15-Oct-2007	2.865	2.610
16	16-Oct-2007	2.865	2.610
17	17-Oct-2007	2.805	2.550
18	18-Oct-2007	2.785	2.525
19	19-Oct-2007	2.740	2.480
20	22-Oct-2007	2.710	2.450
20-day Moving Average		2.81125	2.55600
Rate Delta		-0.255	
Date Delta (DAYS)		1,827.000	
Start Date		20-Aug-15	
Target Date		30-Jun-18	
End date		20-Aug-20	
Interpolated Rate		2.66525	
Source Data			
http://www.rba.gov.au/Statistics/HistoricalIndicativeMidRates/2005_to_2007.xls			

APPENDIX C – LETTER FROM WESTERN POWER



363 Wellington Street Perth WA 6000
GPO Box L921 Perth WA 6842
T: (08) 9326 4911 F: (08) 9326 4595
www.westernpower.com.au
Electricity Networks Corporation ABN 18 540 492 861

Our ref: DMS# 4173297v3
Contact: Tom Pearcy 9326 4742

27 November 2007

Troy Forward
Senior Analyst
Independent Market Operator
The Forrest Centre
Level 22, The Forrest Centre
221 St Georges Terrace
Perth

Dear Troy,

RE: Scope of work Review for Maximum Reserve Capacity Price Components

This letter is in reply to your email of 24 September requesting Western Power's comments on the work to be included in estimating the connection works. Your email provided the following basis for the estimate:

Estimate the capital cost (procurement, installation and commissioning, excluding land cost) of a generic, industry standard 330kV substation that facilitates the connection of a 160 MW open cycle gas turbine power station. The estimated cost will be based on a generic three breaker mesh substation configuration. The substation will be located near to an existing transmission line and include an allowance for 2km of 330kV overhead single circuit line to the power station that will have no road, rail, electrical or gas pipeline crossings. It shall be assumed that the switchyard will be located on flat land in a rural location and there will be no unforeseen environmental or civil costs associated with the development. The connection of the switching station into the existing transmission line will be turn-in, turn-out and will be based on the most economical (i.e. least cost) solution. It is assumed that the existing transmission line will not require modification to allow the connection with the exception of one new tower located at the substation to allow a point of connection. Costs associated with any staging works will not be considered. The estimate will include all the components and costs associated with a standard substation.

Western Power has the following comments on this proposed scope of work:

1. The estimate is based on a generic industry standard 330 kV substation and facilities. This should include a comment that it is required to meet the requirements for the Technical Rules. The scoping document from SKM indicates meeting Western Power Standards but it should also mention the requirement to meet the Technical Rules as this is what governs our standards.
2. The estimate is based on a three breaker mesh arrangement. While a mesh arrangement is generally suitable, it would not be appropriate where the connection is into an existing or proposed 330 kV terminal. Our terminals would generally be constructed to allow for a one

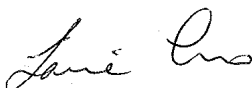
UA1041

and a half breaker arrangement to meet security, reliability and expansion requirements. It would be worth having SKM comment on the cost implications of this change.

3. In terms of the distance of the power station to the nearest transmission lines, some recent connections have required more than 2 km of 330 kV transmission line to make the connection from the gas turbines to the connection point. The most recent connections required 3 km, 7 km and 12km. Western Power recommends that a minimum of 3 km be used to estimate the cost of the connecting line.
4. In regard to "deep connection" costs, I confirm that Western Power intends to review its obligations under the Access Code and the present policy for charging project proponents for network reinforcement. In the meantime, it is recommended that the "deep connection" component of the network connection costs is simply adjusted by the assessed escalation rate.

If you have any questions relating to the above please contact Tom Pearcy on 9326 4742.

Yours sincerely,



Laurie Curro
MANAGER NETWORK PLANNING & DEVELOPMENT

APPENDIX D – WEIGHTED AVERAGE COST OF CAPITAL

The following WACC formula is used for the determination of the Maximum Reserve Capacity Price.

Item	Value
Margin for Debt (M_D)	1.5%
Margin for Equity (M_E)	15.1%
Real Commonwealth 10 Year Bond Rate (B)	2.6767%
Return to Debt (R_d)	(B+ M_d) = 4.17%
Return to Equity (R_e)	(B+ M_e) = 17.77%
Debt to Equity Ratio	60:40
D/V	0.6
E/V	0.4

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

The values of MD, ME, E/V and D/V are all detailed in the Market Rules and the IMO does not consider there any basis to change these parameters.

As was proposed and used in the Maximum Reserve Capacity Price for the 2007 Reserve Capacity Cycle, the IMO considers that the statement regarding the annualised capital cost calculation should read:

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

Where it currently reads:

ANNUALISED_CAPCOST[t] is the CAPCOST[t], expressed in Australian dollars in year t, annualised over a 15 year period, using a real pre-tax return to equity equal to the Commonwealth 10 Year Bond Rate (Real) plus a

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

The IMO has retained the Allen Consulting Group to review, the entire WACC calculation. However, the findings of this work support the above outcome. The work conducted by the Allen Consulting Group is outside the scope of this review and therefore cannot be used without further changes to the Market Rules. Such changes will be considered and progressed in due course.

APPENDIX E – CALCULATION OF THE 2008 MAXIMUM RESERVE CAPACITY PRICE

Item	Appendix Term	4 Value
Generator Price (US\$/MW)	GTP	180,000
Generator Price Scaling Factor		3.15804
US CPI (t-x)	USCPI	202.9
US CPI (t)	USCPI	214
Exchange Rate (A\$/US\$)	ER	1/0.8882
Margin for NOx (%)		5
$PC[t] = GTP[t-x] \times (USCPI[t]/USCPI[t-x]) \times ER[t,t-x] \times (1+NOx)$ $PC[t] = 180,000 \times 3.15804 \times (214.0/202.9) \times (1/0.8882) \times (1 + 0.05)$ <p>PC[t] = \$708,762</p>		
On-Cost Margin (%)	M	12.72
Capacity - nominal (MW)	CAP	160
Real Interest Rate on Debt (%)	D	4.17
Transmission Cost (A\$M)	TC	20.7073
Fixed Fuel Cost (A\$M)	FFC	2.6359
$CAPCOST[t] = (PC[t] \times (1+M) \times CAP \times (1 + 1.5D + 0.5D^2) + TC[t] + FFC[t]$ $CAPCOST[t] = 708,762 \times (1+0.1272) \times 160 \times (1 + 1.5 \times (0.0417) + 0.5 \times (0.0417)^2) + 20,707,300 + 2,635,900$ <p>CAPCOST[t] = \$159,276,503</p>		

Table continued over page.

Item	Appendix Term	4 Value
Loan Period		15
Margin For Debt (%)		1.5
Margin for Equity (%)		15.1
Debt Ratio (%)		60
WACC Pre-Tax Rate (%)		9.61
Annualised Capital Cost (A\$)	ANNUALISED _CAPCOST	\$20,476,662
Factor K	K	1.0529
Fixed O&M Cost(A\$/MW)	FIXED_O&M	13,669.00
Summer Derating Factor	SDF	1.18
$\text{PRICECAP}[t] = k \times (\text{FIXED_O\&M}[t] + \text{ANNUALISED_CAPCOST}[t] / (\text{CAP} / \text{SDF}))$ $\text{PRICECAP}[t] = 1.0529 \times (13,669 + 20,476,662 / (160 / 1.18))$ $\text{PRICECAP}[t] = \$173396.1861$ $\text{PRICECAP}[t]_{\text{Rounded}} = \$173,400.00 \text{ per MW per Year}$		
Max Reserve Capacity Price		\$173,400

APPENDIX F – COMPARISON BETWEEN 2007 AND 2008 MAXIMUM RESERVE CAPACITY PRICE

Item	Appendix Term	4 Reserve Capacity Year	
		2007	2008
Commonwealth 10 Year Bond Rate		2.41	2.67
Margin For Debt (%)		1.5	1.5
Margin for Equity (%)		15.1	15.1
US CPI (t-x)	USCPI	202.9	202.9
US CPI (t)	USCPI	211.7	214
US Inflation Rate (%)		4.34	5.47
Loan Period		15	15
Debt Ratio (%)		60	60
WACC Pre-Tax Rate (%)		9.35	9.61
Capacity - nominal (MW)	CAP	160	160
Summer Derating Factor	SDF	1.18	1.18
Generator Price (US\$/MW)	GTP	180,000	180,000
Generator Price Scaling Factor		2	3.15804
Exchange Rate (A\$/US\$)	ER	1.31113	1.12587
Add Margin for NOx (%)		5	5
On-Cost Margin (%)	M	15	12.72
Transmission Cost (A\$M)	TC	16.9088	20.7073
Fixed Fuel Cost (A\$M)	FFC	3.2435	2.6359
Fixed O&M Cost(A\$/MW)	FIXED_O&M	11,713.00	13,669.00
Capital Cost Power Station (A\$/MW)	PC	517,102	708,762
Total Capital Cost (A\$)	CAPCOST	\$120,952,306	\$159,276,503
Annualised Capital Cost (A\$)	ANNUALISED_CAPCOST	\$15,316,607	\$20,476,662
Factor K	K	1.0187	1.0529
Max Reserve Capacity Price		\$142,200	\$173,400