# Review of the Maximum Reserve Capacity Price 2012

- WP04331-OSR-RP-0001
- Rev 1
- 2 February 2012

# Review of the Maximum Reserve Capacity Price 2012

- WP04331-OSR-RP-0001
- Rev 1
- 2 February 2012

Sinclair Knight Merz
ABN 37 001 024 095
11th Floor, Durack Centre
263 Adelaide Terrace
PO Box H615
Perth WA 6001 Australia
Tel: +61 8 9469 4400
Fax: +61 8 9469 4488
Web: [www.skmconsulting.com](http://www.skmconsulting.com)

# Contents

# Document history and status

| Revision | Date issued | Reviewed by | Approved by | Date approved | Revision type |
|---|---|---|---|---|---|
| Rev A | 21-10-2011 | J McEnhill | | | Final Draft |
| Rev 0 | 8 -11 -2011 | J McEnhill | G Glazier | 9-11-2011 | Issue to Client |
| Rev 1 | 20-11-2011 | R Zauner | G Glazier | 22 -11-2011 | Incorporate Client Comments |
| Rev 2 | 2-2-2012 | | G Glazier | 2-2-2012 | Change 2013/2014 Escalation to 2.625% |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## Distribution of copies

| Revision | Copy no | Quantity | Issued to |
|---|---|---|---|
| Rev A | Electronic | | Final Internal Review |
| Rev 0 | Electronic | | IMO |
| Rev 1 | Electronic | | IMO |
| Rev 2 | Electronic | | IMO |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

| | |
|---|---|
| **Printed:** | 2 February 2012 |
| **Last saved:** | 2 February 2012 |
| **File name:** | D:\Documents and Settings\JMcEnhill\My Documents\(DRAFT) 2011 IMO MRCP Report - Power Station Elements_JSM Review & Mark-up 221011.docx |
| **Author:** | A McLennan / A Malla / R Zauner |
| **Project manager:** | Jaden Williamson |
| **Name of organisation:** | Independent Market Operator |
| **Name of project:** | Review of the Maximum Reserve Capacity Price 2012 |
| **Name of document:** | WP04331-OSR-RP-0001_2011 IMO MRCP Report |
| **Document version:** | Rev 1 |
| **Project number:** | WP04331 |

# 1. Introduction

As part of the establishment of the Wholesale Electricity Market (WEM) within the South West Interconnected System (SWIS), the Government of Western Australia (WA) set up the Independent Market Operator (IMO) to administer and operate the market.

The Market Rules require the IMO to conduct a review of the Maximum Reserve Capacity Price (MRCP) each year. As part of this process Sinclair Knight Merz (SKM) has been commissioned to determine the following for the year 2012:

- Capital cost (procurement, installation and commissioning, excluding land cost) of a generic single unit, industry standard, liquid fuelled, 160 MW Open Cycle Gas Turbine (OCGT) power station.
- Fixed Operation and Maintenance (O&M) costs of the above facility with capacity factor of 2 per cent. The costs shall be in 5 year periods covering 1 to 30 years.
- Fixed O&M costs of the connection assets consisting of a generic 330 kV three breaker mesh switchyard configured in a breaker and a half arrangement, that facilitates the connection of a 160 MW OCGT power station to an existing transmission line. Fixed O&M costs of a 2 km, 330 kV overhead single circuit steel lattice tower transmission line that connects the power station and the connection switchyard, whereby the switchyard is located in the vicinity of an existing 330 kV transmission line. Note: insurance expenses are excluded from the above estimates of the fixed O&M costs.
- Owner's costs such as legal, approval, environmental and financing costs associated with the term 'M' used in the WEM Rules.

This report should be read in conjunction with the scope of work agreed between the IMO and SKM which explains the approach of this report in detail and is attached in Appendix A.

In addressing this scope of work, this report combines elements of the "Non Power Station Elements" and "Power Station Elements" reports provided by SKM in previous years with the exclusion of capital cost estimates for the cost of connection assets.

# 2. Generation plant capital cost

Consistent with the Scope of Works detailed in Appendix A, SKM has estimated the capital cost (engineering, procurement, installation and commissioning, excluding land cost) of a generic single unit liquid fuel E-class Open Cycle Gas Turbine (OCGT) power station with inlet air cooling (where effective) and capable of operating on liquid fuel but excluding liquid fuel storage. The capital cost estimate includes all components and costs associated with a complete gas turbine project.

SKM note the following changes in the scope of this report from the scope of the "Review of the Maximum Reserve Capacity Price 2010 – Power Station Elements" report.

- Introduction of inlet air cooling technology.
- Clarification of the plant capacity factor, durations of operation to be met by water and the requirement for $NO_X$ control[1].

## 2.1. Methodology

In order to establish the capital costs for a generic single unit 160 MW OCGT plant, SKM undertook the following steps:

- A Siemens SGT5-2000E with a net nameplate (ISO) rating of 165 MW was selected as the reference machine for the study.
- Developed a capital cost estimate using Thermoflow GT Pro®/PEACE® for the reference machine with liquid fuel burners, water injection for $NO_X$ emission control, evaporative inlet air cooling. The evaporative inlet air cooling has been introduced in this review to meet the requirement for "inlet air cooling where effective" detailed in Appendix A. The evaporative air cooling technology was selected as the most effective inlet cooling technology based on previous analysis undertaken for the IMO[2] and is consistent with SKM's understanding of the technologies commonly adopted for installations in the South West of Western Australia.
- Benchmarked the major equipment costs against Original Equipment Manufacturer (OEM) project costs.
- Benchmarked total man-hours against actual data for an E-class OCGT plant.
- Benchmarked labour rates against actual data from recent projects in south west WA.

---

[1] In previous reports SKM have included the infrastructure for $NO_X$ control as the scope was silent on this requirement.
[2] Analysis can be found at http://www.imowa.com.au/f2179,1630289/WP04268-RPT-ME-001-A_1_Capacity_Augmentation_on_MRCP_Rev1.pdf

- Comparison to normalised existing project data on recent similarly sized plant developments.
- Provide the likely net maximum output for the reference machine at 41°C with evaporative cooling, likely humidity conditions and any other relevant factors using GT Pro®/PEACE®.

The SKM study is based on liquid fuel (distillate) being supplied and stored, fully in accordance with the gas turbine manufacturer's specification requirements, and used as the sole fuel source for the operation of the plant. Other potential liquid fuels or the provision of fuel treatment or conditioning facilities have not been considered in the development of any capital or operating cost estimates presented in this study. The cost of the infrastructure to achieve the above is not included in this study.

In developing the matrix of costs, SKM has utilised:

- Knowledge and experience of generation project development.
- Database for power station capital and operating costs.
- Knowledge of the impact of the flow through of commodity price increases, labour costs, etc., on generation station capital costs and hence appropriate escalation indices.
- Knowledge and experience in generation project costing, including typical allowances for Owner's costs.

In developing the cost estimates, SKM has assumed a standard green field site located in Western Power's SWIS region having no special geological, environmental, permitting or consenting peculiarities. In particular it has been assumed that there are no unusual requirements for ground preparation, such as piling or land remediation.

SKM issued enquiries to main equipment OEM's requesting the submission of current budgetary pricing quotations, for OCGT equipment in the 160 MW capacity range. No responses were received from these suppliers at the time of completing the report. The project costs are therefore substantially based on historical project information and the output of the Thermoflow cost modelling.

## 2.2. Project data price review / market review

In developing the end cost estimate, SKM also utilised information garnered from a number of projects that it has been involved with over the past several years, plus recent completed studies. The major portion of such reference cost information was derived from projects that have been completed and are in commercial operation.

The reference project data has then been further revised to take out non-generic project costs to produce a table of 'normalised' project data costing comparable to that obtained from the Thermoflow GT Pro®/PEACE® cost estimate.

SINCLAIR KNIGHT MERZ
SKM

A large portion of the main equipment for an OCGT plant project comes from overseas, and so changes in foreign exchange rates can have a significant effect on the total estimated capital cost. Recent exchange rates were used to adjust the major equipment costs from OEMs and Thermoflow GT Pro®/PEACE® (cost estimates at an exchange rates of AUD1.36 = Euro1.00, AUD1.00 = USD1.00 and AUD1.11 = CHF1.00, October 2011).

## 2.3. Development of the generic OCGT capital cost estimate

The capital cost estimates has been based on a single dual fuel (natural gas and distillate fuel oil) generating unit. The capital costs exclude the distillate fuel storage and unloading systems. Demineralised water treatment plant, a 1,200 tonne demineralised water storage tank (equivalent to 1,000 tonne of distillate use at a water-to-fuel mass ratio of 1.2:1), and storage for 240 tonne of potable water storage plus 1 hour of fire control are included in the capital costs.

The cost estimate has been based on dual fuel (natural gas and distillate) operation for gas turbines fitted with Dry Low Emissions (DLE) combustion technology. $NO_X$ emissions would typically be in the range of 25 ppmv dry at 15% $O_2$ reference conditions when firing natural gas and 42 ppmv dry at 15% $O_2$ when operating on distillate fuel oil with water injection. The generic cost estimates assume that water injection for $NO_X$ emissions abatement will be required for liquid fuel operation and that on site water treatment and storage facilities will be included. Low $NO_X$ burners are included in the capital cost estimate.

In addressing any need for water injection requirements, the potential source of the water, the treatment and conditioning of the water to achieve the demineralised quality required for any water injection systems, the on-site storage capacity requirements of such water and the disposal and treatment of effluent from any treatment system have been taken into consideration. However, these assumptions are based on sufficient[3] potable or similar quality water supplies being available local to the facility either through pipe or tanker delivery. The requirements for extensive or complex water abstraction or treatment facilities have not been considered.

## 2.4. OCGT capital cost estimate

A breakdown of the capital cost estimate for a 160 MW generic single OCGT plant is given in Table 2-1 below. The estimate represents a generic cost for an OCGT plant constructed on an EPC basis. Owner’s costs additional to the EPC Contract have been excluded, and are accounted for in the calculation of the term “M” in Section 6.

---

[3] Sufficient quality is defined as potable water capable of operating in the evaporative cooler at 2-3 cycles of concentration.

The total capital cost estimate was calculated as **A$126,431,000** which equates to **A$792/kW**.[4]

▪ **Table 2-1 Generic 160 MW OCGT Capital Cost Estimate**

| Item | Cost [$] |
|---|---|
| Main Plant Equipment | 69,512,000 |
| Balance of Plant | 3,212,000 |
| Civil Works | 13,134,000 |
| Mechanical Works (including installation) | 13,215,000 |
| Electrical Works (including installation) | 2,771,000 |
| Buildings | 2,439,000 |
| Engineering & Plant Start-up | 3,588,000 |
| Contractor's Costs | 18,560,000 |
| Total EPC Cost | 126,431,000 |

All costs are presented as mean values and are in June 2011 dollars.

SKM note that the cost of the cost of the main plant and equipment has reduced by approximately A$10 million dollars from that provided in the "2010 Review of the Maximum Reserve Capacity Price 2010 – Power Station Elements" report whilst the cost of installation has increased. The decrease in the plant and equipment is a result of SKM reducing the weighting of historic project data (as it ages) and increasing weighting on recent market data[5] for E class OCGTs. This change in weighting has combined with increased competition globally for the supply of E Class OCGT's to yield a materially lower plant and equipment estimate.

The increase in local costs is reflective of the continuing tight market for construction labour and plant in Western Australia.

[4] Based on 159.6 MW net output defined in section 2.5.
[5] The main source of this recent market data is the cost databases within GT Pro®

## 2.5. Likely Output at Required Conditions

The output of the reference OCGT, with evaporative type combustion air inlet cooling and water injection for emissions abatement purposes, at 41°C, 30% relative humidity and typical atmospheric air pressure conditions is detailed in the table below.

- **Table 2-2 Generic 160 MW OCGT parameters**

| Parameter | Units | Value |
|---|---|---|
| GT Model | | Siemens SGT5-2000E |
| Configuration | | Open cycle |
| Fuel | | Distillate |
| Evaporative inlet air cooling effectiveness | [%] | 85 |
| Water injection ratio | [$M_w/M_f$] | 1.2 |
| Site altitude | [m] | 25 |
| Temperature | [$^oC$] | 41 |
| Relative Humidity | [%] | 30 |
| Gross output | [MW] | 162.0 |
| Net output | [MW] | 159.6 |

# 3. Generation fixed operation & maintenance costs

## 3.1. Assumptions and exclusions

An OCGT plant based on a single gas turbine capable of delivering a nominal 160 MW output operating on distillate fuel oil has been evaluated for a 30 year operating life.

SKM has developed an estimate for fixed O&M costs for the peaking power plant based on a 2% capacity factor, expected to operate infrequently solely on distillate fuel oil. Gas connection costs are therefore not considered in this estimate. Connection switchyard and overhead transmission line fixed O&M are covered separately in Section 4 of the report.

In accordance with the September 2009 report[6] for the IMO, prepared by MMA in conjunction with SKM, the cost of scheduled maintenance overhauls based on number of starts and number of operating hours has been considered as a variable O&M cost, and is not included in this estimate. An allowance for regular balance of plant upkeep and maintenance has been included.

A generation utility Owner's annual revenue entitlements will include a component for the depreciation of their assets. Depreciation relates to capital costs, distributing the loss in value of the assets over the lifetime of the plant. It is not a part of the ongoing costs to operate and maintain the assets, and as such it has not been considered in this estimate or in previous estimates.

## 3.2. Generation operation & maintenance costs

The fixed O&M cost elements shown below in Table 3-1 have been developed from cost data derived from a range of sources including an amalgam of data from current and recent similar OCGT projects. The addition of evaporative inlet air cooling and associated raw water storage has negligible impact on the fixed balance of plant maintenance costs. As previous studies have included water treatment systems for $NO_x$ control there has not been a material change in the basis of the O&M costs from the 2010 study

- **Table 3-1 OCGT Plant Fixed O&M Costs**

| O&M Cost Component | [$M pa] |
|---|---:|
| Plant operator labour | 0.516 |
| OCGT Substation (connection to tie line) | 0.244 |
| Rates | 0.059 |

[6] *MMA September 2009, 'Energy Price Limits for the Wholesale Electricity Market in Western Australia from October 2009', Available on the IMO website.*

| O&M Cost Component | [$M pa] |
|---|---|
| Market Fee | 0.059 |
| Balance of plant | 0.128 |
| Consent (EPA annual charges emissions tests) | 0.031 |
| Legal | 0.027 |
| Corporate Overhead | 0.225 |
| Travel | 0.026 |
| Subcontractors | 0.339 |
| Engineering Support | 0.069 |
| Security | 0.124 |
| Electrical (Including Control & Instrumentation) | 0.123 |
| Fire | 0.061 |
| **Total** | **2.030** |

These costs have been escalated, where appropriate, to June 2011 dollar terms.

Five yearly aggregate fixed OCGT O&M costs are provided in Table 3-2 for each five year period of the 30 year operating life.

- **Table 3-2 Fixed OCGT Plant O&M Costs (June 2011 Dollars)**

| Five Yearly Intervals | 1 to 5 | 6 to 10 | 11 to 15 | 16-20 | 21-25 | 26-30 | 1 to 30 |
|---|---|---|---|---|---|---|---|
| Fixed O&M Costs (A$) | 10,149,314 | 10,149,314 | 10,149,314 | 10,149,314 | 10,149,314 | 10,149,314 | 60,895,882 |

All costs are presented as mean values..

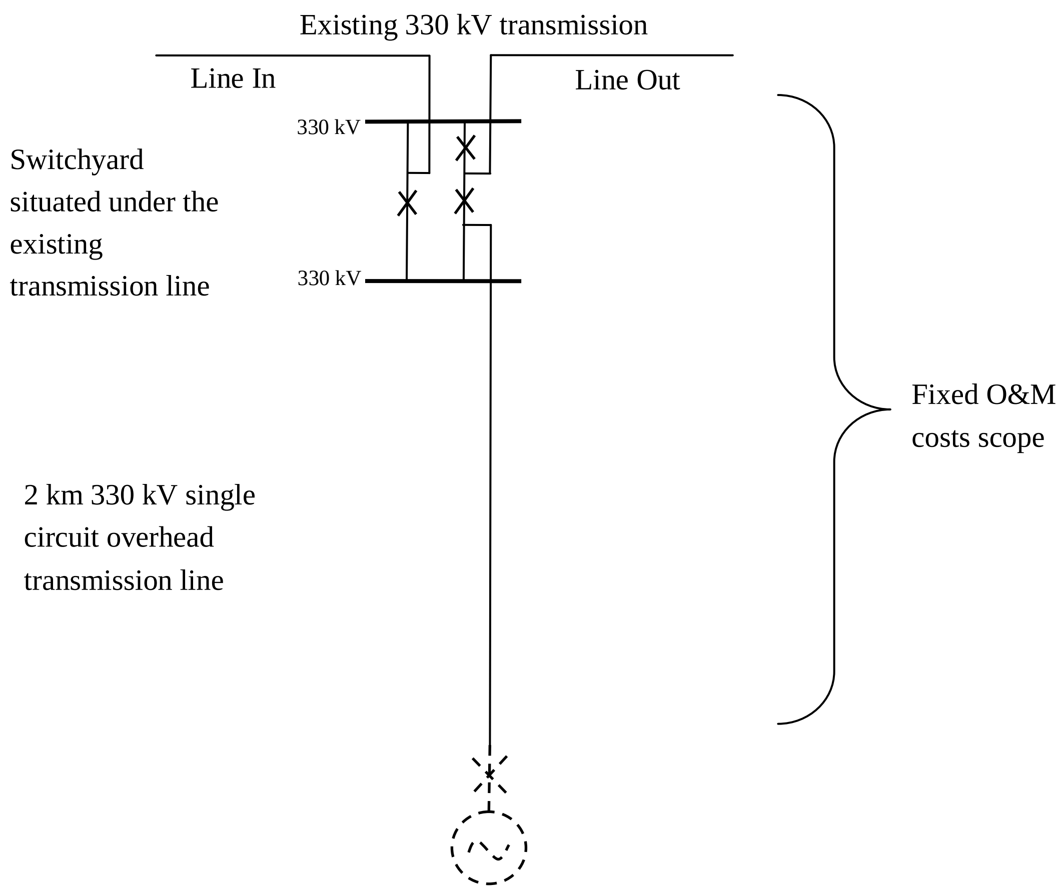
# 4. Connection switchyard and overhead transmission line fixed operation and maintenance costs

## 4.1. General

The connection switchyard fixed O&M costs have been based on the arrangement shown in Figure 4-1.

The fixed O&M costs for this section have been calculated from the isolator on the high voltage side of the generator transformer and therefore do not include any of the costs associated with the generator transformer and switchgear.

▪ **Figure 4-1 Overall connection arrangement.**



The new transmission line is assumed to be a single circuit 330 kV construction with 2 conductors per phase. The rating of the line has been selected to facilitate the transport of up to 200 MVA (at a power factor of 0.8, a 160 MW OCGT can export up to 200 MVA).

## 4.2. General issues and assumptions

SKM has developed the fixed operation and maintenance costs for the network connection on an asset class basis. Therefore a bottom-up approach has been used to estimate the fixed O&M cost of switchyard and transmission line assets based on recent data from several Australian Transmission Network Service Providers (TNSPs). It is noted that these O&M estimates are based on the assumption that the assets represent an incremental addition to a large asset base.

Maintenance cost for an asset is incurred periodically according to its maintenance routines. Since this routine is different for different asset classes, SKM has smoothed these periodic costs evenly over the life of the switchyard and transmission line. The annualised fixed O&M cost estimate allows for the following:

- Cost of labour for routine maintenance.
- Cost of machine/miscellaneous items for routine maintenance.
- Overheads (management, administration, operation etc).

The annualised fixed O&M cost estimates for the switchyard and the transmission line are reported in Section 4.3 and Section 4.4 respectively.

The annualised fixed O&M cost does not allow for defect or asset replacement during the lifetime of the assets. It should be noted that annual insurance costs and tax have been omitted from the annualised fixed O&M costs as these cost components will be dependent on the ownership arrangement and beyond the scope agreed between IMO and SKM.

Depreciation is a separate individual component that forms a part of a regulated utility's annual revenue entitlement. Unlike O&M costs, depreciation relates to the capital cost of the assets. It is an accounting method that allocates the capital cost of the assets over the series of accounting periods to gradually write-off the value of the installed assets from the accounting book. Depreciation is not a part of an asset's ongoing cost to maintain and operate it and thus is different from O&M costs. Therefore, it is not included in the fixed O&M costs estimation.

## 4.3. Switchyard annualised fixed operational & maintenance costs

SKM has assumed that the average life of the 330 kV switchyard assets is 50 years. Table 4-1 shows the cumulative annualised fixed O&M costs presented in 5 yearly periods over the lifetime of the switchyard assets. The annualised fixed O&M cost over the asset lifetime for the switchyard is $57,000 pa in 2011 dollar term.

▪ **Table 4-1 Annualised fixed O&M costs for Switchyard Assets.**

| Period | Cumulative Annualised Fixed Switchyard O&M Costs (A$, 2011) |
|---|---|
| 1 to 5 years | $ 285,000 |
| 6 to 10 years | $ 285,000 |
| 11 to 15 years | $ 285,000 |
| 16 to 20 years | $ 285,000 |
| 21 to 25 years | $ 285,000 |
| 26 to 30 years | $ 285,000 |
| 31 to 35 years | $ 285,000 |
| 36 to 40 years | $ 285,000 |
| 41 to 45 years | $ 285,000 |
| 46 to 50 years | $ 285,000 |

## 4.4. Transmission line annualised fixed operational & maintenance costs

SKM has assumed that the average life of the 330 kV transmission line is 60 years. Table 4-2 shows the cumulative annualised fixed operation and maintenance costs presented in 5 yearly periods over the lifetime of the transmission line assets. The annualised fixed O&M cost over the asset lifetime for the transmission line is $1,100 pa in 2011 dollar term.

▪ **Table 4-2 Annualised Fixed O&M costs for Transmission Line Assets**

| Period | Cumulative Annualised Fixed Transmission Line O&M Costs (A$, 2011) |
|---|---|
| 1 to 5 years | $ 5,500 |
| 6 to 10 years | $ 5,500 |
| 11 to 15 years | $ 5,500 |
| 16 to 20 years | $ 5,500 |
| 21 to 25 years | $ 5,500 |
| 26 to 30 years | $ 5,500 |
| 31 to 35 years | $ 5,500 |
| 36 to 40 years | $ 5,500 |
| 41 to 45 years | $ 5,500 |
| 46 to 50 years | $ 5,500 |

# 5. Cost escalation forecast

## 5.1. 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.

SKM's Capex Cost Escalation Model has been used extensively in developing cost escalation indices for a number of Transmission and Distribution Network Service Providers throughout Australia. The SKM cost escalation methodology has also been accepted by the AER in revenue proposals submitted by these utilities.

The Model draws upon a number of SKM strategic procurement studies between 2006 and 2010 which surveyed the equipment capital costs of a broad range of NSPs throughout Australia. Procurement specialists and equipment suppliers/manufactures were also brought into the process to ascertain the weighting of underlying cost drivers that influenced the final cost of each plant and equipment item. These cost drivers were identified through the projects undertaken by the utilities.

Historical and forecast movements of these underlying cost drivers, from various sources as listed in following Table 5-1 are then used to populate the Model. This allows for suitable escalation indices that are specific for the electricity utility industry to be developed. These cost drivers are periodically updated in the Model.

- **Table 5-1 Annualised Fixed O&M costs for Transmission Line Assets**

| Cost Drivers | Used For | Source |
|---|---|---|
| Aluminium, Copper, Iron Ore, Oil, Steel | Equipment, P&C, Misc Materials, Structure, Conductor, | ABARE, IMF, LME, World Bank, Wachovia, Brent, CRUspi, Consensus Economic Energy & Metal Monitor |
| CPI, General labour, Utility Labour, Civil Works | Installation, Erection, Commissioning, Foundation, Civil, Structure, Fittings, Labour, Insulators | ABS, SKM, Treasury, RBA, The Construction Forecasting Council, Econtech Labour Cost Forecasts |
| Site (EGW) Labour | Installation, Erection, Commissioning, Survey, Clearing & Access | Econtech Cost Forecasts |

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

## 5.2. 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.

## 5.3. Individual escalation driver forecasts

### 5.3.1. General

Table 5-2 identifies the forecast nominal escalation rate to June of next 5 years for each driver.

- **Table 5-2 Individual nominal escalation rate forecast year to June for next 5 years**

| | CPI | EGW Labour | WA Labour | Copper | Steel | Cement Const. |
|---|---|---|---|---|---|---|
| 2012 Nominal | 2.00% | 4.38% | 4.17% | -2.17% | 9.70% | 2.07% |
| 2013 Nominal | 3.25% | 4.38% | 4.17% | -1.67% | -0.05% | 0.96% |
| 2014 Nominal | 2.50% | 4.38% | 4.17% | -0.86% | 0.18% | 1.89% |
| 2015 Nominal | 2.50% | 4.38% | 4.17% | -4.17% | -2.76% | 2.31% |
| 2016 Nominal | 2.50% | 4.38% | 4.17% | -4.81% | -2.81% | 2.85% |

Commentary on the methodology for developing each of the individual driver escalation rates are in the following sections.

### 5.3.2. CPI

SKM applies a method of forecasting the position of CPI as accepted by the Australian Energy Regulator (AER) in several recent Final Decision for Distribution Utilities, including the NSW, Queensland and Victorian distribution businesses.

This method adopts the following process:

- Use two years of forecasts from the most recent Reserve Bank of Australia (RBA) Monetary Policy Statement – (the November 2011 Monetary Policy Statement, Economic Outlook, Inflation, Table 6.1 forecasts were used).

- Thereafter extrapolate CPI as the RBA and the Treasury inflation target's midpoint of 2.50 per cent.

The CPI figures used in SKM forecast modeling are presented in Table 5-3

**Table 5-3 Forecast CPI Figures**

| Year to June | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|
| CPI Forecast | 3.60% | 2.00% | 3.25% | 2.625% | 2.50% | 2.50% | 2.50% | 2.50% |

### 5.3.3. EGW Labour

This labour component of cost escalation captures the change in the cost of labour for Electricity Gas and Water (EGW) or Utilities sector technicians. As this workforce has been in high demand and seen greater than average wage rates in recent times, SKM deemed it necessary to separate these costs from General Labour.

SKM used Australian Bureau of Statistics (ABS) data to develop this cost escalation component, specifically the ABS 6345.0 Labour Price Index, i.e. Series ID A2705170J – 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.

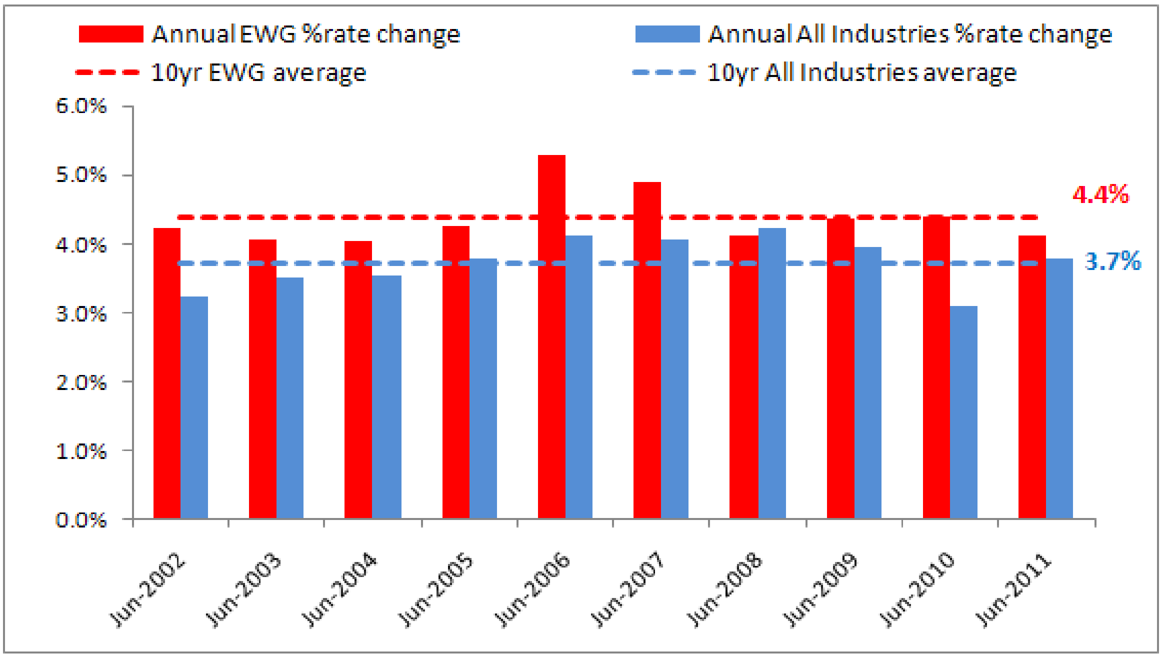
Table 5-4 and Figure 5-1 provide further details of the background data.

**Table 5-4 Annual change in EGW LPI**

| Year To: | EGW Index | Annual Change |
|---|---|---|
| Jun-2001 | 70.8 | |
| 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 |
| Jun-2011 | 108.7 | 1.041 |
| **10 Year Average** | | **1.044** |

SINCLAIR KNIGHT MERZ
SKM

- **Figure 5-1 EGW annual %rate change compared to all industries**




### 5.3.4. 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, i.e. Series ID. A2705992V – 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.

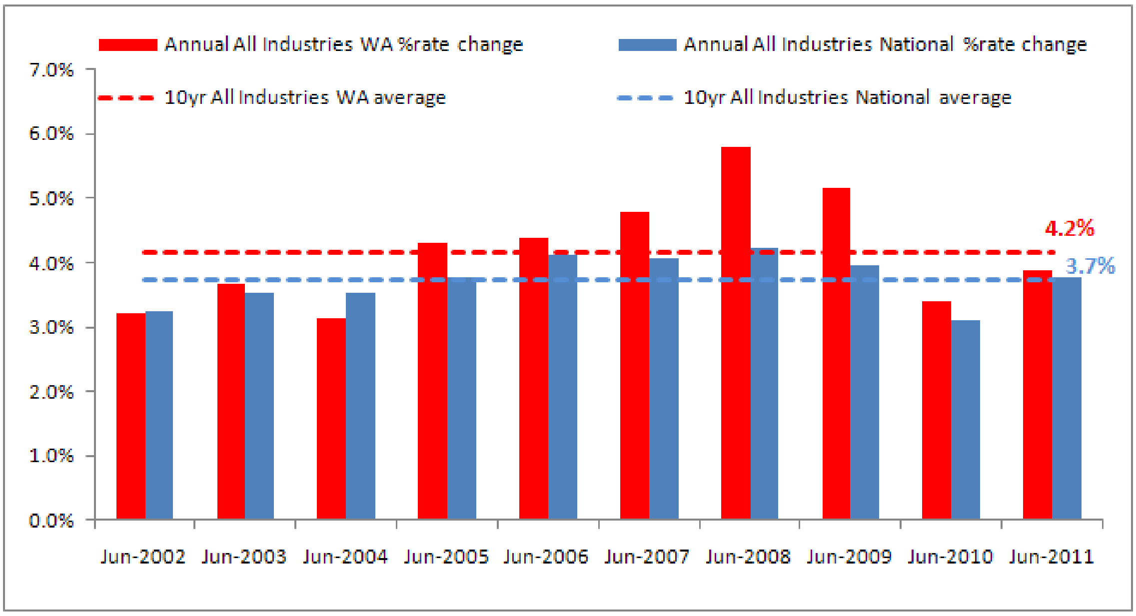
Table 5-5 and Figure 5-2 provide further details regarding the background data.

- **Table 5-5 Annual change in WA LPI**

| Year To: | WA LPI | Annual Change |
|---|---|---|
| Jun-2001 | 71.4 | |
| 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 |

| Year To: | WA LPI | Annual Change |
|---|---|---|
| Jun-2008 | 95.1 | 1.058 |
| Jun-2009 | 100.0 | 1.052 |
| Jun-2010 | 103.4 | 1.034 |
| Jun-2011 | 107.4 | 1.039 |
| **10 Year Average** | | **1.042** |

**Figure 5-2 WA annual %rate change compared to national**




### 5.3.5. Australian to US dollar exchange

As internationally traded commodities used in SKM's forecasts, such as copper, oil and steel, are traded in nominal US dollars (USD), the Australian dollar's (AUD's) relative position to the USD will, in itself, influence the cost of finished goods to an Australian Utility. Where economic forecasts are presented in real terms these are converted to nominal USD using US CPI forecasts.

As a final step after determining forecast USD prices for each globally traded commodity, SKM converts the underlying commodity cost to AUD.

For this study, SKM has assumed the AUD/USD exchange rate to remain approximately at parity (i.e. at current levels) over the required forecast horizon. This assumption is consistent with the RBA view[7], a recent poll result of 50 major international banks conducted by Reuters[8], HSBC

[7] RBA August 2011 Monetary Policy Statement, Economic Outlook, Domestic Activity, Page 72

Global Research Macro Global Economics Q4 2011 report, and the Exchange Rate Forecast published in 10th October 2011 by NAB Research.

### 5.3.6. Copper

When developing forecasts for the future annual market price position of the various materials' key cost drivers, SKM's methodology places greater weight on credible market prices than pure economic forecasts. SKM uses market forward prices as far as these are available in the future, and then a linear interpolation to future economic and other credible market forecasts beyond the time horizon covered by futures markets.

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 uses a five 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. SKM's Cost Escalation Model has a resolution of one month, and all prices are determined monthly, with annual averages used to smooth volatility from month to month.

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 five steps involved are:

1) Determine the average of the most recent month of London Metal Exchange (LME) copper prices/tonne.
2) Determine the average 3, 15 and 27 months LME contract prices for the most recent month.

---

[8] Reuters FX Polls for AUD/USD FX Spot Rate for 12 months tenor, updated 14th Oct 2011.

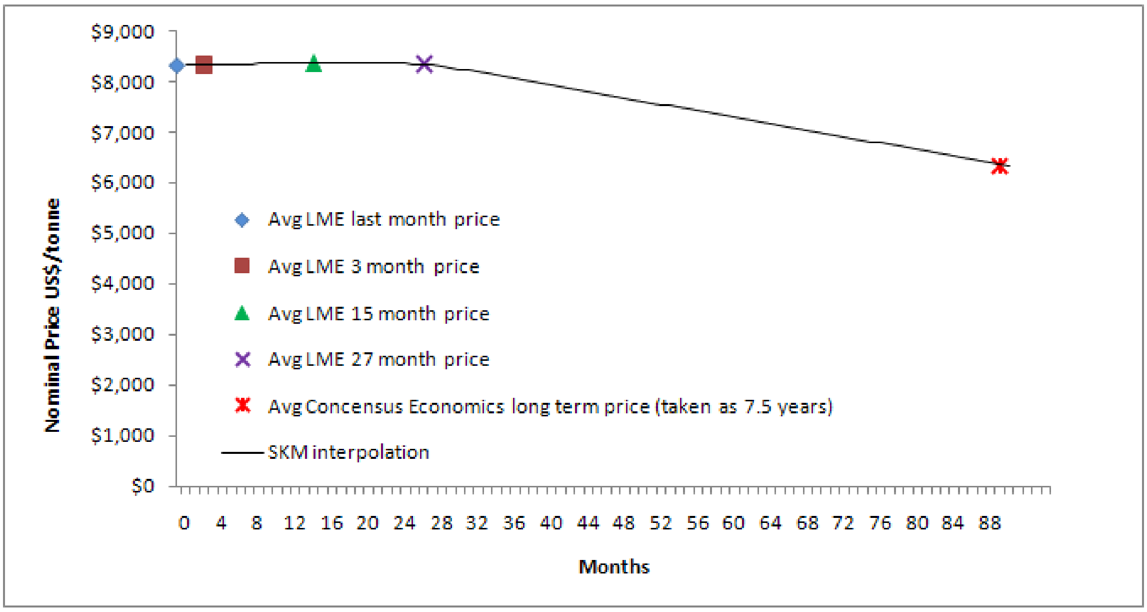
3) Determine the most recent Consensus Long-Term Forecasts position (taken as 7.5 years from survey date[9]).
4) Apply linear interpolation between each of the data points above.
5) Identify the June points for the relevant years in the interpolated results, and calculate annual year to June prices as the underlying commodity cost movement to be used in the equipment escalation model.

This methodology is illustrated in Figure 5-3 and Figure 5-4.

**Figure 5-3 Diagram of SKM methodology for Cu forecast price (Steps 1-3)**


[9] The Consensus Long-term forecast is listed in the publication as a 5 – 10 year position. As a reasonable assumption, SKM consider the position to refer to the mid-point of this range, being 7.5 years, or 90 months. The long term (real) forecast is adjusted for US CPI to determine a long term (nominal) price. Market prices are by definition nominal.

▪ **Figure 5-4 Diagram of SKM methodology for Cu forecast price (Steps 4-5)**




The average year to June input numbers used during SKM's escalation modelling of the copper market prices are presented in Table 5-6.

▪ **Table 5-6 Forecast average annual copper price (A$/tonne nominal)**

| | Jun-10 | Jun-11 | Jun-12 | Jun-13 | Jun-14 | Jun-15 | Jun-16 | Jun-17 | Jun-18 |
|---|---|---|---|---|---|---|---|---|---|
| Cu Price | $6,691 | $8,690 | $8,502 | $8,360 | $8,288 | $7,942 | $7,560 | $7,178 | $6,795 |
| Annual Change | | 29.88% | -2.17% | -1.67% | -0.86% | -4.17% | -4.81% | -5.06% | -5.33% |

### 5.3.7. Steel

SKM's methodology used for developing forward market positions for copper and aluminium is presently not considered suitable for steel, due to the lack of a clear benchmark steel futures market. SKM note that the LME commenced trading in steel billet futures in February 2008 and the available future contract prices are applicable only for delivery to Dubai and Turkey[10]. While the steel billet is a semi-finished product, its price movement has a strong correlation with the end product like steel reinforcement bar (used for construction), and therefore its forecast or future price trend can be used to calculate the escalation rate for steel[11]. However, one of the limitations for using the LME forecast prices for steel billet is the unavailability of a longer term trend (prices available up to 15 months only).

[10] http://www.lme.co.uk/5723.asp
[11] http://www.lme.com/steel-faqs.asp

Due to the above stated reasons, SKM has used the Consensus Economics forecast as the best currently available outlook for steel prices. Consensus Economics provides quarterly forecast prices in the short term, and a "long term" (5-10 year) price.

SKM has used the July 2011 Consensus Economics survey report to compile the steel escalation information provided in this report. This publication provided quarterly forecast market prices for steel from September 2011 to December 2013, as well as a long-term forecast pricing position i.e. annual average of 2014, 2015, 2016, and 5–10 year position which is taken as 7.5 years (90 months) from survey date.

Consensus Economics provides two separate forecasts for Steel, using Hot Rolled Coil (HRC) steel prices in the USA domestic market and the other the European domestic market. The Consensus Economics US HRC price forecasts are presented in US$ per *Short Ton,* which SKM converts into metric tonnes for consistency with the European price.

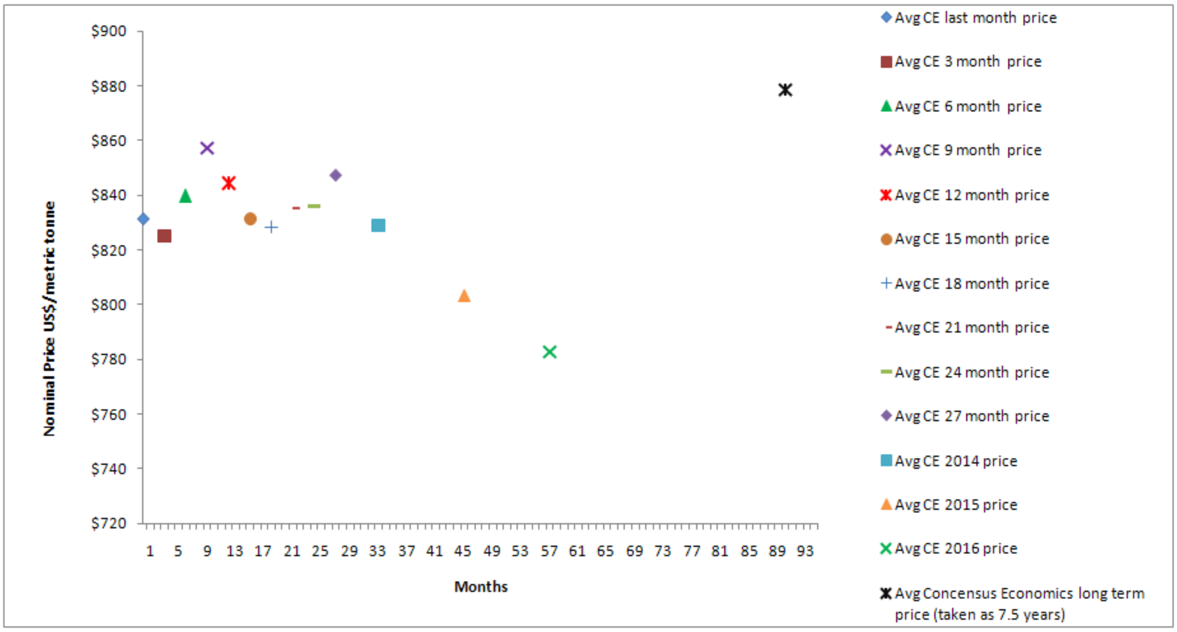
SKM's methodology uses a five step approach to produce specific data points between which a simple method of interpolation is able to be applied, in order to fill in any missing data points and arrive at the required pricing positions.

Because of the volatility in daily spot and futures markets, SKM uses the monthly average of these two forecasts (US HRC and EU HRC) as its steel price inputs to the cost escalation modelling process. 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 five steps involved are:

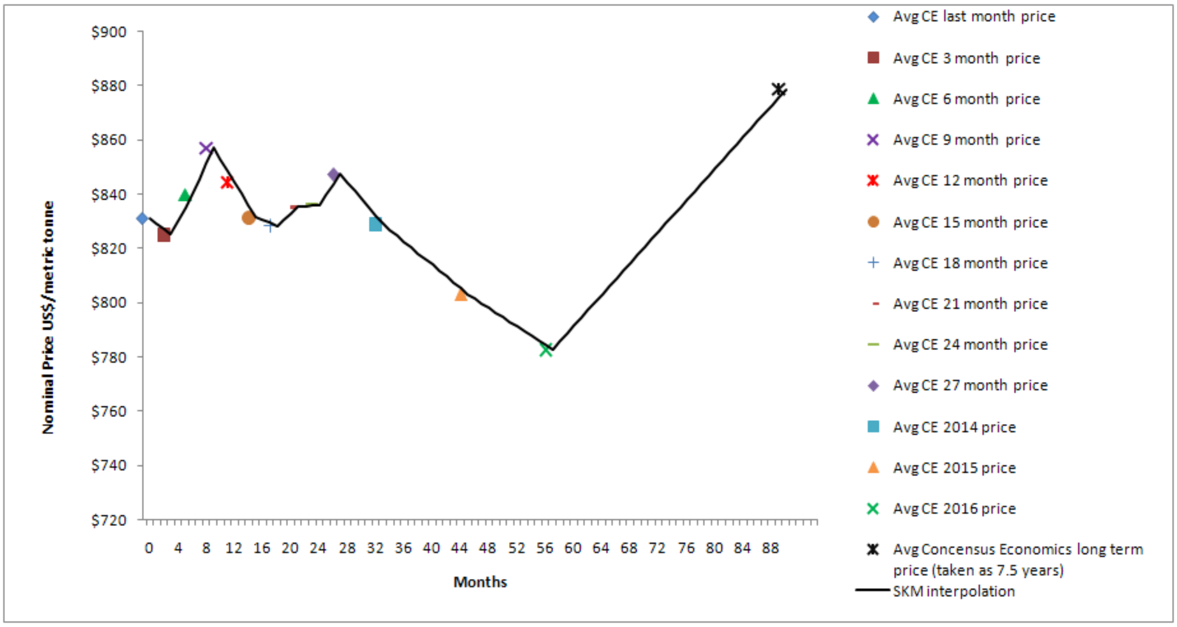
1) Determine the average of the most recent month USA and European Consensus Economics survey average HRC steel price/ metric tonne.
2) Determine the average of the most recent USA and European 3, 6, 9, 12, 15, 18, 21, 24 and 27 months Consensus Economics survey average HRC steel price/ metric tonne.
3) Determine the average of the most recent USA and European Consensus Economics survey of Long-Term Forecasts positions average HRC steel price/ metric tonne.
4) Apply linear interpolation between each of the above data points.
5) Identify the June data points for the relevant years in the interpolated results, and calculate annual year to June average points from these June points, and feed these prices into the model.

This methodology is illustrated in Figure 5-5 and Figure 5-6.

- **Figure 5-5 Diagram of SKM methodology for steel forecast price (Steps 1-3)**




- **Figure 5-6 Diagram of SKM methodology for steel forecast Price (Steps 4-5)**




The average year to June input numbers used during SKM's esalation modelling of the steel market prices are presented in Table 5-7.

**Table 5-7 Forecasted average annual steel price (A$/metric tonne nominal)**

| | Jun-10 | Jun-11 | Jun-12 | Jun-13 | Jun-14 | Jun-15 | Jun-16 | Jun-17 | Jun-18 |
|---|---|---|---|---|---|---|---|---|---|
| Steel Price | $624 | $763 | $837 | $837 | $838 | $815 | $792 | $802 | $836 |
| Annual Change | | 22.24% | 9.70% | -0.05% | 0.18% | -2.76% | -2.81% | 1.20% | 4.35% |

### 5.3.8. Cement–Construction

The Australian Construction Industry Forum (ACIF)[12] is the peak consultative organisation of the building and construction sectors in Australia. The ACIF has established the Construction Forecasting Council (CFC)[13] through which it provides a tool kit of analysis and information. SKM referred to a range of forecast trends generated by the CFC as a proxy for the future movement in the price of cement and/or engineering type construction work in the WA market.

In commenting on activity in construction related to the electricity and pipeline industry, the CFC in its September 2011 publication notes the following:

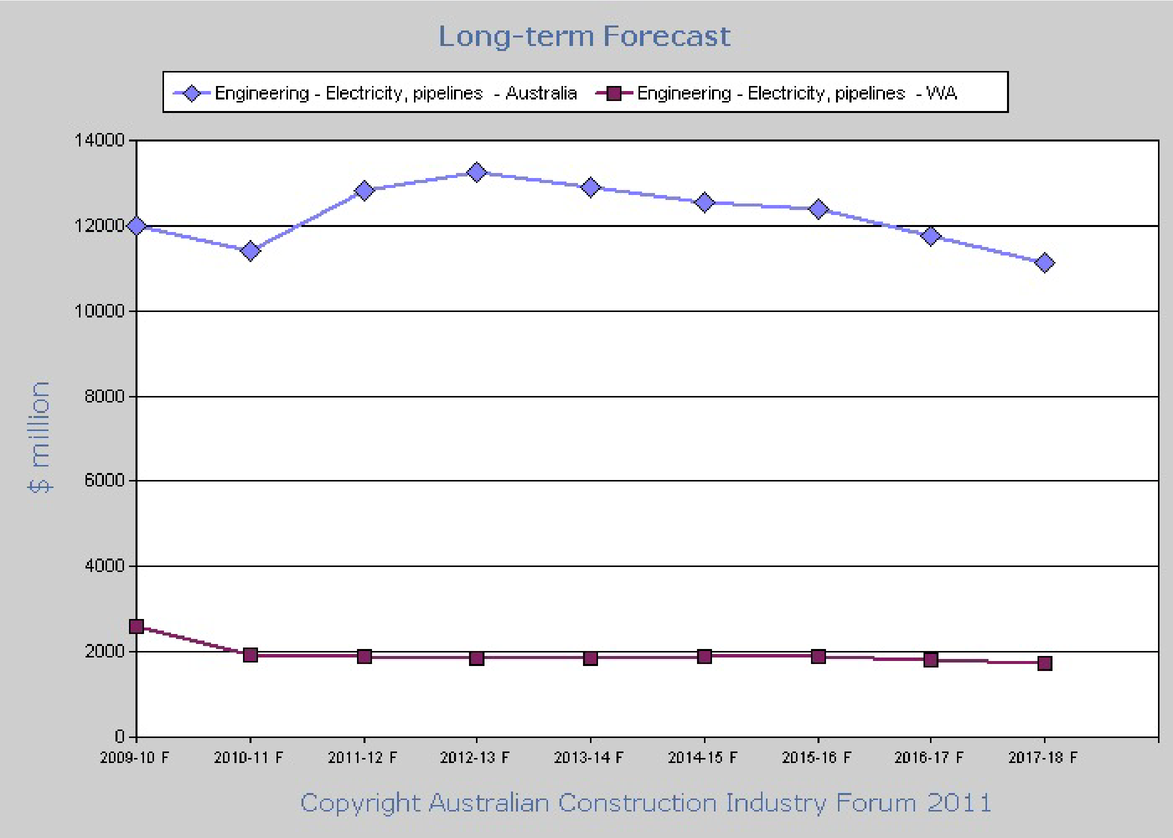
> *"Electricity and pipeline construction activity reached a very high $12 billion in 2008/09 and 2009/10, due to the start of several new renewable energy projects such as wind farms. Electricity and pipeline construction should be sustained at a high level over the medium term, reflecting gas pipeline construction associated with major LNG developments in Queensland and West Australia"*[14].

This statement is illustrated in Figure 5-7 which shows forecast trends for both overall Australia and WA.

---

[12] http://www.acif.com.au/
[13] http://www.cfc.acif.com.au/cfcinfo.asp
[14] http://www.acif.com.au/forecasts/summary/highlights-for-engineering-construction

▪ **Figure 5-7 Engineering (electricity & pipeline) construction volume in Australia and WA**



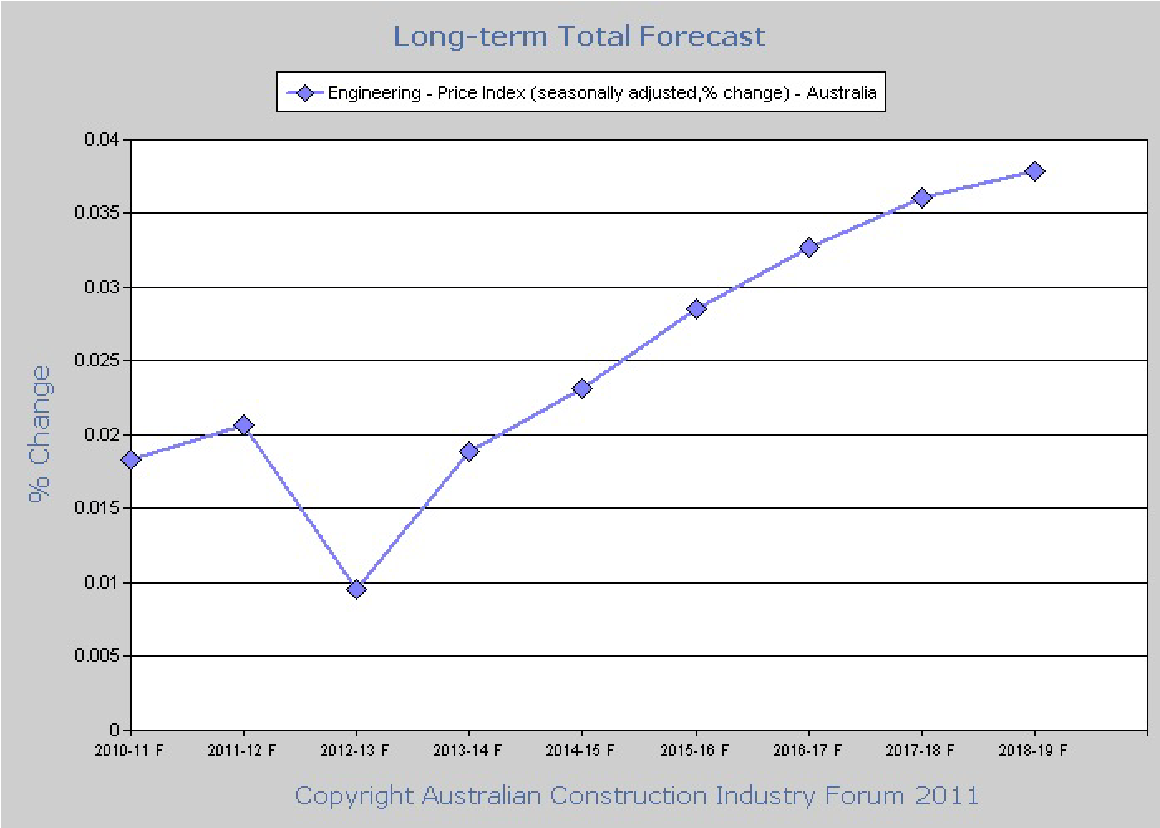

This outlook is likely to sustain the market demand for related construction materials, and thus the resultant market prices. The CFC also provides a forecast of related construction costs in the going forward, through which annual growth rates in the cost of construction are able to be developed.

The CFC also provide forecasts of the price index and its annual per cent change rate (or the escalation factor) related to ‘Engineering’ construction category for overall Australia region. This is shown in Table 5-8 and illustrated in Figure 5-8.

▪ **Table 5-8 Australia wide engineering construction nominal escalation factor forecast**

| | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | 2016-17 | 2017-18 | 2018-19 |
|---|---|---|---|---|---|---|---|---|---|
| Price Index (seasonally adjusted) | 1.00 | 1.02 | 1.03 | 1.05 | 1.07 | 1.10 | 1.14 | 1.18 | 1.23 |
| % change | | 2.07% | 0.96% | 1.89% | 2.31% | 2.85% | 3.27% | 3.60% | 3.78% |

- **Figure 5-8 Australia wide engineering construction nominal escalation factor trend**




## 5.4. Weighting of the cost drivers

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

The power station, connection switchyard and the overhead transmission line costs are disaggregated into the respective underlying commodity component cost items and the escalation rate of each individual cost drivers are applied proportionally, to understand the effect of escalation of each cost driver to the overall asset costs.

## 5.5. Capital cost escalation factors

The final nominal Capital Cost Escalation Factors determined by SKM for the annual forecast year to June for next 5 years are shown in Table 5-9.

- **Table 5-9 Nominal capital cost composite escalation factor annual forecast year to June for next 5 years**

| Assets | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|
| Power Station (Capex) | 4.29% | 2.20% | 2.31% | 1.22% | 1.16% |

The nominal escalation factors in this table are the resulting averages of the cost driver indices weighted by the cost items makeup proportion of the respective capital costs. For example, the component makeup of the Power Station capital cost estimate appears in Table 2.1 of this report. Each of the listed cost items is influenced by multiple underlying commodity cost driver indices in different proportions.

Using the above escalation factors, the total capital cost estimate of the power station in April 2014 is forecasted as **A$137,082,695** which equates to **A$859/kW**.[15]

## 5.6. Fixed operational & maintenance cost escalation factors

The final nominal Operating Cost Escalation Factors determined by SKM for the annual forecast year to June for next 5 years are shown in Table 5-10.

- **Table 5-10 Nominal fixed O&M cost composite escalation factor annual forecast year to June for next 5 years**

| Assets | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|
| Power Station (Opex) | 3.33% | 3.82% | 3.57% | 3.52% | 3.52% |
| Connection Switchyard (Opex) | 4.38% | 4.38% | 4.38% | 4.38% | 4.38% |
| Overhead Transmission Line (Opex) | 4.38% | 4.38% | 4.38% | 4.38% | 4.38% |

The fixed O&M cost escalation factors for the Connection Switchyard and the Overhead Transmission Line follows the Australian Electricity Gas Water Labour Price Index. The fixed O&M cost escalation factor for the Power Station is the resulting average of the cost driver indices weighted by its cost items makeup proportion. The makeup components of the Power Station fixed O&M cost appears in Table 3.1 of this report. Each of the listed cost items is influenced by one of the cost driver indices.

[15] Based on 159.6 MW net output defined in section 2.5.

# 6. Calculation of the M factor

## 6.1. Introduction

The allowance, M, to be included for "Legal, Insurance, Approvals, Other Costs and Contingencies" is to be estimated in accordance with Section 1.12.1 of the Market Procedure as:

> *The IMO shall engage a consultant to determine the value of margin M, which shall constitute the following costs associated with the development of the Power Station project:*
>
> *(a) Legal costs associated with the design and construction of the power station;*
> *(b) Financing costs associated with equity raising;*
> *(c) Insurance costs associated with the project development phase;*
> *(d) Approval costs including environmental consultancies and approvals, and local, state and federal licensing, planning and approval costs;*
> *(e) Other costs reasonably incurred in the design and management of the power station construction; and*
> *(f) Contingency costs.*

The factor M is applied to the estimated capital cost of the power station expressed in AUD/kW. The capital cost in the method to which the M factor is applied is the power plant capital costs excluding transmission connection capital cost and land capital cost (which are separate factors).

## 6.2. Implications of the specified procedure

The following assertions regarding the structure of the assumed OCGT project can be derived from the procedures:

- The costs are based on the costs to develop a single unit "E" class liquid fuelled gas turbine plant of nominal capacity 160 MW. When calculating specific costs the capacity at 41$^{o}$C is considered.
- The plant operates at a low capacity factor (2%).
- The plant would be developed upon industrial land. The nominated locales are areas where existing similar plants are located and other industrial facilities:
  - Collie Region.
  - Kemerton Industrial Park Region.
  - Pinjar Region.
  - Kwinana Region.

- North Country Region.
- Kalgoorlie Region.
- The costs of acquiring land are excluded from the M parameter.
- The power plant is delivered on a single package, turnkey EPC contract.
- The power plant costs are estimated based on a notional project being committed at the current time. The commissioning time may be of the order of three years in the future to coincide with the period the capacity auction was undertaken for. Since the delivery time of such a gas turbine is approximately 2 years from the time of EPC contract closure, the factors should consider that prices for plant etc may be subject to 1 year of variation between the time of the auction and the time of financial closure of the EPC contract.
- The procedure is not explicit in identifying whether a project financed model or a corporate financed model of the power station development are to be assumed. The discussion in the procedure regarding the project being eligible to receive a Long Term Special Price Arrangement suggests Project Finance whereas the relatively low debt issuance cost prescribed (12.5bp) and the specification for comparator companies in the WACC review suggest Corporate Finance. The project development costs for a Project Financed project tend to be higher due to additional processes undertaken (preparation, issue and attendance upon Information Memoranda, debt syndication, due diligence reviews, etc.). It is considered appropriate that the form of financing model be more appropriately considered within the development of the WACC parameter than within the M parameter.
- The recognition of costs attributable to the project development commences at the time of the auction approximately 1 year before Financial Close and prior to approval and procurement processes being undertaken. The cost of these processes is thus included within the M factor.

## 6.3. Derivation of the M factor for 2011

### 6.3.1. Values applied in 2010

Costs for indirect capital cost elements vary widely between projects and there is a lack of specific data from the WA market. Consideration is given to the 2010 scope and values and whether any changes are considered appropriate in the 2011 review.

The parameters applied in the 2010 review for the M factor are listed in Table 6-1. These components are discussed below.

- **Table 6-1 Calculation of the M factor in 2010**

| Component of 'M' | % of Total EPC |
|---|---|
| Project Management | 1.9% |
| Project Insurance | 1.5% |
| Contingencies | 5.0% |
| Cost of Raising Capital | 4.0% |
| Environmental Approvals | 0.7% |
| Legal Costs | 1.2% |
| Owner's Engineers - Part A (Including concept design, specification, tendering, contract negotiations) | 0.4% |
| Owner's Engineers - Part B (Including Construction Phase OE Costs, oversee project, witness tests & Commissioning) | 3.0% |
| Initial Spares requirements | 0.8% |
| Site Services (Provision of potable water, construction power, communications, domestic sewerage etc. at site) | 0.1% |
| Total M as a percentage of CAPEX | **18.6%** |

These were applied to a base EPC Capex estimate of A$121.8 million in 2010. The following analysis is based on a 2011 estimate of A$126.431 million.

Note that the prescribed method has changed between 2010 and 2011. Not all parameters are described as they were in the previous years' review.

### 6.3.2. Project management and Owner's engineering

The scope of these parameters has not changed. These costs typically are made up of consulting engineering services. The change in Producer Price Indices (PPI) (Australia wide) for "Engineering design and engineering consulting services" from June 2010 to June 2011 has been 0.9%[16].

### 6.3.3. Legal

The legal costs allowed in 2010 amounted to A$1.46 million. This would be expected to cover a full service such as for a Project Financed project. For a Corporate Financed OCGT project, delivered on an EPC basis, the project agreements are more limited (EPC, connection agreement, loan agreement, land purchase, fuel supply agreement, etc.). The allowance previously applied should suffice.

[16] ABS "6427.0 Producer Price Indexes, Australia", Table 22. Selected output of division M professional, scientific and technical services, group and class index numbers, Series A2314202T.

The 2010 amount has been escalated at the PPI rate for “Legal services” of 2.7%[17].

#### 6.3.4. Insurance

The cost of project contract works insurance is included within the Capital Cost estimate as such no allowance for this insurance is made within the M parameter. This is a change from the 2010 methodology which included an allowance for these insurances within the M factor.

The insurances purchased by the Owners are highly dependent on the contractual framework used to deliver the Power Station. Insurances required during construction may include:

- Insurance to cover any assets the owner caries during construction, this may include early order plant.
- Owner’s public liability and professional indemnity insurances.
- Other owners insurances during construction.

An allowance of 0.4% has been provided in the margin M to cater for these costs.

#### 6.3.5. Approvals

The cost of environmental approvals depends on the ‘level of assessment’ as set by the Environmental Protection Authority (EPA) under the Environmental Protection Act 1986 (the EP Act) and whether the development would affect any ‘Matters of National Environmental Significance’, thereby triggering Commonwealth approvals processes (the Environmental Protection and Biodiversity Act).

Should the State level be set to ‘Assessment on Referral Information’ (ARI) then costs may be significantly lower than the level of assessment being set to ‘Public Environmental Review’ (PER), in accordance with the Environmental and Protection Act. The significance of likely environmental impacts, scale of the development and its location, discharge requirements, technology options etc. will decide what level of assessment is required by the regulator. This includes factors such as (but not limited to) whether the site is Greenfield or Brownfield, existing environment (such as local airshed, water resources, proximity of sensitive receptors (dwellings), etc.), requirement for specialist studies to support the referral and community expectations.

For an ARI-type level of assessment, expected costs would be of the order of A\$100,000 to A\$500,000, varying with the level of desktop environmental studies required. The core of this is

[17] ABS op cit, Series A2314223C.

the development of approvals strategy, some preliminary environmental baseline studies (largely desktop), consultation with the regulators, and general project management of the process.

If the project is assigned a PER level of assessment the amount of work can be far more significant. In addition to the above, the project may require detailed environmental studies relevant to the project area, community consultation, as well as a significant review and response to comment period. Indicative costs would be in the order of A$600,000 to A$2.0 million for this level, depending upon the significance of the environmental factors.

As for application and process fees, these are insignificant in comparison to the cost of getting the studies and documentation ready for the regulators decision making processes.

The ARI level processes have been amended and this makes the costs somewhat more uncertain. At this time the impact is thought to be upon schedule than the cost of the processes.

An OCGT project operating at a very low capacity factor, located in an existing precinct and sited sensitively with regards to other stakeholders, as would be expected in commercial practice, is thought more likely to be able to use the simpler approvals process.

For this review a midrange allowance of A$1.0 million is applied.

### 6.4. Financing costs associated with equity raising

The specification for consideration of the WACC parameters requires comparator companies of market capitalisation at least A$200 million. For "typical" parameters of P/E ≈ 15 and payout ratio of 60% internal equity growth would be the order of $5 million/year. A company of this scale would be expected to need to raise equity to finance a project of this scale at an assumed 40% gearing, as prescribed in the method. For larger energy companies this may not necessarily be the case.

For a Project Financed project, the cost of raising equity would include the sponsor's equity raising costs and also the costs of establishing the project vehicle.

The actual cost will be highly specific to the circumstances of the project and its developer.

In 2010 an allowance of 4% was provided for the "Cost of raising capital". The method has been subsequently narrowed to equity raising costs only (a debt issuance cost being included within the WACC).

An allowance of approximately 3% is considered consistent with the 4% allowance applied in 2010, deducting an approximate amount for the debt issuance costs that have been removed.

## 6.5. Start-up costs

Start-up costs have not been explicitly allowed for previously. For an OCGT plant the primary start-up costs would include:

- Costs of recruiting and training staff and employing staff during the period prior to commercial operations.
- Cost of fuel and consumables used in testing and commissioning.

A 2% allowance is recommended.

## 6.6. Initial spares

The 2010 allowance for initial spares of 0.8% is considered reasonable.

## 6.7. Contingency costs

The "contingency" allowed in 2010 was 5%, reflecting an allowance for minor and unidentified items. These could include things such as office fit-out, office equipment, pre-work on the site prior to the EPC contract (e.g. access, fencing/security, removal of debris or contamination etc to facilitate studies), special tools etc.

For this review, an overall contingency allowance of 5% is included, consistent with SKM's interpretation of the Scope of Works (detailed in Appendix A) and previous year's reports.

## 6.8. Overall M factor

The M factor resulting from this analysis is given in Table 6-2.

- **Table 6-2 Calculation of M Factor 2011**

| Component of 'M' | 2010 % of EPC | 2011 % of EPC | 2011 $k AUD |
|---|---|---|---|
| Project Management | 1.9% | 1.8% | $2,276 |
| Project Insurance | 1.5% | 0.4% | $506 |
| Cost of Raising Capital | 4.0% | 3% | $3,793 |
| Environmental Approvals | 0.7% | 0.8% | $1,011 |
| Legal Costs | 1.2% | 1.1% | $1,391 |
| Owner's Engineers - Part A (Including concept design, specification, tendering, contract negotiations) | 0.4% | 0.4% | $506 |
| Owner's Engineers - Part B (Including Construction Phase OE Costs, oversee project, witness tests & Commissioning) | 3.0% | 2.8% | $3,540 |
| Initial Spares requirements | 0.8% | 0.8% | $1,011 |
| Site Services (Provision of potable water, construction power, communications, domestic sewerage etc. at site) | 0.1% | 0.1% | $126 |
| Start-up costs | | 2.0% | $2,529 |
| Contingencies | 5.0% | 5.0% | $6,322 |
| **Total M** | **18.6%** | **18.2%** | **$23,010** |

As noted above, the 160 MW OCGT plant capital cost estimate and 'M' factor combined are calculated to reflect a "most likely" outcome, consistent with SKM's interpretation of the scope of works.

# Appendix A Scope of work

## A.1 Project scope

SKM shall provide the following estimates and information.

### A.1.1 Development of costs for the power station

1. Advice including an estimate of the costs associated with engineering, procurement and construction of the Power Station as at April in Year 3 of the Reserve Capacity Cycle. This advice shall include:
    a. A summary of any escalation factors used in the determination.
    b. Likely output at 41°C which will take into account available turbine and inlet cooling technology, likely humidity conditions and any other relevant factors.
2. The Power Station costs shall be determined with specific reference to the use of actual project-related data or current market information and shall take into account the specific conditions under which the Power Station will be developed. This may include direct reference to:
    a. Existing power stations or power station projects under development, in Australia and more particularly Western Australia.
    b. Cost information obtained from the market sources such as supplier and manufacturer for recent and relevant actual cost reference.
    c. Worldwide demand for gas turbine engines for power stations.
    d. The engineering, design and construction, environment and cost factors in Western Australia.
    e. The level of economic activity at the state, national and international level.
3. Development of the Power Station costs shall include components for the gas turbine engines, and all Balance of Plant costs that would normally be applicable to such a Power Station based *GT Pro* breakup. This will include the following items:
    a. Equipment;
    b. Civil Works;
    c. Mechanical Works;
    d. Electrical Works;
    e. Buildings and Structures;
    f. Engineering and Plant start-up (includes commissioning); and
    g. Miscellaneous and other costs.
4. The Power Station upon which the Maximum Reserve Capacity Price shall be based will:
    a. be representative of an industry standard liquid-fuelled Open Cycle Gas Turbine (OCGT) power station;
    b. have a nominal nameplate capacity of 160 MW prior to the addition of any inlet cooling system;

c. operate on distillate as its fuel source with distillate storage for 14 hours of continuous operation;
d. have a capacity factor of 2%;
e. include low Nitrous Oxide ($NO_x$) burners or associated technologies (e.g. water injection) as considered suitable and required to demonstrate good practice in power station development;
f. include an inlet air cooling system where this would be cost effective; and
g. Include water receival and storage capability to support 14 hours of continuous operation.

### A.1.2 Fixed operating and maintenance costs

1. Fixed Operating and Maintenance (O&M) costs for the Power Station inclusive of the following items:
   a. Plant operator labour;
   b. OCGT substation (connection to tie line);
   c. Rates;
   d. Market fee;
   e. Balance of plant;
   f. Consent (EPA annual charges emission tests);
   g. Legal;
   h. Corporate overhead;
   i. Travel;
   j. Subcontractors;
   k. Engineering support;
   l. Security;
   m. Electrical (including Control & Instrumentation); and
   n. Fire.
2. Fixed Operating and Maintenance (O&M) costs for the associated transmission connection work (i.e. the overhead transmission line and the connection switchyard) inclusive of the following items:
   a. Cost of labour for routine maintenance;
   b. Cost of machine/plant/tool hire for routine maintenance; and
   c. Overhead (management, administration, operation etc).
3. It is noted that SKM will not provide an estimate of annual asset insurance cost required to insure the replacement of power station capital equipment, infrastructure, and associated transmission connection work.
4. The estimated fixed O&M cost will not allow for defect or asset replacement during the lifetime of the assets.

5. SKM notes that the maintenance cost for an asset is incurred periodically according to its maintenance routines. Since this routine is different for different asset classes, SKM will smooth these period costs evenly over the life of the power station, transmission line and connection switchyard and convert into an annualised fixed O&M costs.
6. To assist in the computation of annualised Fixed O&M costs, the costs associated with each major component shall be presented for each 5 year period up to 60 years.
7. Fixed O&M costs must be determined as at April in Year 3 of the Reserve Capacity Cycle. Where Fixed O&M costs have been determined at a different date, those costs must be escalated using the following escalation factors which shall be provided as part of the advice provided under scope A.1.2 and applied to relevant components within the Fixed O&M cost:
    a. Generation O&M Cost escalation factor for Generation O&M costs;
    b. a Labour cost escalation factor for transmission and switchyard O&M costs; and
    c. CPI for fixed network access and/or ongoing charges determined with regard to the forecasts of the Australian Bureau of Statistics and, beyond the period of any such forecasts, the mid-point of the ABS's target range of inflation.

### A.1.3 Legal, financing, insurance, approvals, other costs and contingencies (margin M)

1. The IMO shall engage a consultant to determine the value of margin M, which shall constitute the following costs associated with the development of the Power Station project:
    a. legal costs associated with the design and construction of the power station;
    b. financing costs associated with equity raising;
    c. insurance costs associated with the project development phase;
    d. approval costs including environmental consultancies and approvals, and local, state and federal licensing, planning and approval costs;
    e. other costs reasonably incurred in the design and management of the power station construction; and
    f. Contingency costs.