SINCLAIR KNIGHT MERZ

SKM

INDEPENDENT MARKET OPERATOR

Review of the Maximum Reserve Capacity Price 2014

- WP04729-OSR-RP-0001
- Rev 1A
- 25 October 2013

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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 2014:

- Capital cost (procurement, installation and commissioning, excluding land cost) of a generic single unit, industry standard, liquid fuelled, 160 MW nameplate rated 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. The costs shall be in 5 year periods covering 1 to 50 years.
- 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. The costs shall be in 5 year periods covering 1 to 60 years.
- Note: insurance expenses are excluded from the above estimates of the fixed O&M costs.
- Fixed fuel costs of the above facility including a 1,000 tonne diesel fuel tank supplying fuel to the power station to enable 14 hours of operation at maximum capacity
- 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 B**.

2. Generation plant capital cost

SKM has estimated the capital cost (capex) comprising engineering, procurement, installation and commissioning, excluding land costs 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 consistent with the scope of work detailed in **Appendix B**.

2.1. Methodology

To establish the capital cost for a single unit 160 MW OCGT plant the following steps were undertaken:

- Siemens SGT5-2000E (33MAC)[1] with a distillate operation nameplate rating of 173 MW (gross) at ISO[2] conditions was selected as the reference machine for the study. There exist two versions of this model, 33MAC and 41MAC. The term MAC refers to 'maintenance concept' which impacts the timing of scheduled major overhaul intervals (i.e. 33,000 hours / 41,000 hours). For a gas turbine with an expected capacity factor of 2%, a 33MAC version is most likely due to the preference for increased output as opposed to extended maintenance intervals. The Alstom GT13E2 was recently uprated to approximately 200 MW and therefore not a suitable reference machine. The Mitsubishi 701D has a nameplate capacity of 147 MW on distillate fuel operation but it is no longer in active production.
- Evaporative air cooling technology was selected as the most effective inlet cooling technology based on previous analysis undertaken for the IMO[3] and is consistent with SKM's understanding of the technologies commonly adopted for installations in the South West of Western Australia.
- Utilised recent, budgetary quotes for main plant equipment pricing and EPC capital costs.
- Benchmarked the plant capital costs ($/kW basis) against similar completed projects in Australia including WA and assessed which elements of the costs are fixed and which are scalable to output
- Converted the scalable costs to a $/kW value and used this $/kW to predict the cost of the nominal 160MW unit
- Converted the nominal 160MW plant output to the predicted value at site conditions

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[1] This is the only gas turbine make/model in production that is rated in close proximity to the 160MW nominal nameplate capacity as per Appendix B requirements.
[2] ISO conditions are 15°C ambient dry bulb temperature, 60% relative humidity at 1.013bar_A atmospheric pressure (typical sea level elevation pressure conditions).
[3] Analysis can be found at http://www.imowa.com.au/docs/default-source/Governance/Market-Advisory-Committee/MAC-Working-Groups/wp04268-rpt-me-001-a_1_capacity_augmentation_on_mrcp_rev1.pdf?sfvrsn=2

- Escalated the historical project cost using appropriate escalation indices[4] (year end to June 2013) for each capital cost component.
- Provided 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®/GT MASTER®.

The SKM study is based on liquid (distillate) fuel being supplied and stored, fully in accordance with the gas turbine manufacturer's specification requirements. 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. Note that the cost of the infrastructure to achieve the above is given in **Section 5 – Fixed fuel costs**.

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.

The project costs are substantially based on historical project information and the output of the project data price review.

2.2. Project data price review

In developing the end cost estimate, SKM utilised reference project data developed for the 2013 IMO report. The reference project consists of Thermoflow GT PRO® heat balance model. The model utilised information garnered from a number of OCGT projects and studies that had been completed in Australia from 2007-2010. Though there have been OCGT projects completed in Australia since 2010, these have been primarily limited to aero-derivative type installations, such as the GE LM6000 and the Rolls-Royce Trent 60, which have a lower individual unit capacities (40 - 60 MW) and higher relative equipment cost ($/kW basis)[5] due to the technology differences. It is also understood that the primary fuel in these installations would be natural gas.

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[4] Escalation indices were sourced from the Australian Bureau of Statistics for CPI and Labour (Perth based) and commodity indices for steel and concrete.
[5] Note that all referenced prices are in Australian dollars unless otherwise noted

The reference project cost model was updated to reflect to current (2013) pricing for main plant equipment. The remaining project capital costs components were escalated using various historic (year end to June 2013) escalation indices appropriate to each make-up component of the total capex to provide an estimate in June 2013 dollar terms.

2.3. Development of the generic OCGT capital cost estimate

The cost estimate has been based on dual fuel combustor/burner (natural gas and distillate) fitted with dry low emissions (DLE) combustion technology. NO_X emissions would typically be in the range of 25 ppmvd at 15% O_2 reference conditions when firing natural gas and 42 ppmvd when operating on distillate fuel oil with water injection. Water injection for NO_X emissions abatement will be required for liquid fuel operation. The capital cost estimate includes on site water treatment and storage facilities.

The capital costs exclude the distillate fuel oil storage and unloading systems. They are determined separately in **Section 5**. 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 1.4:1); and storage capacity for 240 tonne of potable water plus 1 hour of fire control water are included in the capital costs.

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[6] 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 the 173 MW reference unit utilising a single OCGT plant is given in Table 2-1 below. This table shows which elements of the cost are assessed as scalable and which are considered to be fixed. The estimate represents a generic cost for an OCGT plant constructed on an EPC basis. Owner's costs additional to the EPC contract price have been excluded, and are accounted for in the calculation of the term "M" in **Section 7**.

The total capital cost estimate was calculated as **$ 123,782,500** which equates to **760 $/kW**[7] at site conditions**.**

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[6] Sufficient quality is defined as potable quality water capable of operating in the evaporative cooler at 2-3 cycles of concentration.
[7] Based on 162.8 MW net output of the reference unit as defined in section 2.5

- **Table 2-1 Generic 173 MW OCGT capital cost estimate**

Item	Cost [$k]	Type of cost
Main plant equipment	68,062.7	Scalable
Balance of plant	3,029.5	Scalable
Civil works	15,784.4	Scalable
Mechanical works (including installation)	9,355.1	Scalable
Electrical works (including installation)	3,432.4	Scalable
Buildings	5,479.1	Fixed
Engineering & plant start-up	4,142.3	Fixed
Contractor's costs	14,497.0	Fixed
Total EPC cost	**123,782.5**	

All costs are presented as mean values and are in June 2013 dollars. The reference price for main plant equipment is based upon an EUR/AUD exchange rate of 0.7064.

SKM notes that the total cost estimate has increased by approximately **$ 2.04 million** dollars from that estimated in the "2013 Review of the Maximum Reserve Capacity Price" report.

Whilst the capital cost methodology has largely remained the same, fewer historical projects were utilised because the Siemens SGT5-2000E gas turbine is now the only currently available applicable gas turbine model, within the specified single unit capacity range, whereas previous years had also considered and utilised cost data from the previous Alstom GT13E2 lower capacity version open cycle gas turbine projects.

The Siemens gas turbine employs a silo type combustor which requires more space and hence the civil works and buildings costs have increased. The main plant equipment is manufactured in Europe and the costs are thus highly influenced by the exchange rate. Relative to the Euro the Australian Dollar weakened by ~14% between June 30 2012 and June 30 2013, which increased the capital cost for this component. However, this increase is slightly offset because the Siemens SGT5-2000E is relatively less expensive ($/kW) than the Alstom GT13E2.

To estimate the capital cost of the nominal 160 MW unit the scalable costs were converted to $/MW and multiplied by the nominal plant output. These were added to the fixed costs to give a total capital cost estimate of **$** 116,293,300; which equates to 773 $/MW at site conditions[8].

2.5. Plant output at ISO and required conditions

The unit rating of 173 MW running on distillate fuel at full load ('base load'), ISO ambient conditions (15°C, 60% relative humidity) gives a net output of 170.8 MW. At the site conditions (41°C, 30% relative humidity) with evaporative cooling in operation this reduces to a net output of 162.8 MW.

[8] Based on 150.5 MW net output of the 160 MW unit as defined in section 2.5

The nominal 160 MW unit has a net output of 157.6 MW. At the site conditions (41°C, 30% relative humidity) with evaporative cooling in operation this reduces to a net output of 150.5 MW.

A summary of these results[9] is provided in Table 2-2.

- **Table 2-2 SGT5-2000E and nominal 160 MW unit estimated power outputs at ISO and site conditions**

Unit	ISO conditions		Site conditions		Delta
	MW gross	MW net	MW gross	MW net	net/net
SGT5-2000E	173	170.8	165.2	162.8	4.68%
160 MW Nominal	160	157.6	152.9	150.5	4.51%

As can be seen from the table above, there is a small (less than 0.2%) difference between the load reductions for the SGT%-2000E and nominal 160 MW machines. This is due to rounding of the nominal outputs and losses, and the assumptions made in the modelling.

The approach taken in this report is noted to differ from previous years. This is due to a previous misinterpretation of the Market Rules which has since been corrected.

[9] Based upon GTPro results for Siemens SGT5-2000E, model ID # 395. GTPro performance is based upon Siemens SIPEP v. The losses include GT and plant auxiliaries, the generator step-up transformer, HVAC and lighting.

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**.

In accordance with the September 2009 report[11] 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.

- **Table 3-1 OCGT plant fixed O&M costs**

O&M cost component	[$k pa]
Plant operator labour	555.0
OCGT substation (connection to tie line)	253.0
Rates	61.0
Balance of plant	135.0
Consent (EPA annual charges emissions tests)	33.0
Legal	28.0

[11] *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	[$k pa]
Corporate overhead	233.0
Travel	27.0
Subcontractors	365.0
Engineering support	72.0
Security	134.0
Electrical (Including control & instrumentation)	132.0
Fire	63.0
Total	**2,091.0**

These costs have been escalated, where appropriate, to June 2013 dollar terms. The costs for statutory reporting requirements, that are common requirements to all generating plants, are inclusive of the costs allocated to the corporate overhead and subcontractor components.

In previous years, a line item for Market Fee had been included, however this cost has been identified to be a variable cost that would be recovered through energy costs; hence this item has been removed from this section.

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 2013 dollars)**

Five yearly intervals	1 - 5	6 - 10	11 - 15	16 - 20	21 - 25	26 - 30	1 - 30
Fixed O&M costs ($k)	10,448.9	10,448.9	10,448.9	10,448.9	10,448.9	10,448.9	62,693.4

All costs are presented as mean values.

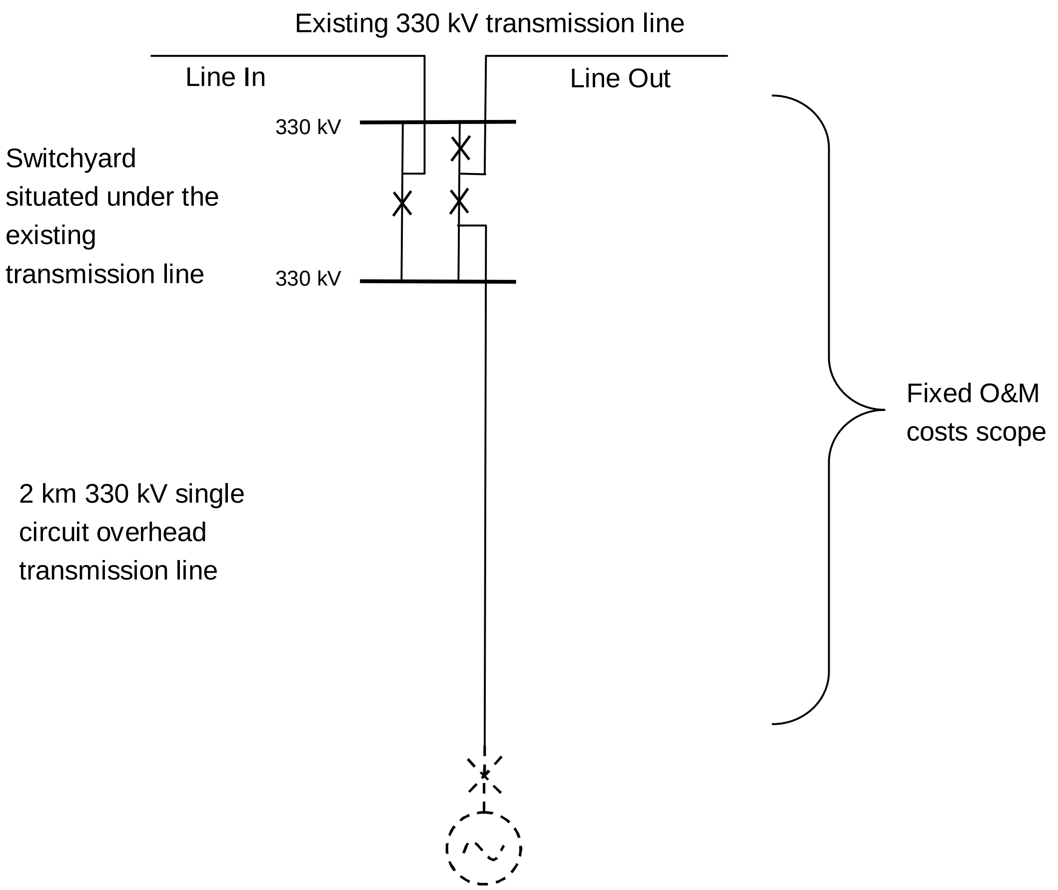
4. Connection switchyard and overhead transmission line fixed operation and maintenance costs

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. Assumptions and exclusions

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 on-going 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 operational & maintenance costs

SKM has assumed that the average life of the 330 kV switchyard assets is 50 years. Table 4-1 shows the fixed O&M costs presented in 5 yearly periods over the lifetime of the switchyard assets. The fixed O&M cost over the asset lifetime for the switchyard is $ 60,500 pa in June 2013 dollar terms.

Table 4-1 Five yearly aggregate fixed O&M costs for switchyard assets.

Period	Five yearly aggregate fixed switchyard O&M costs (in 2013 $k)
1 to 5 years	302.5
6 to 10 years	302.5
11 to 15 years	302.5
16 to 20 years	302.5
21 to 25 years	302.5
26 to 30 years	302.5
31 to 35 years	302.5
36 to 40 years	302.5
41 to 45 years	302.5
46 to 50 years	302.5

4.4. Transmission line operational & maintenance costs

SKM has assumed that the average life of the 330 kV transmission line is 60 years. Table 4-2 shows the fixed operation and maintenance costs presented in 5 yearly periods over the lifetime of the transmission line assets. The fixed O&M cost over the asset lifetime for the transmission line is $ 1,180 pa in June 2013 dollar terms.

Table 4-2 Five yearly aggregate fixed O&M costs for transmission line assets

Period	Five yearly aggregate fixed transmission line O&M costs (in 2013 $k)
1 to 5 years	5.9
6 to 10 years	5.9
11 to 15 years	5.9
16 to 20 years	5.9
21 to 25 years	5.9
26 to 30 years	5.9
31 to 35 years	5.9
36 to 40 years	5.9
41 to 45 years	5.9
46 to 50 years	5.9
51 to 55 years	5.9
56 to 60 years	5.9

5. Fixed fuel costs

5.1. Introduction

The estimation of the capacity price for 2014 is to include, as per previous years, costs associated with the fuel supply. The cost is denoted as the Fixed Fuel Cost (FFC) in the Market Procedure.

This component is the cost associated with the development and construction of an onsite liquid fuel oil storage and supply facilities, with supporting infrastructure, with sufficient capacity for 24 hours of operation on liquid fuel, including the cost of initially filling the tank with fuel to a level sufficient for 14 hours operation.

5.2. Basis of design

For a detailed breakdown of the basis of design utilised in the estimates for the fixed fuel costs please refer to SKM's "Review of the Maximum Reserve Capacity Price 2013" report.

5.3. Fixed fuel cost scope

5.3.1. IMO defined requirements

The IMO defined Fixed Fuel Costs for the liquid fuel storage and handling facilities are to include:

a. A fuel tank of 1,000 t (nominal) capacity including foundations and spillage bund suitable for 14 hours operation.

b. Facilities to receive fuel from road tankers.

c. All associated pipework, pumping and control equipment.

5.3.2. Included scope

The scope of work, for the supply of diesel fuel oil included as the basis of the estimation of the Fixed Fuel Cost component, comprises:

i. Road tanker fuel oil unloading facilities, including:
   a. 2 x fuel road tanker oil unloading station arms, interconnecting header piping and valves.
   b. 2 x motor driven fuel unloading pumps complete with inlet suction strainers, interconnecting piping and valves.
   c. Fuel oil delivery metering equipment.
   d. Interconnecting piping, valves and fittings from the unloading station to the fuel oil storage area.
ii. Bulk fuel oil storage facilities, including:
   a. 1 x bulk diesel fuel oil storage tank, complete with all necessary fittings.
   b. 1 x waste oil collection tank, complete with all necessary fittings.
iii. Fuel forwarding and supply facilities, including:

a. 2 x duty and standby motor driven fuel oil forwarding pumps, complete with inlet suction strainers, interconnecting piping and valves.
b. 2 x duty and standby filter separator trains.
c. 1 x fuel supply metering equipment.
d. Interconnecting piping, valves and fittings from the fuel tank to the forwarding pumps and from the forwarding pumps to the open cycle gas turbine (OCGT) fuel oil connection, with recirculation return to storage.

iv. Oily water treatment and separation equipment, including:
   a. 2 x motor driven waste water collection and supply pumps complete with inlet suction strainers, interconnecting piping and valves.
   b. Oily water separator, above ground plate type separator or similar.
   c. Interconnecting oily waste water, waste oil piping and treated water interconnecting piping, valves and fittings.

v. Electrical equipment and supporting systems for the above equipment, including interconnecting cabling and fittings.

vi. Local plant mounted instrumentation, control and protection systems for the above equipment, including interconnecting cabling and fittings

vii. Civil and structural works, including:
   a. Fuel oil road tanker unloading and oil spill containment area.
   b. Bulk fuel oil storage tank foundations and concrete containment bund area.
   c. Fuel unloading and forwarding pump area foundations and spill containment area.
   d. Weather protection canopies or similar structures.
   e. Miscellaneous equipment and piping supports and structures.

The assumed main limits of supply and terminal interface connection points include:

i. Fuel oil delivery road tanker vehicle unloading / loading connections.
ii. Waste oil collection tanker vehicle loading connections.
iii. Fuel oil supply connection to the OCGT at a single connection point.
iv. Fuel oil return connection from the OCGT at a single connection point.
v. Treated water discharge connection to the site drainage system at a single point local to the fixed fuel oil facility perimeter boundary.
vi. AC power supply connection at the fixed fuel oil facility distribution board equipment.
vii. Earthing connections to the power station earth grid local to the fixed fuel oil facility perimeter boundary.
viii. Control and communications connections at a marshalling panel provided within the fixed fuel oil facility.

5.4. Estimated cost

5.4.1. Estimate classification

SKM has generally adopted the AACE (Association for the Advancement of Cost Engineering) international recommended practices for the classification of capital cost estimates (CAPEX), in accordance with the table in **Appendix A**. Based on the current level of information and the level of completed engineering and definition, the presented Fixed Fuel Cost estimate is a Class 4 Order of Magnitude Estimate.

This classification is directly comparable with the Type 1 estimate basis, used and reported in previous years.

5.4.2. Basis of the estimate

The basis of the capital cost estimate is in accordance with the criteria outlined in the table and includes the following information sources:

- Factoring of a June 2012 budget quotation, for a comparable project, based on the supply, installation and testing of fuel oil storage tanks of the same capacity.
- Escalated the cost using appropriate escalation indices[12] (year end to June 2013) for each capital cost component.
- Materials take-offs of the preliminary civil and structural design completed for this facility, to which composite material rates were applied.
- Similarly, application of composite estimated installed rates for estimated piping quantities and similar commodities.
- Application of factors for the remaining scope of works as described in the table.

The estimated capital cost outcome is detailed in the following sections.

5.4.3. Fuel facilities costs

The estimated capital cost for the fixed fuel oil facility as presented in this report is **$ 5.98 million**.

The estimate is an Order of Magnitude Class 4 type estimate.

5.4.4. Cost of fuel

The estimated cost of diesel fuel is 21.65 $/GJ (higher heating value), based on the IMO "2013 Review of the Energy Price Limits for the Wholesale Electricity Market in the SWIS (dated 16 May 2013)" report. This cost includes delivery transportation but excludes excise and GST.

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[12] Escalation indices were sourced from the Australian Bureau of Statistics for CPI and Labour (Perth based) and commodity indices for steel and concrete.

This corresponds to 0.9959 $/kg based on a higher heating value of 46 MJ/kg; or 0.8366 $/litre based on a specific gravity of 0.84.

To maintain consistency with previous years' reports, the first fill fuel oil quantity, based on 14 hours operation and an allowance for maintaining a minimum tank working volume, is 815 m^3.

The estimated cost of first fill capacity as presented in this report is **$ 0.682 million**.

5.4.5. Estimate summary

The estimated capital cost breakdown is summarised as follows:

- **Table 5-1 Estimate summary for fixed fuel system**

No.	Item description	Cost [$ k]
1	Main plant equipment, including installation: ▪ main fuel oil storage tank	$ 1,520.0
2	Mechanical balance of plant (BoP) equipment, including installation: ▪ fuel oil pump equipment. ▪ oily water separator equipment. ▪ piping and fittings	$ 722.7
3	Civil and structural works, including installation	$1,977.0
4	Electrical and control works, including installation	$ 432.8
5	Spares and consumables	$ 68.6
6	Engineering, procurement and construction management (12%)	$ 558.3
7	Contractor's on-costs, including risk, insurance and profit	$ 697.9
A	**Total - fixed fuel oil facility CAPEX**	**$ 5,977.3**
B	**Base fuel storage of 815 m^3 @ $ 0.9127/l**	**$ 681.8**
	TOTAL	**$ 6,659.1**

6. Cost escalation forecast

6.1. Background

SKM has been actively researching the 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 (collectively NSPs) throughout Australia. The SKM cost escalation methodology has also been accepted by the Australian Energy Regulator (AER) in recent revenue proposals submitted by these utilities.

The model draws upon strategic procurement studies that SKM conducted in 2006 and 2010 which surveyed the equipment 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 are periodically obtained from various sources and are used to populate the model. This information is typically sourced from well recognised public domains as well as being acquired from professional subscription services. The escalation factors developed for the IMO were based on the most up-to-date information available at the time of compilation.

6.2. 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 behaviour, all subject to uncertainty.

6.3. Individual escalation driver forecasts

6.3.1. General

Table 6-1 presents the forecasted nominal end of June escalation rates for each driver over the next 5 years.

Table 6-1 Individual nominal escalation rate forecast year to June for next 5 years

	CPI	EGW labour	WA labour	Copper	Steel	Construct
2014 Nominal	2.50%	4.32%	4.31%	4.34%	11.87%	5.57%
2015 Nominal	2.50%	4.32%	4.31%	3.00%	5.06%	5.52%
2016 Nominal	2.38%	4.32%	4.31%	2.99%	4.26%	5.36%
2017 Nominal	2.50%	4.32%	4.31%	1.93%	5.15%	5.50%
2018 Nominal	2.50%	4.32%	4.31%	1.81%	4.00%	5.49%

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

6.3.2. Australian CPI

SKM applies a method of forecasting the position of Australian CPI as accepted by the AER in several recent Final Decisions for electricity NSPs, including the NSW, Queensland and Victorian businesses.

This method adopts the following process:

- Plot the most recent actual/ historical quarterly Australian CPI data from the Australian Bureau of Statistic (ABS) record (June 2013 quarter data for this modelling exercise) and determine the annual Australian CPI % change by comparing it to past historical data;
- Use two and half years' of annual Australian CPI % change forecasts from the most recent Reserve Bank of Australia (RBA) Monetary Policy Statement – (the August 2013 Monetary Policy Statement, Economic Outlook, Inflation, Table 6.1 forecasts were used), with forecast out to December 2015.
- Thereafter extrapolate CPI as the RBA and the Treasury inflation target of an average of between two and three per cent over the cycle by using a midpoint of two and a half per cent.
- For the 2015/16 financial year, the IMO's WACC calculation utilises a CPI rate of 2.375%. SKM has aligned its forecasted rate for this year for consistency.

The CPI figures used in SKM forecast modeling are presented in Table 6-2

- **Table 6-2 Year to June CPI forecast**

Year to June	2013 A	2014 F	2015 F	2016 F	2017 F	2018 F
CPI Forecast	2.40%	2.50%	2.50%	2.38%	2.50%	2.50%

6.3.3. Australian EGW labour

This Australian labour price index captures the labour cost escalation for electricity, gas, water and waste water (EGW) or 'Utilities' sector. As this workforce has been in high demand and seen greater than average wage increments in recent times, SKM deemed it necessary to separate these costs from general labour.

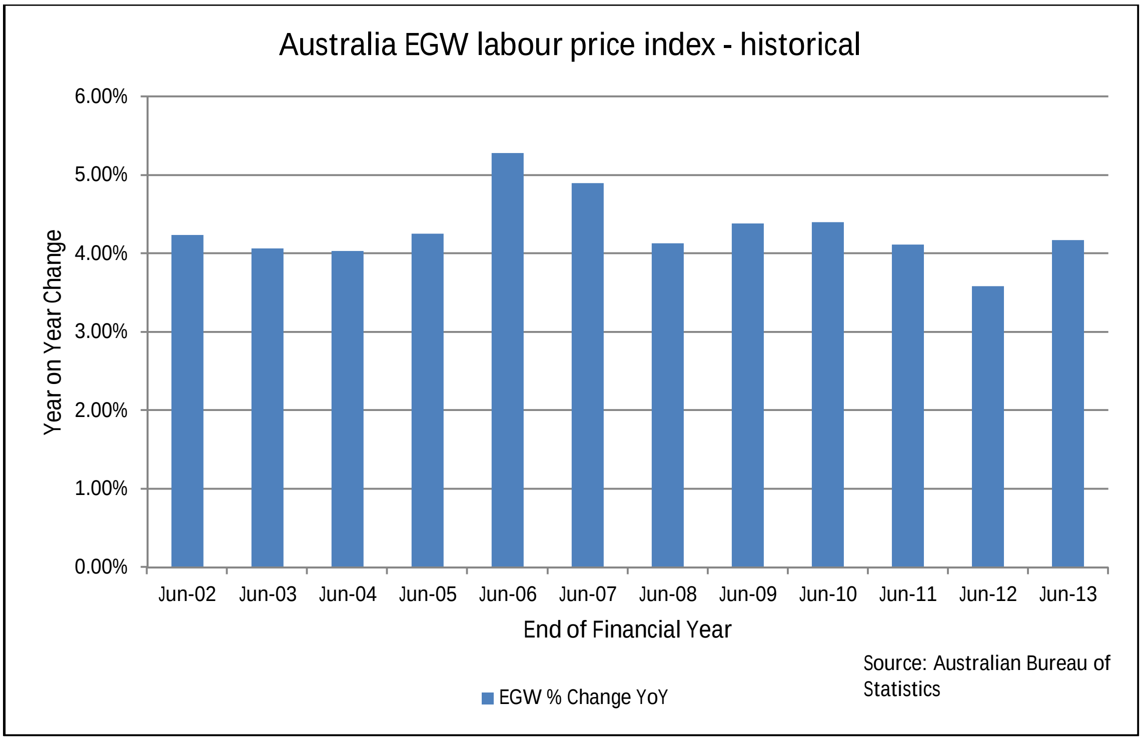
SKM used the data published by the Australian Bureau of Statistics (ABS) to develop this cost escalation component. The ABS 6345.0 Labour Price Index; Table 2a to 9a All WPI series: original (financial year index numbers for year ended June quarter); financial year index; total hourly rates of pay excluding bonuses; Australia; private and public; electricity, gas, water and waste services; Series ID A2705170J was used for this purpose.

Table 6-3 and Figure 6-1 provide further details of the background data.

- **Table 6-3 Annual change in EGW industries Australia LPI**

Year To:	EGW industries Australia LPI	Annual change %
Jun-2002	73.8	
Jun-2003	76.8	4.07%
Jun-2004	79.9	4.04%
Jun-2005	83.3	4.26%
Jun-2006	87.7	5.28%
Jun-2007	92.0	4.90%
Jun-2008	95.8	4.13%
Jun-2009	100.0	4.38%
Jun-2010	104.4	4.40%
Jun-2011	108.7	4.12%
Jun-2012	112.6	3.59%
Jun-2013	117.3	4.17%
10 year average %('04-'13)		**4.32%**

- **Figure 6-1 Annual change % of EGW industries Australia LPI**



6.3.4. Western Australia (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 the actual costs.

SKM again used the data published by the ABS to develop this rate. The ABS 6345.0 Labour Price Index; Table 2a to 9a All WPI series: original (financial year index numbers for year ended June quarter); financial year index; total hourly rates of pay excluding bonuses; Western Australia; private and public; all industries; Series ID A2705992V was used for this purpose.

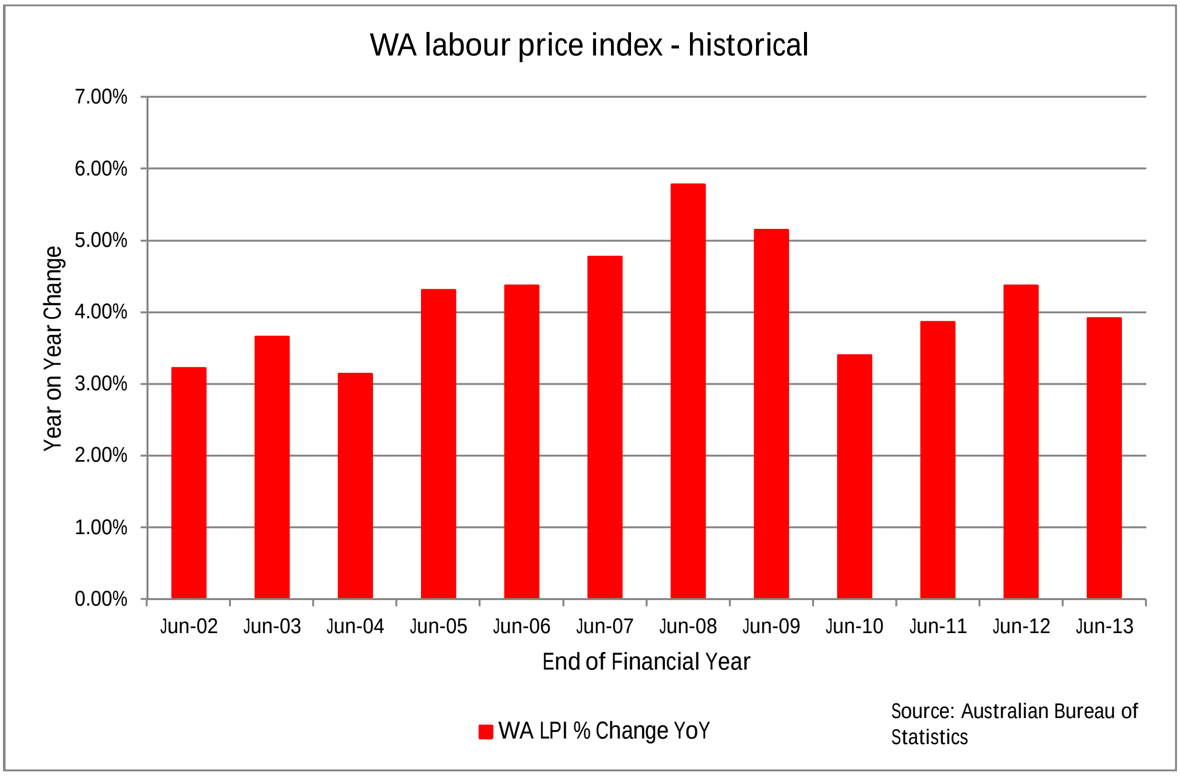
Table 6-4 and Figure 6-2 provide further details regarding the background data.

- **Table 6-4 Annual change in all industries WA LPI**

Year To:	All industries WA LPI	Annual change %
Jun-2002	73.7	
Jun-2003	76.4	3.66%
Jun-2004	78.8	3.14%
Jun-2005	82.2	4.31%
Jun-2006	85.8	4.38%

Year To:	All industries WA LPI	Annual change %
Jun-2007	89.9	4.78%
Jun-2008	95.1	5.78%
Jun-2009	100.0	5.15%
Jun-2010	103.4	3.40%
Jun-2011	107.4	3.87%
Jun-2012	112.1	4.38%
Jun-2013	116.5	3.93%
10 year average %('04-'13)		**4.31%**

- **Figure 6-2 Historical Western Australia labour price indices**



6.3.5. Australian dollar to US dollar exchange

As internationally traded commodities used in SKM's forecasts, such as copper 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 considers the AUD/USD exchange rate to gradually decrease from the present 0.93 to 0.84 over the required forecast horizon. This foreign exchange forecast rate is based on the AER's draft response on Victoria's SP Ausnet recent reset submission dated August 2013.

6.3.6. 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 (August 2013) of London Metal Exchange (LME) copper spot prices/tonne.
2) Determine the average of 3 month, December of +1 year, December of +2 year and December of +3 year months LME contract prices for the most recent month.
3) Determine the most recent Consensus Economics long-term forecasts position (taken as 7.5 years from survey date[13]). SKM has used the August 2013 Consensus Economics survey report.
4) Apply linear interpolation between each of the data points above.

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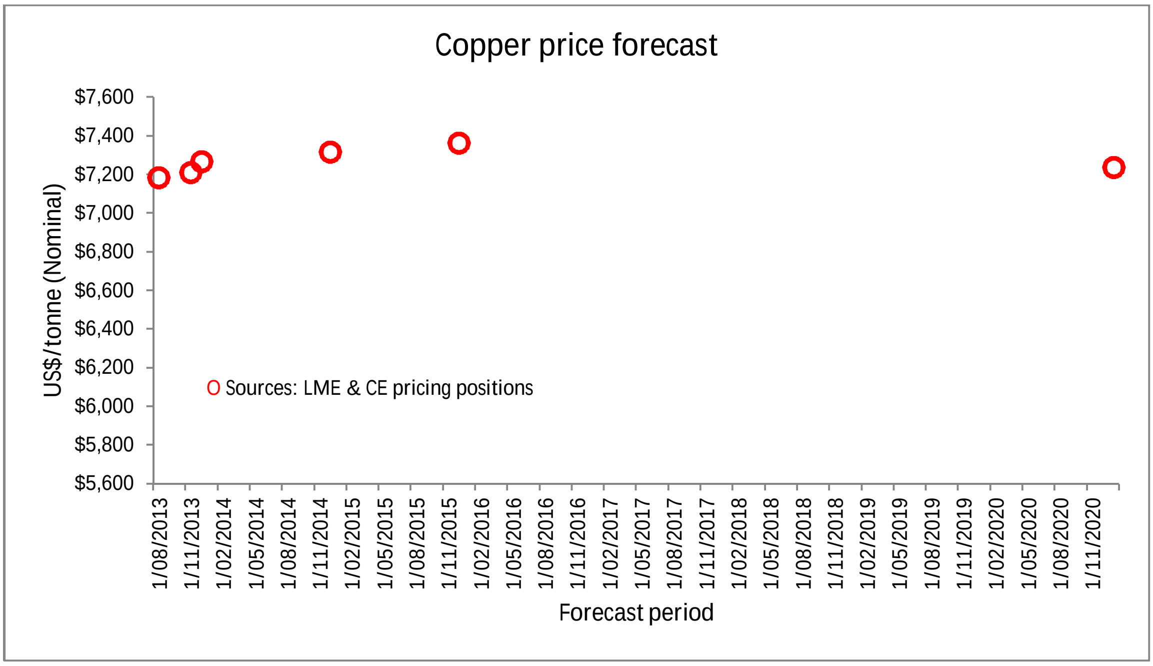
[13] The Consensus Economics long-term forecast is listed in the publication as a 5 – 10 year position. As a reasonable assumption, SKM considers the position to refer to the mid-point of this range, being 7.5 years, or 90 months. The long term (real) forecast is adjusted for US CPI to determine a long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

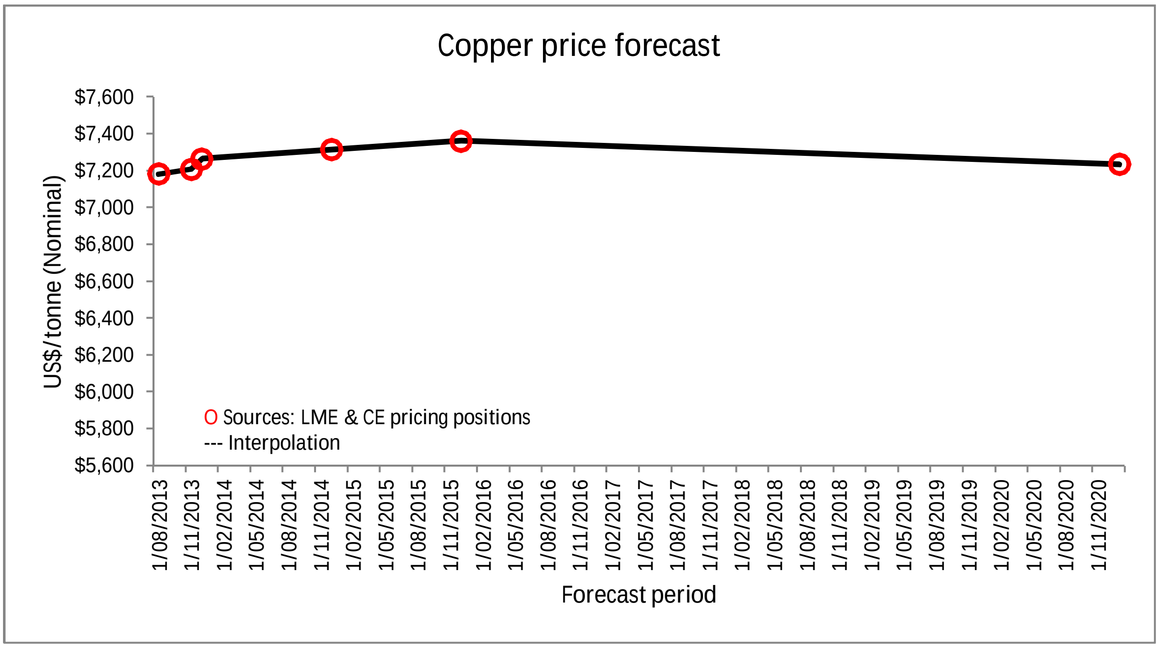
5) Identify the June points for the relevant years in the interpolated results, and calculate annual year to June average prices as the underlying commodity cost movement to be used in the equipment escalation model.

This methodology is illustrated in Figure 6-3 and Figure 6-4.

- **Figure 6-3 Diagram of SKM methodology for copper forecast price (Steps 1-3)**



- **Figure 6-4 Diagram of SKM methodology for copper forecast price (Steps 4-5)**



The average year to June input numbers used during SKM's escalation modelling of the copper nominal prices are presented in Table 6-5. It has been converted to Australian dollars and the impact of the Australian carbon price mechanism has been duly considered. Refer **Section 6.4** regarding the impact of Australian carbon price mechanism.

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

Year end to	Jun-13	Jun-14	Jun-15	Jun-16	Jun-17	Jun-18	Jun-19
Copper price	7,466	7,790	8,023	8,422	8,575	8,739	8,911
Annual change		4.34%	3.00%	2.99%	1.93%	1.81%	1.92%

6.3.7. 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 notes 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[14]. 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[15]. 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).

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 August 2013 Consensus Economics survey report to compile the steel escalation information provided in this report. This publication provided quarterly forecast market prices for steel from present month (i.e. August 2013) to +29 months, as well as a long-term forecast pricing position i.e. annual average of +3 years, +4 years, +5 years, 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.

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

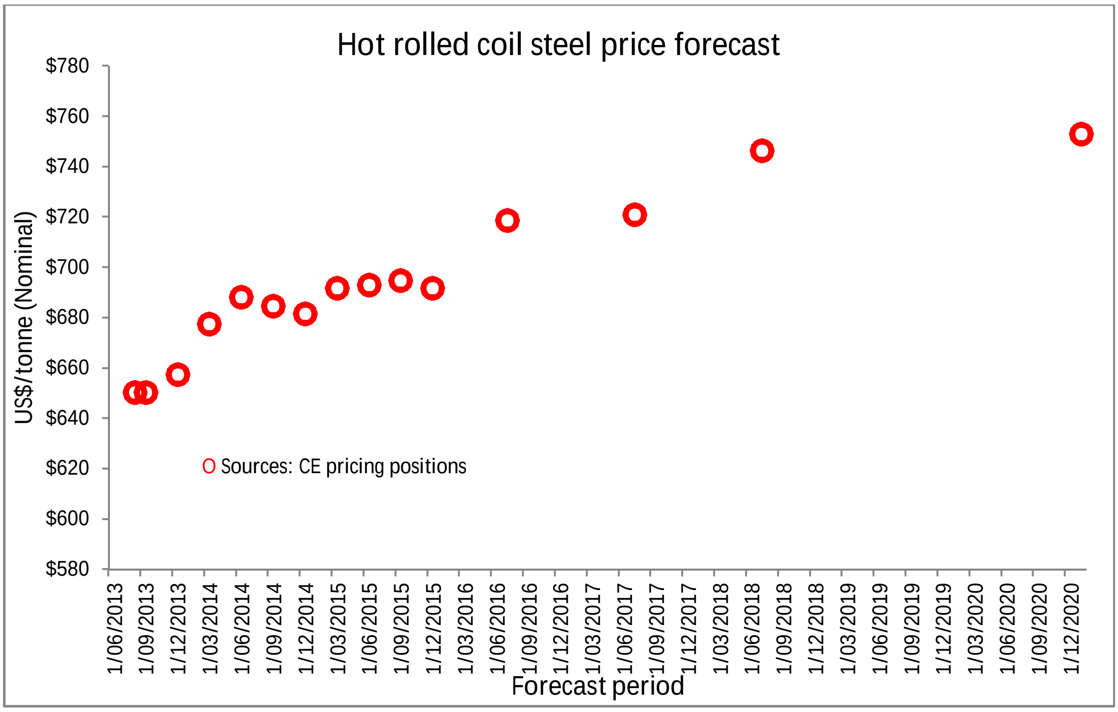
SKM's methodology uses a five step approach to produce specific data points between which a simple method of interpolation is able to be applied, in order to fill in any missing data points and arrive at the required pricing positions.

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:

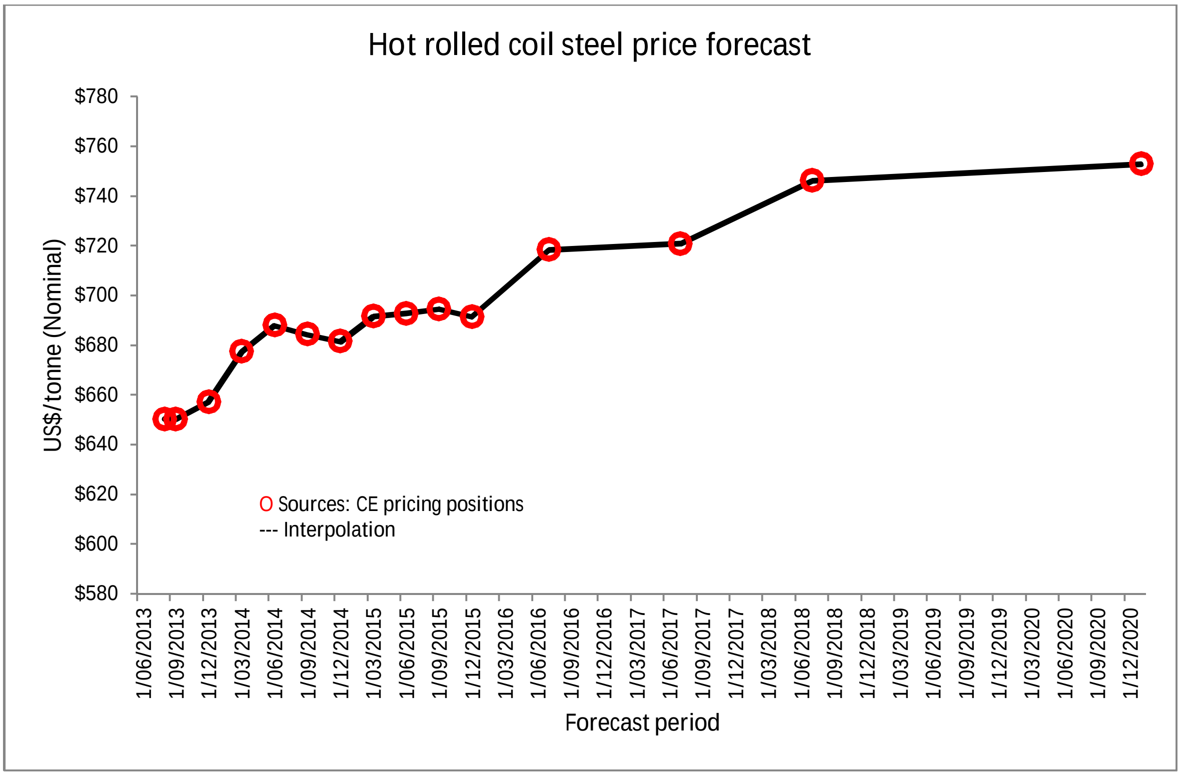
1) Determine the average of the most recent month USA and European Consensus Economics survey average HRC steel price/ metric tonne.
2) Determine the average of the most recent USA and European 2, 5, 8, 11, 14, 17, 20, 23, 26, 29, June of +3 years, June of +4 years, and June of +5 years months Consensus 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 6-5 and Figure 6-6.

- **Figure 6-5 Diagram of SKM methodology for steel forecast price (Steps 1-3)**



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



The average year to June input numbers used during SKM's escalation modelling of the steel nominal prices are presented in Table 6-6. It has been converted to Australian dollar and the impact of the Australian carbon price mechanism has been duly considered. Refer **Section 6.4** regarding the impact of Australian carbon price mechanism.

- **Table 6-6 Forecasted average annual steel price ($/metric tonne nominal)**

Year end to	Jun-13	Jun-14	Jun-15	Jun-16	Jun-17	Jun-18	Jun-19
Steel Price	$641	$717	$754	$786	$826	$859	$897
Annual Change		11.87%	5.06%	4.26%	5.15%	4.00%	4.33%

6.3.8. Engineering construction

The Australian Construction Industry Forum (ACIF)[16] is the peak consultative organisation of the building and construction sectors in Australia. The ACIF has established the Construction Forecasting Council (CFC)[17] 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 civil work or engineering type construction work in the WA market.

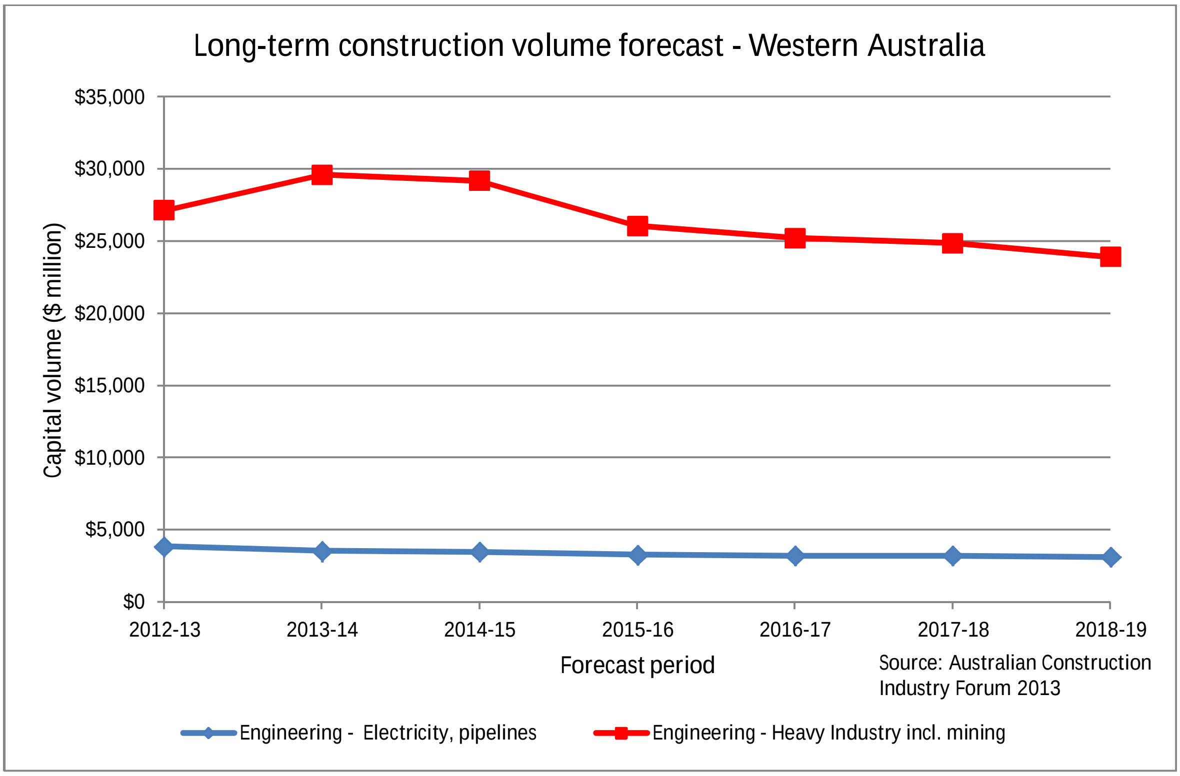
16 http://www.acif.com.au/
17 http://www.cfc.acif.com.au/cfcinfo.asp

In commenting on activity in construction related to the electricity and pipeline industry, the CFC in its most recent commentary (dated May 2013) notes the following:

> *"Energy and pipelines: Strong growth in the medium term is induced by the carbon price mechanism. There are a number of clean energy initiatives coming on line in the short term e.g. $2b wind farms in Silverton (NSW), $1b Kennedy (QLD),$2b Coolah (NSW), and Solar Dawn*
>
> *Western Australia: Very strong growth continuing, driven by mega gas and minerals projects, and the investment in associated infrastructure.*
>
> *Heavy industry including mining: Short term strong growth driven by three very large LNG projects: $30b Australia Pacific LNG, and $30b Wheatstone LNG "*[18].

This statement along with the commentary on construction activities related to heavy industry is illustrated in Figure 6-7 which shows forecast trends in WA.

Figure 6-7 Engineering (electricity & pipeline) construction volume in Australia and WA



This outlook is likely to sustain the market demand for related construction materials and activities, and thus the resultant market prices. The CFC also provides forecasts of the price index related to

[18] http://www.acif.com.au/forecasts/summary/highlights-for-engineering-construction

'engineering' construction category for overall Australia region. This is illustrated in Figure 6-8 and the figures with the calculated annual % change (or escalation factor) are shown in Table 6-7.

▪ **Figure 6-8 Australia wide engineering construction price index forecast**

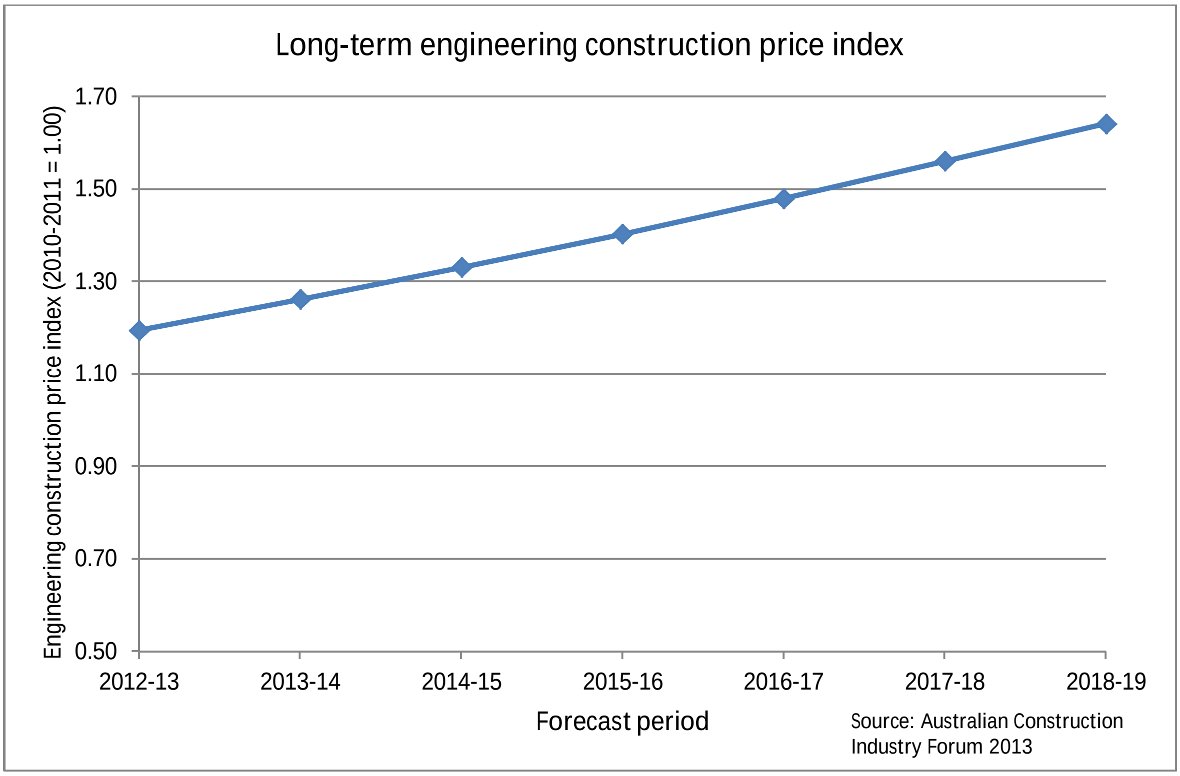


Table 6-7 Australia wide engineering construction nominal escalation factor forecast

Year end to	Jun-13	Jun-14	Jun-15	Jun-16	Jun-17	Jun-18	Jun-19
Price Index (2010-11 = 1.00)	1.195	1.262	1.331	1.403	1.480	1.561	1.642
% change		5.57%	5.52%	5.36%	5.50%	5.49%	5.13%

6.4. Carbon price mechanism impact

SKM has modelled the impact of the carbon price mechanism in Australia on the price of the commodities and the results shows that the impact ranges from being very small to nil. This is primarily driven by copper and steel manufacturing being classified as 'emissions-intensive trade-exposed' (EITE) activities and receiving substantial support from the Commonwealth government, tempering the price increase as a result of the carbon price mechanism.

The actual impact of the carbon price mechanism (or lack of) will be affected by various factors which are discussed below:

- The impact and therefore the inclusion of the Australian carbon price on the power station capital asset classes is dependent on the asset component make-up profile, prospective asset/project suppliers portfolio, market dynamics, competition and international pricing pressure. It is noted most of the power station capital plant equipment will be sourced from the international market which does not have any impact of an Australian carbon price mechanism. Only assets which are locally manufactured and for which the scope for international competition is negligible, will experience and be able to pass through the local carbon price impact. The magnitude of this impact is however very small and the extent of the pass through to the customer is uncertain. Further, given that some locally manufactured items will be made from imported materials, the international price may also act to constrain local price impacts.
- The assistance level for the EITE industries is generous for industries in the 'High' emission category and is designed to gradually decrease as the affected industries improve their efficiency and productivity increases in due course. This existing trade assistance is effective at vastly reducing but not eliminating this impact.
- Compared to aluminium production (for example), the emission intensities (measured in *tonnes of* CO_2 *emitted per tonne of commodity produced*) of copper and steel production are relatively low. Therefore, the additional cost of carbon emission for copper and steel production is relatively lower.
- Post July 2015 the Australian carbon price mechanism will be linked with the European Union Emission Trading Scheme allowing the trade of the carbon permits between the two markets. The future carbon emission permit price from the EU ETS market is considerably lower than the existing Australian price of carbon permission. This has been modelled or reflected in the latest Federal Government's projection of carbon price in the August 2013 Pre-election Economic and Fiscal Outlook (PEFO).

Based on these factors, SKM has not included the impact of the Australian carbon cost to the provided forecast of commodities price due to the anticipated negligible impact.

It is also noted that the new coalition government has proposed to remove the Australian carbon price mechanism by June 2014.

6.5. 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 in house knowledge, project experience and advice from SKM's team of professional 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 rates of each individual cost drivers are applied proportionally, to understand the effect of escalation of each cost driver to the overall asset costs.

6.6. Capital cost escalation factors

The final nominal capital cost escalation factors determined by SKM for the annual forecast year to end of June for the next 5 years are shown in Table 6-8.

- **Table 6-8 Nominal capital cost composite escalation factor annual forecast year to June for next 5 years**

Assets	Jun-14	Jun-15	Jun-16	Jun-17	Jun-18
Power station	5.92%	4.22%	4.03%	4.11%	3.82%

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 escalation factors in Table 6-8, the total capital cost estimate of the power station on **1 April 2015** is forecasted as **$ 127,080,000** which equates to **844 $/kW**[19]. This forecast estimate is as per Section 2.3.1 (a) of the Market Procedure for MRCP (version 5) which requires the estimate as at April in Year 3 of the Reserve Capacity Cycle.

6.7. Fixed operational & maintenance cost escalation factors

The final nominal operating cost escalation factors determined by SKM for the annual forecast year to June for the next 5 years are shown in Table 6-9.

- **Table 6-9 Nominal fixed O&M cost composite escalation factor annual forecast year to June for next 5 years**

Assets	Jun-14	Jun-15	Jun-16	Jun-17	Jun-18
Power station	3.60%	3.60%	3.60%	3.60%	3.60%
Connection switchyard	4.32%	4.32%	4.32%	4.32%	4.32%
Overhead transmission line	4.32%	4.32%	4.32%	4.32%	4.32%

The fixed O&M cost escalation factors for the connection switchyard and the overhead transmission line follow 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

[19] Based on 150.5 MW net output as defined in section 2.5.

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 or multiple cost driver indices.

Using the escalation factors in Table 6-9, the fixed O&M cost estimate of the power station in **October 2015** is forecasted as **$ 2.265 million per annum** (or $ 11.33 million for a 5 years period in Oct 2015 dollars).

Similarly, the fixed O&M cost estimate of the connection switchyard and the overhead transmission line in **October 2015** are **$ 63,100 per annum** (or $ 316,000 for a 5 years period in Oct 2015 dollar) and **$ 1,230 per annum** (or $ 6,150 for a 5 years period in Oct 2015 dollars) respectively.

These forecast estimates are as per Section 2.5.6 (a) of the Market Procedure for MRCP (version 6) which requires the fixed O&M estimates as at October in Year 3 of the Reserve Capacity Cycle.

7. Calculation of the M factor

7.1. Introduction

The allowance, M, to be included for "Legal, Insurance, Approvals, Other Costs and Contingencies" is to be estimated in accordance with **Section 2.8** 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).

7.2. Implications of the specified procedure

The following assumptions 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 Siemens SGT5-2000E liquid fuelled gas turbine plant re-valued to a nominal capacity of 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 can be up to 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 should 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 that is taken to be 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.

7.3. Values applied for 2013

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 2013 scope and values and whether any changes are considered appropriate in the 2014 review.

The parameters applied in the 2013 review for the M factor are listed in Table 7-1. These components are discussed below.

Table 7-1 Calculation of the M factor in 2013

Component of 'M'	2013 % of EPC	2013 $k AUD
Project management	1.96%	$2,391
Project insurance	0.50%	$609
Cost of raising capital	3.00%	$3,651
Environmental approvals	0.82%	$1,000
Legal costs	1.19%	$1,448
Owner's engineer - part A (including concept design, specification, tendering, contract negotiations)	0.44%	$531
Owner's engineer - part B (including construction phase OE costs, oversee project, witness tests & commissioning)	3.06%	$3,718
Initial spares requirements	0.80%	$974
Site services (provision of potable water, construction power, communications, domestic sewerage etc. at site)	0.10%	$122
Start-up costs	2.00%	$2,434
Contingencies	5.00%	$6,085
Total M	**18.87%**	**$22,962**

These were applied to a base EPC capex estimate of $ 121.7 million in 2013. The following analysis is based on a 2014 estimate of $ 116.3 million.

The prescribed method is unchanged from the 2013 update.

7.4. Derivation of the M factor for 2014

7.4.1. Project management and owner's engineering

These costs typically are made up of consulting engineering services and have been broken down into three components – project management by the developer / owner and owner's engineering costs which may be via a contract with a services provider. The latter are separated into pre and post commitment costs. As before, we have used the producer price indices to escalate the 2013 costs. The change in producer price indices (PPI) (Australia wide) for "Engineering design and engineering consulting services" from June 2012 to June 2013 has been 0.8%[20].

7.4.2. Legal

The legal costs allowed in 2013 amounted to $ 1.45million. This would be expected to cover a full service such as for a project financed project. For a corporate financed 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.

The 2013 amount has been escalated at the PPI rate for "Legal services" of 7.3%[21].

7.4.3. Insurance

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 carries during construction, this may include early order plant.
- Owner's public liability and professional indemnity insurances.
- Other owners insurances during construction.

An allowance of 0.5% has been provided in the margin M to cater for these costs. This is in line with the 2013 update which had an increase from the 2012 update due to market information on increases in insurance premiums.

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[20] ABS "6427.0 Producer Price Indexes, Australia", Table 24. Selected output of division M professional, scientific and technical services, group and class index numbers, Series A2314202T.

[21] ABS op cit, Series A2314223C.

7.4.4. 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 EP 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 $100K to $500K, varying with the level of desktop environmental studies required. The core of this is 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 $600K to $2.0million 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 more 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 $ 1.0 million is applied. This is unchanged from the 2013 update.

7.4.5. Financing costs associated with equity raising

The specification for consideration of the WACC parameters requires comparator companies with market capitalisation of at least $ 200 million. For "typical" parameters of P/E ≈ 15 and payout ratio of 60% internal equity growth would be in the order of $5million/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 2013 an allowance of 3% was provided for the "Cost of raising capital", on the basis this was equity raising costs only (a debt issuance cost being included within the WACC).

The allowance of approximately 3% is still considered appropriate.

7.4.6. Initial spares and site services

The 2013 allowances for initial spares of 0.8% and for site services of 0.1% are considered reasonable.

7.4.7. Start-up costs

Start-up costs were considered for the first time in 2012 and reassessed in 2013. 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.

The previous allowance of 2% is still considered appropriate.

7.4.8. Contingency costs

The "contingency" allowed in 2013 was 5%, reflecting an allowance for minor and unidentified items. These could include things such as undetected latent conditions, risk of contractor insolvency, unseasonal or divergent weather patterns, 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 B**) and previous year's reports.

7.5. Overall M factor

The M factor resulting from this analysis is given in Table 7-2.

- **Table 7-2 Calculation of M factor 2014**

Component of 'M'	2013 % of EPC	2014 % of EPC	2014 $k
Project management	1.96%	2.07%	$2,410
Project insurance	0.50%	0.5%	$581
Cost of raising capital	3.00%	3.00%	$3,489
Environmental approvals	0.82%	0.86%	$1,000
Legal costs	1.19%	1.34%	$1,554
Owner's engineer - part A (including concept design, specification, tendering, contract negotiations)	0.44%	0.46%	$535
Owner's engineer - part B (including construction phase OE costs, oversee project, witness tests & commissioning)	3.06%	3.22%	$3,748
Initial spares requirements	0.80%	0.80%	$930
Site services (provision of potable water, construction power, communications, domestic sewerage etc. at site)	0.10%	0.1%	$116
Start-up costs	2.00%	2.00%	$2,326
Contingencies	5.00%	5.00%	$5,815
Total M	**18.87%**	**19.35%**	**$22,504**

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 work.

Appendix A Estimate classification criteria

APPENDIX B2 ESTIMATE CLASSIFICATION CRITERIA

The following table indicates the requirements for compiling capital cost estimates to the nominated accuracy, and also as a basis for the review process at this phase of the study. This is a guide only and may vary in some areas due to the documentation made available at the time the study period commences.

	Class 4 *Order of Magnitude/Concept*	Class 3 *Pre-Feasibility Study (PFS)*	Class 2 *Feasibility Study (FS)*	Class 1 *Definitive Estimate*
METHODOLOGY	Capacity factored (1) Equipment Factored (2) Historical data/Parametric models	Combination of MTO's, budget pricing, factors and semi-detailed unit rates	Detailed MTO's, detailed unit costs, budget pricing for all major equipment. Defined equipment list	Combination of commitments, awarded contracts, defined unit rates & detailed MTO's
PURPOSE	Preliminary economic and technical Investigation. Project screening. Comparison of alternatives, configurations and options.	Economic Feasibility of one or more chosen options.	Project Approval and basis of securing financing. "Bankable " study	Detailed Control. Target measurement Change/Variation Monitor and control of implementation phase.
BASIS OF ESTIMATE				
Accuracy - Indicative Range	±30% to ±100%	±20%to ±25%	±10%to ±15%	±5% to ±10%
Accuracy Development	Judgmental	Evaluated	@Risk Detail Analysis	@Risk Detail Analysis
Level of Project Definition	0% to 5%	10% to 30%	30% to 70%	70% to 100%
Level of Engineering(% of total)	0 to 2%	2 to 5%	15 to 30%	30 to 100%
Expected Contingency Range	25% to 40%	15% to 20%	10% to 15%	5% to 10%
Contracting Strategy	Assumed	Preliminary	Defined	In Place
SITE				
Location	Assumed	Specific	Specific	Final
Maps and Surveys	None	Preliminary	Some detail	Detail
Soil Tests & Geotechnical	None	Preliminary	Final	Final
Site Visits	Not Required	Desirable	Essential	Construction Start
Construction Support	Assumed	Proposed method	Detail support	Final
Construction site Agreement	Assumed	Assumed	Prelim discussion	Final / In Place
Delivery Strategy	Assumed	Preliminary	Defined	Fixed
Labour Awards	None	Assessed	Detailed basis	Actual
GENERAL PROJECT DATA				
Project Scope Description	General	Defined	Defined	Defined
Plant Production/Facility Capacity	Identified	Defined	Defined	Defined
Hydrology and Soils Report	Assumed	Defined	Defined	Actual
Integrated Project Plan	General	Preliminary	Specific	Fixed
Project Master Schedule	Assessed	Preliminary	Detailed	Defined
Escalation Strategy	None	Preliminary	Defined	Defined
Work Breakdown Structure (WBS)	Outlined	Preliminary	Complete	Fixed/Package
Project Code of Accounts	None	Preliminary	Defined	Complete
Foreign Exchange	None	Preliminary	Defined/Agreed	Fixed
Contingency/Accuracy Strategy	Assessed/Factored	Deterministic	Probabilistic	Detail calc. on ETC
Estimate Basis Document	Outlined	Defined	Detailed	Detailed
ENGINEERING DELIVERABLES				
Design Criteria	Outlined	Preliminary	Optimised/Final	Fixed
Technology	Existing	Selected Options	Confirmed/Complete	Complete
Block Flow Diagrams	Basic	Preliminary/Complete	Optimised/Final	Complete
Plot Plans	None	Preliminary	Detailed	Complete
Process Flow Diagrams (PFD's)	None	Started/Preliminary	Optimised/Final	Complete
Utility Flow Diagrams (UFD's)	Outlined	Started/Preliminary	Preliminary/Complete	Complete
Piping & Instr. Diagrams (P&ID's)	None	Outlined	Optimised/Final	Complete
Heat & Material Balances	None	Preliminary	Optimised/Final	Complete
Process Equipment List	None	Preliminary	Detailed	Complete
Utility Equipment List	None	Preliminary	Detailed	Complete
Electrical Single Line Diagrams	None	Preliminary	Preliminary/Detailed	Complete
Specifications & Data Sheets	None	Preliminary	Detailed	Complete
General Arrangement Drawings	None	Preliminary	Approved for Design	Complete
Spare Parts Inventory	None	% of Direct Costs	Detailed	Complete
Detailed Design Drawings	None	None	None	Preliminary/Complete
CAPITAL COST ESTIMATE				
Direct Costs	Factored	Combination	Detail	Actual/Detail
Indirect Costs	Factored	Combination	Detail	Actual/Detail
Major Equipment Costs	Data Base / Factored	Single Source	Multiple Source	Fixed Tender
Civil Work	Rough quantity	Preliminary	Detailed Take-off	Tender Prices/Contracts
Structural Work	$/unit vol.	Prelim take-off	Detailed Take-off	Tender Prices/Contracts
Piping & Instrumentation	% Machinery	Prelim take-off / %	Detailed Take-off	Tender Prices/Contracts
Electrical	$/kW	Prelim take-off	Detailed Take-off	Detailed/Contracts
Installation	Factored/%	Site Hours/Rates	Site Hours/Rates	Site Hours/Contracts
Owners Costs	Factored/%	Excluded	Provided	Detailed

Appendix B Scope of work

B.1 Project scope

SKM shall provide the following estimates and information.

B.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;

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   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.
   h. Include the minimum level of equipment or systems required to satisfy the Balancing Facility Requirements

B.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 Detection and Protection Systems.
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 B.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.

B.1.3 Fixed fuel cost

2. Fixed fuel costs for the liquid fuel storage and handling facilities including:
   a. A fuel tank of 1,000 t (nominal) capacity including foundations and spillage bund suitable for 14 hours operation.
      1. Facilities to receive fuel from road tankers.
      2. All associated pipework, pumping and control equipment.
3. The estimate will be based on the following assumptions:
   a. Land is available for use and all appropriate permits and approvals for both the power station and the use of liquid fuel have been received.
   b. Any costing components that may be time-varying in nature must be disclosed by the IMO. Such components might be the cost of the liquid fuel, which will vary over time and as a function of exchange rates etc.
4. SKM notes that the costing must only reflect fixed costs associated with the fixed fuel cost (FFC) component and must include an allowance to initially supply fuel sufficient to allow for the Power Station to operate for 14 hours at maximum capacity.
5. Fixed fuel costs (FFC) must be determined as at April in Year 3 of the Reserve Capacity Cycle. Where costs have been determined at a different date, those costs must be escalated using the annual CPI cost escalation factor.

B.1.4 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.