DRAFT REPORT: 2017 BENCHMARK RESERVE CAPACITY PRICE FOR THE 2019–20 CAPACITY YEAR

FOR THE WHOLESALE ELECTRICITY MARKET

November 2016

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

IMPORTANT NOTICE

Purpose

AEMO has prepared this document under section 4.16 of the Wholesale Electricity Market Rules to provide information about the proposed final revised value of the 2017 Benchmark Reserve Capacity Price for the 2019–20 Capacity Year, as at the date of publication.

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EXECUTIVE SUMMARY

Each year, the Australian Energy Market Operator (AEMO) is required to determine the Benchmark Reserve Capacity Price (BRCP) in accordance with the Market Procedure: Maximum Reserve Capacity Price (Market Procedure)[1] for the Western Australian Wholesale Electricity Market (WEM).

The BRCP is used to set the maximum price that may be offered in a Reserve Capacity Auction, or as an input in the determination of the administered Reserve Capacity Price if an auction is not required. It aims to establish the marginal cost of providing one additional megawatt (MW) of Reserve Capacity in the relevant Capacity Year.

This report presents the outcome of the draft determination of the BRCP for the 2017 Reserve Capacity Cycle. The 2017 BRCP applies for the 2019–20 Capacity Year, covering the period from 8:00 AM on 1 October 2019 to 8:00 AM on 1 October 2020.

The BRCP is calculated by undertaking a technical, bottom-up cost evaluation of the entry of a new 160 MW open cycle gas turbine (OCGT) generation facility in the South West interconnected system (SWIS) in the relevant Capacity Year. The broad methodology applied to determine the BRCP has not changed in the last five years, and includes the following costs:

- Building a 160 MW OCGT power station with inlet cooling.
- Acquiring land to develop and construct the power station.
- Connecting the power station to the transmission system.
- Building liquid fuel storage and handling facilities sufficient for the power station to operate for 14 hours at full capacity.
- Fixed operating and maintenance (O&M) costs associated with the power station and transmission facilities.
- A margin (Margin M) for legal, approval, financing, and insurance costs and contingencies.
- The weighted average cost of capital (WACC).

The complete methodology used to determine the BRCP is outlined in the Market Procedure.

Proposed 2017 BRCP for the 2019–20 Capacity Year

AEMO proposes a value of $145,800 per MW per year for the 2017 BRCP, 8.8% lower than the 2016 Maximum Reserve Capacity Price[2] of $159,800 per MW per year.

[1] Please note this Market Procedure has not been updated to reflect the amendments to the WEM Rules that commenced on 1 July 2016 as a result of the Electricity Market Review. The Maximum Reserve Capacity Price is now referred to as the Benchmark Reserve Capacity Price and all references to the Independent Market Operator should now refer to AEMO. The Economic Regulation Authority is now responsible for this Market Procedure which is available at: https://www.erawa.com.au/cproot/14362/2/Market%20Procedure%20-%20Maximum%20Reserve%20Capacity%20Price.pdf.

[2] Please note that from this point on the 2016 MRCP will be referred to as the 2016 BRCP.

Changes from the 2016 BRCP

Table 1 shows the year-on-year variation in the input parameters between the 2016 BRCP (for the 2018–19 Capacity Year) and the 2017 BRCP.

Table 1 Breakdown of variance between 2016 and 2017 BRCP

	Impact ($)	Impact (%)	BRCP (AU$)
2016 BRCP			**159,800**
Escalation factors	-5,100	-3.2	154,700
Power station cost	1,500	0.9	156,200
Margin M	-2,400	-1.5	153,800
Fixed fuel cost	-200	-0.1	153,600
Land cost	-100	-0.1	153,500
Transmission cost	1,500	0.9	155,000
WACC	-7,400	-4.6	147,600
Fixed O&M	-1,800	-1.1	145,800
2017 BRCP	**-14,000**	**-8.8**	**145,800**

The key changes from the 2016 BRCP are:

- Lower escalation factors have reduced the 2017 BRCP by 3.2%, largely due to lower forecasts of commodity prices and labour costs.
- Margin M has reduced the 2017 BRCP by 1.5%, as a result of a reduction in environmental approval and permitting costs.
- The WACC has reduced the 2017 BRCP by 4.6%, due to a negative real risk free rate. AEMO notes that while a negative risk free rate is not sensible in the current Australian market, the Market Procedure does not provide discretion for an alternative value to be used.

Invitation for submission

AEMO invites submissions on the proposed 2017 BRCP and the supporting information by **5:00 PM (Western Standard Time)** on **2 December 2016**. More details on the required submission format are provided in Chapter 4.

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1. INTRODUCTION

The Benchmark Reserve Capacity Price (BRCP) is used to set the maximum price that may be offered in a Reserve Capacity Auction. A Market Participant may offer up to 110% of the BRCP when submitting their Reserve Capacity Offer into the Reserve Capacity Auction. If an auction is not required, the BRCP is used as an input in the determination of the administered Reserve Capacity Price. The BRCP aims to establish the marginal cost of providing one additional megawatt (MW) of Reserve Capacity in the relevant Capacity Year.

This report presents the components and outcome of the BRCP draft determination for the 2017 Reserve Capacity Cycle[3], which applies to the 2019–20 Capacity Year. Following the public consultation process, AEMO must consider submissions before submitting a final 2017 BRCP to the Economic Regulation Authority (ERA) for approval in accordance with clause 4.16.7 of the Wholesale Electricity Market (WEM) Rules.

1.1 Overview of input parameters

The BRCP is calculated by undertaking a technical, bottom-up cost evaluation of the entry of a new 160 MW open cycle gas turbine (OCGT) generation facility in the South West interconnected system (SWIS) during the relevant Capacity Year. The broad methodology and fixed input parameters used to determine the BRCP have not changed in the last five years due to the deferral of the five yearly review of the Market Procedure: Maximum Reserve Capacity Price (Market Procedure) to 2017.[4]

In determining the 2017 BRCP, AEMO used publicly available information including advice from independent consultants, Western Power, and the Western Australian Land Information Authority (Landgate).

The organisations and the input parameters they provided are shown in Table 2 below.

Table 2 Consultants and agencies

Organisation	Cost estimates provided
GHD (Australia)	Power station capital costs and relevant escalation factors Margin for legal, approval, financing, insurance, other costs and contingencies Fixed fuel costs Generation O&M costs and relevant escalation factors Switchyard O&M costs and relevant escalation factors Transmission line O&M costs and relevant escalation factors
Landgate	Land costs
PricewaterhouseCoopers (PwC)	Debt risk premium (DRP)
Western Power	Transmission connection costs and relevant escalation factors

Throughout this report, cost and price estimates are expressed in Australian dollars, unless otherwise specified.

[3] See http://wa.aemo.com.au/home/electricity/reserve-capacity/reserve-capacity-timetable-overview.

[4] Please note this Market Procedure has not been updated to reflect the amendments to the WEM Rules that commenced on 1 July 2016 as a result of the Electricity Market Review. The Maximum Reserve Capacity Price is now referred to as the Benchmark Reserve Capacity Price and all references to the Independent Market Operator should now refer to AEMO. The Economic Regulation Authority is now responsible for this Market Procedure which is available at: https://www.erawa.com.au/cproot/14362/2/Market%20Procedure%20-%20Maximum%20Reserve%20Capacity%20Price.pdf.

1.3 Supporting documentation

The following related documents are available on AEMO's website[5]:

- 2017 BRCP calculation spreadsheet, draft report version.
- GHD report, *2017 Benchmark Reserve Capacity Price for the South West Interconnected System* (20 October 2016).
- PwC letter, *Determining the debt risk premium using the ERA's 'Bond Yield Approach'* (25 October 2016).
- Landgate report, *Land values for the 2017 Benchmark Reserve Capacity Price* (16 September 2016).
- Weighted Average Cost of Capital (WACC) parameter calculation spreadsheet for draft report.
- Western Power report, *Total Transmission Cost Estimate for the Benchmark Reserve Capacity Price for 2019/20* (14 October 2016).

[5] See http://www.aemo.com.au/Electricity/Wholesale-Electricity-Market-WEM/Reserve-capacity-mechanism/Benchmark-Reserve-Capacity-Price.

2. 2017 BRCP INPUT PARAMETERS

1.2 Escalation factors

The 2017 BRCP calculation is based on a theoretical power station that would commence operation on 1 October 2019. Costs have been determined as at 2016 and have been escalated to 2019.

Depending on the type of component cost being estimated, different escalation factors are used. This is summarised in Table 3.

Table 3 Cost escalation forecast

Escalation factor	Component costs applied to	Source and methodology
Power station capital cost	Power station capital cost	The methodology is derived by GHD and summarised in their report. The determination involves sourcing information from the Australian Bureau of Statistics, London Metal Exchange, Reserve Bank of Australia and the CME Group.
Generation O&M cost	Generation O&M cost	
Connection asset O&M cost	Switchyard O&M cost Transmission line O&M cost	
Consumer Price Index (CPI)	Asset insurance O&M cost Fixed network access and ongoing O&M charges Fixed fuel cost Land cost	A general measure of price inflation for all Australian households is forecast by the Reserve Bank of Australia (RBA). Where a forecast range is provided, the mid-point is applied. For the first year outside of the RBA's forecast horizon, the average of the previous year's forecast and the mid-point of the RBA's target for inflation is used. For all periods beyond, the mid-point of the RBA's target for inflation is used.
Transmission connection cost	Transmission connection cost	This is estimated using the average change over five years as per clause 2.4.2 of the Market Procedure. However, as five years of actual data was not available for the 2017 BRCP the escalation rate is averaged over a period for which equivalent data is available. Western Power provides these escalation factors.

The escalation factors by financial year that were applied to the 2017 BRCP are listed in Table 4.

Table 4 Escalation factors

Escalation factor	2016–17	2017–18	2018–19	2019–20
Power station capital cost	-1.01%	2.51%	1.96%	2.81%
Generation O&M cost	2.58%	1.85%	2.33%	2.33%
Connection asset O&M cost	1.60%	1.60%	1.90%	1.90%
CPI	2.00%	2.00%	2.25%	2.50%
Transmission connection cost	-0.02%	-0.02%	-0.02%	-0.02%

All escalation factors have decreased from the 2016 Maximum Reserve Capacity Price[6] except for the transmission connection cost escalation. Persistent low commodity prices, in particular for copper and steel, have reduced the power station capital cost escalation factor. Slow growth in labour costs associated with subdued activity in the resources and energy sectors have lowered the generation and connection O&M escalation factors.

[6] Please note that from this point on the 2016 MRCP will be referred to as the 2016 BRCP.

1.3 Capital costs

1.3.1 Power station capital cost (PC)

GHD used the Siemens SGT5-2000E (33MAC) 173 MW[7] OCGT as the reference equipment to determine the power station capital cost component of the 2017 BRCP, consistent with the 2016 BRCP. The unit is considered to be the most appropriate machine available to meet the criteria for the BRCP calculation.[8] GHD used version 25 of Thermoflow's GTPro[9] model to evaluate the plant equipment, engineering, procurement, and construction capital costs. Estimated costs were referenced against similar completed projects in Australia where possible

The total capital cost was escalated to 1 April 2019 using the power station capital cost escalation factor.

The proposed value of **PC = $810,229 per MW**.

The estimated PC has decreased by 2.9% (a reduction of around $25,000) from the 2016 BRCP, due to lower commodity prices and labour costs.

1.3.2 Capacity Credit (CC) allocation

GHD used GTPro to model the output of the 160 MW reference generator by adjusting the expected performance of the equipment to site conditions at Muja power station (41°C, 30% relative humidity, and 217 metres above sea level).

The proposed value of **CC = 148.5 MW**.

1.3.3 Legal, approval, financing, insurance, other costs and contingencies (M)

'Margin M' covers legal, approval, financing, insurance, other costs, and contingencies during the project construction phase. It is estimated from similar costs associated with recent, comparable developments from GHD's data bank, excluding any project-specific abnormal costs. The costs are scaled to the reference equipment where relevant. Margin M is then added as a fixed percentage of the capital cost of developing the power station.

The proposed value of **M = 17.19%**.

The reduction in Margin M from 20% in the 2016 BRCP is due to a significant reduction in environmental permit and approval costs, which is now based on a less arduous works approval assessment.

1.3.4 Land costs (LC)

Land valuations were made for the following six regions where development of a power station in the SWIS is most likely:

- Collie.
- Kalgoorlie.
- Kemerton Industrial Park.
- Kwinana.
- North Country (Eneabba and Geraldton).
- Pinjar.

[7] This is the nameplate rating provided by GTPro.
[8] There is currently no generator available on the market that matches the specifications of the Market Procedure. As a result, GHD has scaled the estimation for the 173 MW Siemens unit to represent the expected configuration of the 160 MW generator specified in the Market Procedure.
[9] Further information is available at: http://www.thermoflow.com/combinedcycle_PCE.html

Landgate assessed hypothetical land sites for each region in or near existing industrial estates for land that would be suitable for the development of a power station. Valuations were completed as at 30 June 2016 and exclude transfer duty (previously known as stamp duty). AEMO has added the applicable transfer duty to the land parcel cost using the Office of State Revenue's online calculator.[10]

AEMO calculated the average of the six valuations and escalated this to 1 April 2019 using the CPI escalation factor. The size of the land parcels for all regions was three hectares, except for Kemerton, where the minimum land size is five hectares.

The proposed value of **LC = $2,430,526**.

The LC estimates decreased by 8.5% from the 2016 BRCP. The continued slowdown in the WA economy, driven by a weakening resources sector, has reduced demand for industrial land, resulting in lower sales and land prices. This has affected the land valuations of Geraldton, Kwinana and Pinjar regions.

1.3.5 Transmission connection cost (TC)

TC is based on a weighted average of the capital contributions of generators connecting to the SWIS over the previous five years. Estimates are based on actual connection costs and access offers identified by Western Power through its confidential database.

As there is no actual project data available in the five-year window, Western Power estimated the shallow connection cost in accordance with the methodology described in the Market Procedure. The methodology includes the estimation of capital costs such as the procurement, installation and commissioning of the substation and easement costs. Western Power provided an independent audit report to verify the accuracy of the estimates on the basis that the underlying data is commercial in-confidence and therefore cannot be published.

Shallow connection cost estimates include construction of a substation, 2 kilometres (km) of overhead line to the power station, and an overhead line easement. AEMO provides easement costs to Western Power for use in estimating shallow connection costs. AEMO's easement cost estimate is based on the following assumptions:

- The easement is 12 hectares (2 km long and 60 metres wide).
- A new generator may not need to purchase the entire 12 hectares, instead securing easement rights for some or all of the land. AEMO estimates easement costs to be half of the land value.
- The land value includes transfer duty.

Easement costs have decreased by 7.9% from the 2016 BRCP, due to a fall in land values in the Geraldton, Kwinana, and Pinjar regions (see Section 2.2.4 for more information).

The shallow connection costs have decreased from $22,983,826 to $22,558,523 for the 2017 BRCP.

The proposed value of **TC = $175,444 per MW**.

No escalation factors have been applied, as Western Power has already escalated the TC estimate to 1 April 2019.

The TC estimate has increased from the 2016 BRCP value of $160,280. Despite the decrease in shallow connection costs and easement costs the overall TC estimate has increased by 9.5%. This is due to the increase in the other components of the TC estimate provided by Western Power that AEMO does not have visibility into.

1.3.6 Fixed fuel cost (FFC)

FFC is the cost associated with developing and constructing onsite liquid fuel storage and supply facilities, and supporting infrastructure, including the initial cost of filling the tank with diesel to a level

[10] Available at: https://rol.osr.wa.gov.au/Calculators/faces/Calculators?_afrLoop=247790592985840&_afrWindowMode=0&_adf.ctrl-state=re8l3w9ui_4.

sufficient for 14 hours of operation. GHD provided an estimate of FFC as of 30 June 2016, which is escalated to 1 April 2019 using the CPI escalation factor. The cost of diesel includes delivery and excise but excludes GST.

The proposed value of **FFC = $6,803,924**.

The FFC estimate decreased by 4.0% from the 2016 BRCP. This is largely associated with a decrease in the price of delivered diesel to $0.66 per litre (10.8% lower than the 2016 BRCP), as a result of low international oil prices, the slightly lower gross output of the reference equipment, and a higher fuel to energy efficiency rating. Therefore, the cost of the first fill of the storage tank has fallen to $434,000, compared to $600,300 in the 2016 BRCP.

1.3.7 Weighted average cost of capital

The WACC is determined by using the Capital Asset Pricing Model to estimate the costs of equity and debt. The debt risk premium (DRP) was estimated by PwC, while the risk free rate and expected inflation components of the WACC are calculated using information available from the RBA's website.[11] The nominal risk free rate is determined using observed yields of Commonwealth Government bonds, while the DRP is derived using observed yields of corporate bonds. A corporate tax rate of 30% is assumed.

Appendix A provides more detail about the steps for estimating the WACC.

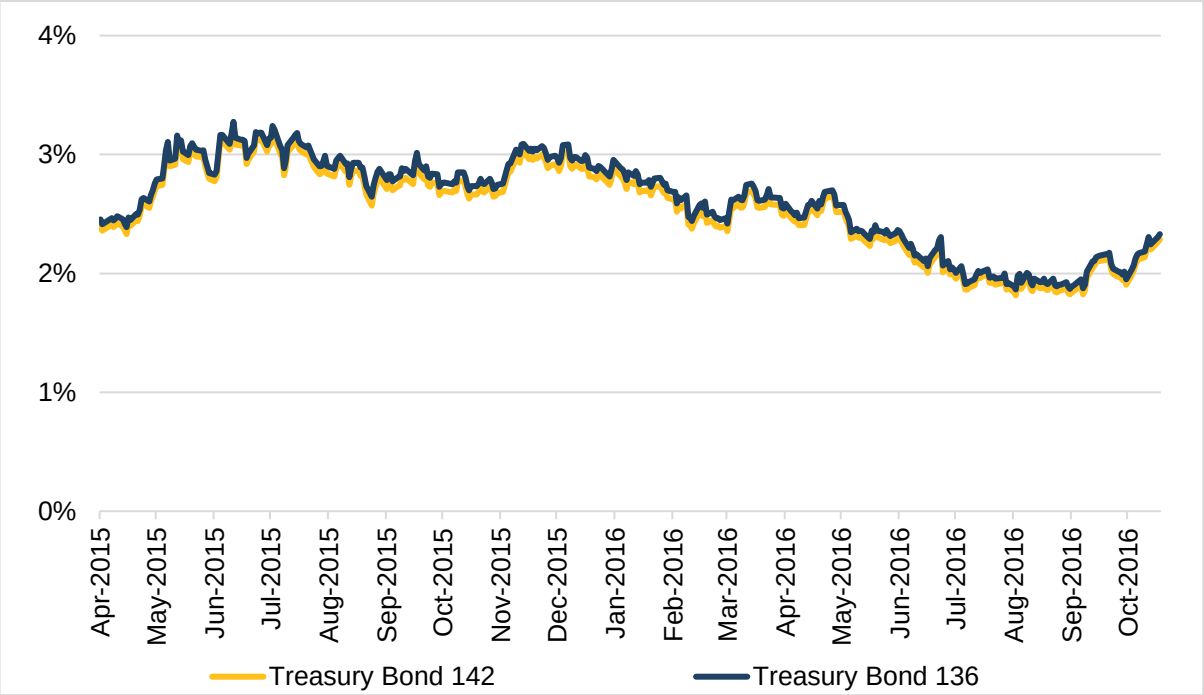
Risk free rate of return methodology

The nominal risk free rate is calculated from the annualised yield of a selection of Commonwealth Government bonds with maturity dates of roughly 10 years. The rate is estimated using a 20-day average from market observations ending on 18 October 2016.

Commonwealth Government bond yields have fallen since the 2016 BRCP in line with a decline in global bond yields, as shown in the figure below. The nominal risk free rate calculated from these bonds is 2.12%, a decrease from 2.92% in the 2016 BRCP.

[11] See http://www.rba.gov.au/statistics/tables/ and http://www.rba.gov.au/publications/smp/index.html.

Figure 1 Commonwealth Government bond yields, April 2015 to October 2016



The nominal rate is then adjusted for inflation to determine the real risk free rate of return. As per the Market Procedure, AEMO is required to use the RBA's inflation forecasts or the mid-point of the RBA's target inflation range outside of the forecast period. Based on the RBA's forecasts and target of 2% to 3%, the expected rate of inflation is 2.39%.

The above parameter values have resulted in a real risk free rate of -0.26%. AEMO notes that a negative risk free rate is not sensible for the Australian market, as it would imply that riskier assets are generating negative returns. However, the All Ordinaries stock index has increased by 6.8% between January and October 2016, and the Standard and Poors/Australian Stock Exchange 200 index has increased by 6.2%.[12]

If the expected rate of inflation is replaced with the current rate of inflation of 1%,[13] the real risk free rate of return is 1.11%. AEMO considers this to be a better representation of the current market. However, AEMO has no discretion to deviate from the methodology stipulated in the Market Procedure.

In addition, AEMO notes the ERA calculated a negative real risk free rate in the *Determination on the 2016 Weighted Average Cost of Capital for the Freight and Urban Railway Networks, and for Pilbara railways*.[14] This was due to an assumed long-term inflation rate of 2.5%, which the ERA determined was not representative of inflation expectations implicit in prices observed in the market. Hence the ERA deviated from their methodology and used an inflation rate of 1.74%, calculated from Treasury Bonds and Treasury Indexed Bonds.

Debt risk premium methodology

The Market Procedure requires AEMO to determine the methodology to estimate the DRP which in the opinion of AEMO is consistent with currently accepted Australian regulatory practice.

[12] See http://www.asx.com.au/about/historical-market-statistics.htm for more information.
[13] Australian Bureau of Statistics. 2016. *Consumer Price Index, Australia, June 2016*. Available at: http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/6401.0Main+Features1Jun%202016?OpenDocument. Viewed: 2 November 2016.
[14] Available at https://www.erawa.com.au/cproot/14527/2/Att%201%20Rail%20-%20WACC%20Final%20Determination%20of%20WACC%202016%2061%202017.PDF.

The ERA has recently adopted a modified bond yield approach to estimate the DRP for *the Final Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution Systems.*[15] AEMO considers this revised methodology to be representative of current accepted Australian regulatory practice, and the DRP has been calculated accordingly. AEMO notes that the revised methodology was supported by a number of Market Participants during the consultation period for the 2016 BRCP.

The revised bond yield approach uses a larger sample of bonds issued by Australian utilities on Australian and international markets to estimate a bond yield curve to calculate a 10-year DRP. PwC estimated the DRP at 2.32% from market observations ending on 14 October 2016.

Capital Asset Pricing Model results

The proposed value of the **WACC (real terms) = 4.82%**.

This is lower than the WACC (real terms) of 5.69% used in the 2016 BRCP. This is a direct result of the negative real risk free rate of return calculated in accordance with the Market Procedure.

AEMO notes that if the current rate of inflation is used in the estimation of the real risk free rate of return, the WACC (real terms) is 6.26%. Using a WACC of 6.26% results in the proposed BRCP increasing by 8.6% ($158,300), which is closer to the 2016 BRCP.

The WACC methodology outlined in the Market Procedure has been questioned by Market Participants during the consultation period of previous BRCP determinations. AEMO has compiled a list of these and other concerns regarding the methodology (see Appendix C) and will provide this information to the ERA for consideration during the review of the Market Procedure tentatively scheduled for next year.

1.4 Operating and maintenance costs

1.4.1 Generation O&M costs

Generation O&M costs assume that the OCGT plant is based on a single gas turbine capable of delivering a nominal 160 MW output, using diesel fuel, with a 30-year operating life and a 2% capacity factor. Gas connection costs are therefore not considered. An allowance for balance of plant (service of pumps, fire systems etc.) has been included.

A 15-year annuity is calculated based on individual component costs as at June 2016, which are derived from similar recent OCGT projects. These costs are then escalated to 1 October 2019 using the generation O&M escalation factor.

The proposed value of **generation fixed O&M costs = $14,572 per MW per year**.

The estimated O&M cost decreased by 10.8% from the 2016 BRCP. This is due to the decrease in the generation O&M escalation factor (see Section 1.2 for more detail).

1.4.2 Switchyard O&M costs

Switchyard O&M costs are calculated from the isolator on the high voltage side of the generator transformer and do not include any generator transformer or switchgear associated costs.

A bottom-up approach is used to estimate the switchyard costs, based on the annual charge for the connection infrastructure. The cost estimate includes labour, machinery parts, and general overheads that are incurred during routine maintenance, which occurs one week per year on average.

The 330 kV switchyard is assumed to have an average asset life of 60 years. A 15-year annuity is calculated based on the cost estimate as at June 2016, which is then escalated to 1 October 2019 using the connection O&M escalation factor.

[15] Available at https://www.erawa.com.au/cproot/13880/2/GDS%20-%20ATCO%20-%20AA4%20-%20Amended%20Final%20Decision%20-%20PUBLIC%20VERSION.PDF.

The proposed value of **switchyard O&M costs = $528 per MW per year**.

The switchyard O&M cost estimate increased by 7.3% from the 2016 BRCP. GHD considers the 2016 cost estimate to be undervalued. However, a comparison of the costs is not possible as the previous consultant used to develop the 2016 BRCP provided limited details on their switchyard assumptions. AEMO has ensured that GHD completed a bottom-up technical approach when setting their assumptions.

1.4.3 Transmission line O&M costs

The new transmission line is assumed to be a single circuit 330 kV construction with two conductors per phase and is assumed to have an average asset life of 60 years. The rating of the line is selected to facilitate the transport of up to 200 MVA (power factor of 0.8). A bottom-up approach is used to estimate the transmission costs based on the annual charge for the connection infrastructure.

The cost estimate includes labour, machinery parts, and general overheads that are incurred during routine maintenance. A 15-year annuity is calculated based on the cost estimates as at June 2016, which is then escalated to 1 October 2019 using the connection O&M escalation factor.

The proposed value of **transmission line O&M costs = $32.74 per MW per year**.

The transmission line O&M estimate increased significantly from the 2016 BRCP value of $9.47 per MW per year. GHD considers the 2016 cost estimate to be undervalued, and have assumed that a line inspection would be carried out over a two-day period each year that requires the hiring of a scissor lift.

1.4.4 Asset insurance costs

The fixed O&M component includes annual insurance costs to cover power station asset replacement, business interruption, and public and products liability insurance. AEMO has obtained advice on insurance costs from an independent broker to calculate insurance premiums. The broker prefers to remain anonymous to protect its competitive position.

Premiums are calculated as follows:

- Asset replacement insurance is calculated as 0.28% of the limit of liability, as advised by the broker. The limit of liability is determined as the sum of the capital construction cost and value of fuel.
  - The capital cost and value of fuel are estimated as: PC x (1 + M) x CC + FFC.
  - AEMO calculates asset replacement insurance as $430,370 per year.
- Business interruption insurance includes coverage for the potential refund liability for the facility for two years. While a construction period of one year is assumed in the application of WACC, a period of time would be required prior to commencement of construction work following a loss event (for example, for service procurement, building approvals, and any demolition or clearing works). The refund mechanism in the WEM Rules means that a Market Participant may be required to refund two years' worth of capacity payments in less than 15 months.
- AEMO calculates business interruption insurance as **$126,064 per year**.
- Public and products liability insurance is estimated as **$114,407 per year**. This liability includes 10% transfer duty for a limit of $50 million for any one occurrence, as required by Western Power in an Electricity Transfer Access Contract.
- A cost of **$20,952 per year** for an annual insurance site survey is included.

The premium estimates are consistent with the assumption that the insurance covers:

- A newly constructed generation facility with on-site diesel storage.
- A facility located in a rural region of the SWIS with no cyclone risk.
- Machinery breakdown.

- Deductibles of $25,000 to $50,000 for public and products liability insurance, $500,000 for property damage, and 60 days for business interruption insurance.

Estimated insurance costs are escalated where necessary to 1 October 2019 using the CPI escalation factor.

The proposed value of Asset insurance costs = **$4,767 per MW per year**.

The insurance cost estimates have increased by 2.4% from the 2016 BRCP. This is due to an increase in business interruption, asset replacement, and public and products liability insurance premiums, in line with global energy sector insurance markets. Changing weather patterns and increased risk of natural disasters is a cause for concern amongst insurers. The recent South Australian state-wide power outage in September 2016 has led to Australian insurers adopting a cautious stance on liability cover for power stations.

1.4.5 Fixed network access and on-going charges

Network access charges are estimated using Western Power's network access tariffs (Price List) data from the 2016–17 Price List approved by the ERA.[16] The relevant tariff that applies to generation facilities is the Transmission Reference Tariff 2. As network access charges vary by location, AEMO considers the list of six regions outlined in the Market Procedure and applies the unit price for the most expensive location.

Muja Power Station substation "Use of System" is the most expensive location and hence is selected as the base tariff input for the estimation of the fixed network access charges. The other two input component costs include control system and transmission metering service charges. Total annual costs per MW are calculated as at July 2016 and have been escalated by CPI to 1 October 2019.

The proposed value of **Fixed network access costs = $10,219 per MW per year**.

The fixed network access cost estimates have decreased by 7.9% from the 2016 BRCP, due to a fall in the use of system charges.

Due to the Western Australian Government's Electricity Market Review[17] the 2016 BRCP report made reference to the removal of TUOS charges, as requested by the Public Utilities Office (PUO). Under the assumption that the regulation of Western Power's networks would be transferred to the National Electricity Rules on 1 July 2018, the 2016 BRCP report modelled the impact of the removal of TUOS charges on the final BRCP value. However, given the bills[18] related to this transfer are now unlikely to proceed, the PUO has requested AEMO to not make any reference to the removal of TUOS charges in the 2017 BRCP.

[16] Available at https://www.erawa.com.au/cproot/14244/2/2016-17%20Price%20List.pdf.
[17] More information available at: https://www.finance.wa.gov.au/cms/Public_Utilities_Office/Electricity_Market_Review/Network_Regulation.aspx
[18] The National Electricity (Western Australia) Bill 2016 available at: http://www.parliament.wa.gov.au/Parliament/Bills.nsf/003B5D7348CF977C48257FD9003EBCFE/$File/Bill189-1.pdf

3. PROPOSED VALUE OF THE 2017 BRCP

3.1 Annualised Capital Costs (ANNUALISED_CAP_COST)

The theoretical total capital cost (CAP_COST) of building a new power station in the SWIS and connecting it to the grid is estimated from the component costs determined in Section 1.3. This is expressed as:

$$CAP\_COST=\left((PC \times (1+M) + TC) \times CC + FFC + LC\right) \times (1+WACC)^{\frac{1}{2}}$$

The proposed value of **CAP_COST = $180,482,951**.

CAP_COST is then annualised over a 15-year period using the WACC.

This produces an **ANNUALISED_CAP_COST = $17,174,459 per year**.

The annualised capital cost estimate decreased by 10.3% from the 2016 BRCP.

3.2 Annualised Operating and Maintenance Costs (ANNUALISED_FIXED_O&M)

The theoretical annualised fixed O&M cost is the sum of individual O&M components calculated in Section 1.4. This is expressed as:

ANNUALISED_FIXED_O&M = generation O&M costs + switchyard O&M costs + transmission line O&M costs + asset insurance costs + fixed network access costs and on-going charges

Depreciation is omitted, as it forms part of a regulated utility's annual revenue entitlement.

The proposed value of **ANNUALISED_FIXED_O&M = $30,199 per MW per year**.

The annualised fixed O&M cost estimate decreased by 7.3% from the 2016 BRCP.

3.3 BRCP Calculation

The BRCP is estimated by summing the annualised fixed O&M and annualised capital expenditure on a per MW basis. This is expressed as:

$$BRCP = ANNUALISED\_FIXED\_O\&M + \frac{ANNUALISED\_CAP\_COST}{CC}$$

The proposed value of the 2017 BRCP is estimated to be $145,772, which is then rounded to the nearest $100.

The proposed **BRCP = $145,800 per MW per year**.

The proposed 2017 BRCP is 8.8% lower than the 2016 BRCP.

An overview of the variation of the components of the 2016 BRCP and 2017 BRCP is in Table 5.

Table 5 BRCP components for 2016 and 2017

	2016 BRCP	2017 BRCP	Unit
BRCP	159,800	145,800	AU$/MW/year
ANNUALISED_FIXED_O&M	32,582	30,119	AU$/MW/year
Generation O&M cost	16,330	14,572	AU$/MW/year
Switchyard O&M cost	492	528	AU$/MW/year
Transmission line O&M cost	9.47	32.74	AU$/MW/year
Asset insurance cost	4,654	4,767	AU$/MW/year
Fixed network access and on-going charges	11,096	10,219	AU$/MW/year
CAP_COST	189,810,126	180,482,951	AU$
Power station cost	834,782	810,229	AU$/MW
Margin M	20.00	17.19	%
Transmission cost	160,280	175,444	AU$/MW
Capacity credit allocation	150.5	148.5	MW
Fixed fuel cost	7,089,948	6,803,923	AU$
Land cost	2,656,499	2,430,526	AU$
WACC	5.69	4.82	%
ANNUALISED_CAPCOST	19,149,362	17,174,459	AU$/year
Term of finance	15	15	Years

The changes between the 2016 and 2017 BRCP values by input parameter are shown in Table 6. Most of the changes relate to a decrease in the WACC and escalation factors.

A detailed breakdown of the historical BRCP since market start is provided in Appendix B.

Table 6 Breakdown of variance between 2016 and 2017 BRCP

	Impact ($)	Impact (%)	BRCP (AU$)
2016 BRCP			**159,800**
Escalation factors	-5,100	-3.2	154,700
Power station cost	1,500	0.9	156,200
Margin M	-2,400	-1.5	153,800
Fixed fuel cost	-200	-0.1	153,600
Land cost	-100	-0.1	153,500
Transmission cost	1,500	0.9	155,000
WACC	-7,400	-4.6	147,600
Fixed O&M	-1,800	-1.1	145,800
2017 BRCP	**-14,000**	**-8.8**	**145,800**

4. INVITATION FOR SUBMISSIONS

AEMO invites submissions on the proposed 2017 BRCP and the supporting documents.

4.1 Submission guidelines

Submissions must be made in writing, clearly address issues that interested parties consider relevant to this review, and provide supporting evidence or calculations where appropriate.

In keeping with the principle of open and transparent processes, all submissions will be published on the AEMO website. If a stakeholder provides confidential information in a submission as supporting evidence, we request two versions, with one clearly marked as confidential which will not be published.

4.2 Making a submission

AEMO prefers to receive submissions by email to wa.capacity@aemo.com.au.

Written submissions may be posted to AEMO, addressed to:

Australian Energy Market Operator

Attn: Group Manager, Operations and Technology (WA)

PO Box 7096

Cloisters Square, Perth, WA 6850

The deadline for submissions is **5:00 PM (Western Standard Time)** on **2 December 2016**.

Enquiries may be directed to Katelyn Rigden or Neetika Kapani on (08) 9254 4300.

APPENDIX A. WACC

The pre-tax real WACC is applied in the determination of the BRCP. The formula is:

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

where

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

and the nominal return on equity is calculated as:

$$R_e = R_f + \beta_e \times MRP$$

while the nominal return on debt is calculated as:

$$R_d = R_f + (DRP + d)$$

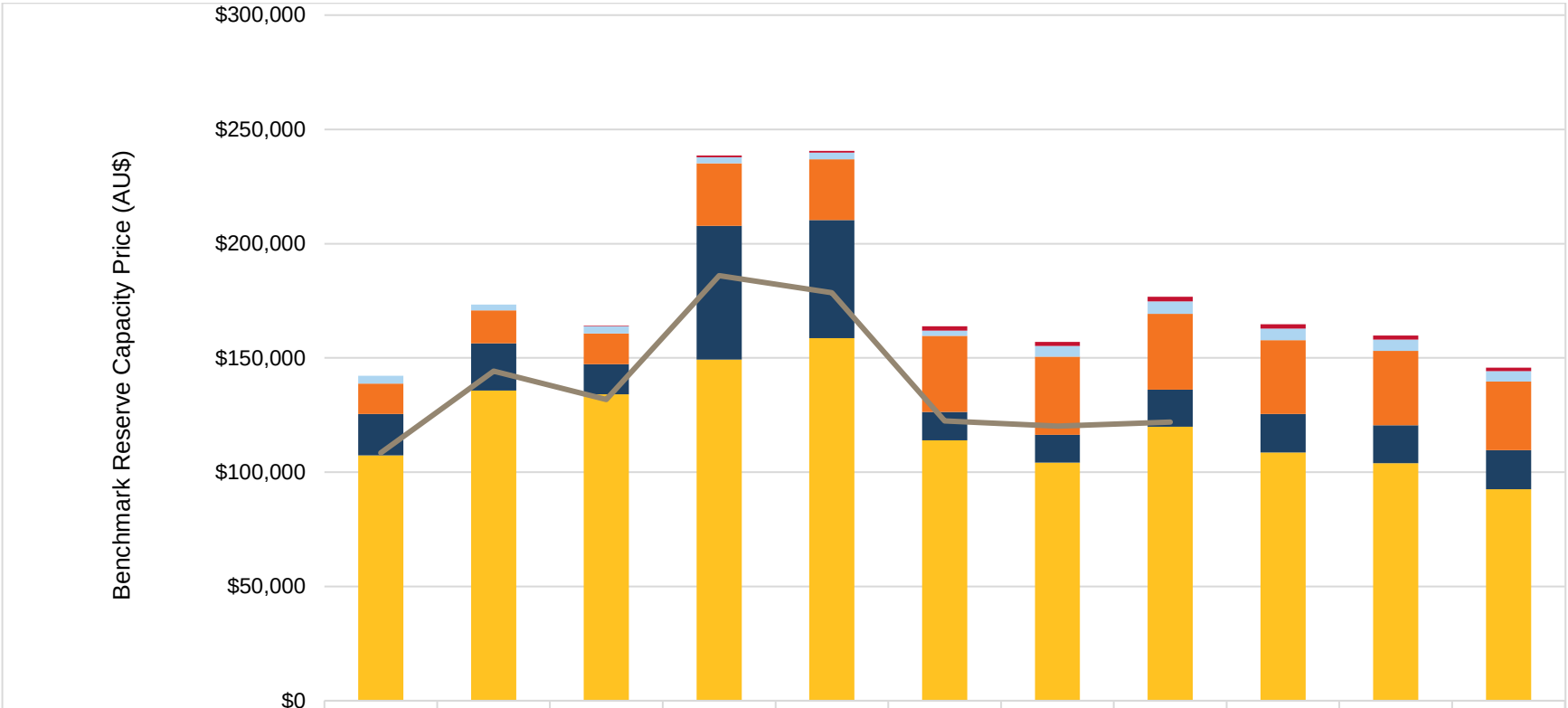
The WACC parameters applied in the 2016 BRCP and the proposed 2017 BRCP are shown in Table 7.

Table 7 WACC parameters for the 2016 and 2017 BRCP

Parameter	Notation	2016 value	2017 value
Nominal risk free rate of return (%)	R_f	2.92	2.12
Expected inflation (%)	i	2.45	2.39
Real risk free rate of return (%)	R_{fr}	0.46	-0.26
Market risk premium (%)	MRP	6	6
Asset beta	β_a	0.5	0.5
Equity beta	β_e	0.83	0.83
Debt risk premium (%)	DRP	2.363	2.320
Debt issuance cost (%)	d	0.125	0.125
Corporate tax rate (%)	t	30	30
Franking credit value	γ	0.25	0.25
Debt to asset ratio (%)	D/V	40	40
Equity to total asset ratio (%)	E/V	60	60

APPENDIX B. HISTORICAL BRCP COMPONENT COST BREAKDOWN

Figure 2 Historical BRCP component cost breakdown



	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Land cost (LC)	$-	$-	$293	$769	$818	$1,973	$1,783	$2,064	$1,912	$1,831	$1,595
Fixed fuel cost (FFC)	$3,456	$2,631	$3,151	$2,615	$2,825	$2,239	$4,680	$5,442	$5,061	$4,886	$4,464
Fixed O&M cost	$13,363	$14,392	$13,431	$27,335	$26,649	$33,384	$34,239	$33,238	$32,307	$32,582	$30,119
Transmission cost (TC)	$18,017	$20,672	$13,151	$58,493	$51,621	$12,329	$12,164	$16,127	$16,860	$16,624	$17,092
Power station cost (PC)	$107,404	$135,701	$134,091	$149,306	$158,710	$113,971	$104,178	$119,942	$108,649	$103,898	$92,503
Reserve Capacity Price	$108,459	$144,235	$131,805	$186,001	$178,477	$122,428	$120,199	$121,889			

APPENDIX C. METHODOLOGY CONCERNS RAISED BY AEMO AND STAKEHOLDERS

Under the WEM Rules, AEMO must hold a public consultation period before determining the final BRCP and providing it to the ERA for approval. In previous years, Market Participants have provided feedback on various aspects of the methodology outlined in the Market Procedure. This year, AEMO has identified additional issues when calculating the components of the BRCP.

AEMO has compiled a number of concerns identified during the determination of the 2017 BRCP and those raised independently by Market Participants. These are listed in Table 8. Please note that this list is not exhaustive.

AEMO has discussed these methodology concerns with the ERA and will provide this list during the next major review of the Market Procedure, due next year.

Table 8 Methodology concerns

Component	Comment
PC – reference equipment	The methodology prescribed in the Market Procedure currently requires the theoretical reference power station to be a 160 MW OCGT. AEMO considers the size of the reference power generator does not reflect future growth of peak demand in the WEM. The average size of generators recently installed in the SWIS is approximately 20 MW. AEMO notes that an OCGT power station has not been installed in the SWIS in the past five years, and that a power station of this configuration is no longer available for purchase on the market.
WACC – DRP	The methodology prescribed in the Market Procedure currently requires AEMO to determine the DRP using a methodology consistent with current accepted Australian regulatory practice. AEMO agrees that the DRP methodology should follow current Australian regulatory practice. However, AEMO notes that footnote one in the Market Procedure restricts the DRP methodology to a specific 'Bond-Yield Approach'.
WACC	AEMO notes that the WACC methodology prescribed in the Market Procedure gives AEMO no discretion to deviate. In a situation where the methodology results in an irregular or nonsensical outcome for any input parameter, AEMO cannot consider an alternative. This may result in a BRCP determination that is not reflective of the current economic situation. AEMO notes the proposed 2017 BRCP calculation has resulted in a lower than expected WACC, due to an irregular real risk free rate of return.
Fixed O&M – Insurance	The methodology prescribed in the Market Procedure currently requires the limit of liability for public and products liability insurance to be determined in accordance with Western Power's network access arrangement. Currently, the access arrangement requires a public liability insurance limit of not less than $50 million. After considering feedback from several independent brokers, AEMO believes the limit of $50 million to be too low.
TC	The TC cost methodology prescribed in the Market Procedure is currently based on actual connection costs and access offers identified by Western Power. Limited new generation capacity is currently being built in the WEM, resulting in less project data available when calculating TC costs. The 2017 BRCP TC calculation contained no actual project data and resulted in an estimation 9.5% higher than last year.

MEASURES AND ABBREVIATIONS

Units of measure

Abbreviation	Unit of measure
AU$	Australian dollar
MW	Megawatt

Abbreviations

Abbreviation	Expanded name
AEMO	Australian Energy Market Operator
ANNUALISED_CAP_COST	Annualised capital cost
ANNUALISED_FIXED_O&M	Annualised fixed operating and maintenance cost
BRCP	Benchmark Reserve Capacity Price
CAP_COST	Capital cost
CC	Capacity Credit
CPI	Consumer price index. Used as a general price inflation index during escalations.
DRP	Debt risk premium
EMR	Electricity Market Review
ERA	Economic Regulation Authority
FFC	Fixed fuel costs
LC	Land cost
M	Margin to cover legal, approval, financing and other costs and contingencies
MRCP	Maximum Reserve Capacity Price
PC	Power station capital cost
PwC	PricewaterhouseCoopers Australia
RBA	Reserve Bank of Australia
OCGT	Open cycle gas turbine
O&M	Operating and maintenance
SWIS	South West interconnected system
TC	Transmission connection costs
TUOS	Transmission use of system
WA	Western Australia
WACC	Weighted average cost of capital
WEM	Wholesale Electricity Market