AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Draft Report: 2019 Benchmark Reserve Capacity Price for the 2021-22 Capacity Year

October 2018

Important notice

PURPOSE

AEMO has prepared this document under section 4.16 of the Wholesale Electricity Market Rules to provide information about the proposed revised value for the 2019 Benchmark Reserve Capacity Price for the 2021–22 Capacity Year, as at the date of publication.

DISCLAIMER

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VERSION CONTROL

Version	Release date	Changes
1	10/10/2018	

Executive Summary

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

The BRCP is used in the calculation of 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 2019 Reserve Capacity Cycle. The 2019 BRCP applies for the 2021-22 Capacity Year, covering the period from 8:00 am on 1 October 2021 to 8:00 am on 1 October 2022.

The BRCP is calculated by undertaking a technical, bottom-up cost evaluation of the entry of a new 160 MW liquid-fuelled 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 since the last five-yearly review completed in 2011[2], and includes the following costs:

- Power Station balance of plant costs.
- Land costs.
- Costs associated with the development of liquid fuel storage and handling facilities (to allow 14 hours of continuous operation).
- Costs associated with the connection of the power station to the bulk transmission system.
- Allowances for legal costs, insurance costs, financing costs and environmental approval costs.
- Reasonable allowance for a contingency margin.
- Estimates of fixed operating and maintenance costs for the power station, fuel handling facilities and the transmission connection components.

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

Proposed value of the 2019 BRCP for the 2021–22 Capacity Year

AEMO proposes a value of $153,200 per MW per year for the 2019 BRCP, 0.3% lower than the 2018 BRCP of $153,600 per MW per year.

Changes from the 2018 BRCP

Table 1 shows the year-on-year variation in the input parameters between the 2018 BRCP (for the 2020–21 Capacity Year) and the 2019 BRCP.

[1] The Market Procedure: Maximum Reserve Capacity Price 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 Economic Regulation Authority is now responsible for the Market Procedure, which is available at: https://www.erawa.com.au/electricity/wholesale-electricity-market/market-procedures. All references to the Independent Market Operator (IMO) and the Maximum Reserve Capacity Price in the Market Procedure should now be to AEMO and the BRCP respectively.

[2] Clause 4.16.9 of the WEM Rules requires the Economic Regulation Authority to carry out a five-yearly review of the Market Procedure referred to in clause 4.16.3 (which is currently the Market Procedure: Maximum Reserve Capacity Price). Clause 1.17.5(e) of the WEM Rules modifies this requirement: the Economic Regulation Authority is not required to carry out the next review of the Market Procedure referred to in clause 4.16.3 (including any public consultation process in respect of the outcome of the review) before 31 October 2017.

Table 1 Breakdown of variance between 2018 and 2019 BRCP

	Impact ($)[3]	Impact (%)	BRCP (AU$)
2018 BRCP			**153,600**
Escalation factors	-2,800	-1.8%	150,800
Power station cost	2,200	1.4%	153,000
Margin M	100	0.1%	153,100
Fixed fuel cost	0	0.0%	153,100
Land cost	0	0.0%	153,100
Transmission cost	400	0.3%	153,500
WACC	200	0.1%	153,700
Fixed O&M	-500	-0.3%	153,200
2019 BRCP	**-400**	**-0.3%**	**153,200**

The 2019 BRCP remains broadly consistent with the 2018 BRCP. The decrease in escalation factors has been offset by an increase in power station capital costs due to a weakening AUD/USD exchange rate. Fixed O&M has decreased due a reduction in asset insurance costs.

Invitation for submission

AEMO invites submissions on the proposed 2019 BRCP and the supporting information by **5:00 pm (Western Standard Time)** on **24 October 2018**. More details on the required submission format are provided in Chapter 5.

[3] Rounded to the nearest $100, zero dollar values indicate an impact of less than $50.

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1. Introduction

The Benchmark Reserve Capacity Price (BRCP) is a dollar per MW per year value which aims to establish the marginal cost of providing one additional megawatt (MW) of Reserve Capacity in the relevant Capacity Year.

The BRCP is used in the calculation of 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.

This report presents the components and outcome of the BRCP draft determination for the 2019 Reserve Capacity Cycle, which applies to the 2021–22 Capacity Year. Following the public consultation process, AEMO must consider submissions before submitting a final 2019 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 since 2011 due to the deferral of the five yearly review of the Market Procedure.

In determining the 2019 BRCP, AEMO used publicly available information including advice from independent consultants, Western Power, and the Western Australian Land Information Authority.

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

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
Western Australian Land Information Authority (Landgate)	Land costs
PricewaterhouseCoopers (PwC)	Debt risk premium (DRP) Relevant escalation factors
Western Power	Transmission connection costs and relevant escalation factors

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

1.2 Supporting documentation

The following related documents are available on AEMO's website[4]:

- 2019 BRCP calculation spreadsheet, draft report version.
- GHD report, *2019 Benchmark Reserve Capacity Price for the South West Interconnected System* (September 2018).
- PwC report, *Estimating the Escalation Factors for the 2019 Benchmark Reserve Capacity Price* (August 2018).
- PwC memo, *2019 Benchmark Reserve Capacity Price Debt Risk Premium for the South West Interconnected System* (September 2018).
- Landgate report, *Land values for the 2019 Benchmark Reserve Capacity Price* (August 2018).
- 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 2021/22* (September 2018).

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

2. Input parameters

This chapter provides information on the input parameters used to determine the 2019 BRCP.

2.1 Escalation factors

The 2019 BRCP calculation is based on a theoretical power station that would commence operation on 1 October 2021. Costs have been determined as at 2018 and have been escalated to 2021.

Different escalation factors are used depending on the parameter to be escalated. 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	Base escalation factors such as steel, copper, labour and the AUD/USD exchange rate were derived by PwC. The determination involved analysing commodity market trends and forecasts from leading investment banks. More information on PwC's methodology is provided in their report. GHD derived the power station capital cost, generation O&M and connection asset O&M escalation factors from the base escalation factors provided by PwC. This methodology is summarised in GHD's report.
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 steps 2.4.1(d) and 2.4.2 of the Market Procedure. However, as five years of actual data was not available for the 2019 BRCP the escalation rate is averaged over a period for which equivalent data is available. Western Power provides these escalation factors.

The escalation factors applied to the 2019 BRCP are listed in Table 4.

Table 4 Escalation factors by financial year

Escalation factor	2018-19	2019-20	2020-21	2021-22
Power station capital cost	5.30%	-1.10%	0.10%	0.60%
Generation O&M cost	1.90%	2.40%	2.10%	2.40%

Escalation factor	2018-19	2019-20	2020-21	2021-22
Connection asset O&M cost	2.30%	3.30%	2.40%	2.30%
CPI	2.00%	2.25%	2.38%	2.50%
Transmission connection cost	1.17%	1.17%	1.17%	1.17%

Power station capital cost and generation O&M escalation factors have generally decreased from the 2018 BRCP, this is due to a fall in the expected price of steel and copper in relevant international markets. The slight increase in the connection asset O&M escalation factor is driven by an expected lift in WA's wage growth, attributed to improving conditions in the labour market. CPI escalation factors remain consistent with the 2018 BRCP.

2.2 Capital costs

2.2.1 Power station capital cost (PC)

The Siemens SGT5-2000E (33MAC) 175.6 MW OCGT was used as the reference equipment to determine the power station capital cost component of the 2019 BRCP, consistent with the 2018 BRCP. The unit is considered to be the most appropriate machine available to meet the criteria for the BRCP calculation[5]. Version 27.0 of Thermoflow's GTPro model was used 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 2021 using the power station capital cost escalation factor.

The proposed value of **PC = $843,378.53 per MW**.

The estimated PC has decreased by 0.4% (a decrease of around $3,400) from the 2018 BRCP, this is due to a lower escalation factor which has offset an increase in the original capital cost as a result of a lower AUD/USD exchange rate.

2.2.2 Capacity Credit (CC) allocation

GTPro was used 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 = 151.4 MW**.

The proposed CC value has not changed from the 2018 BRCP.

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

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

The proposed value of **M = 17.15%**.

The Margin M value in the 2019 BRCP is similar to last year's value (17.12%).

2.2.4 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.

[5] 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 175.6 MW Siemens unit to represent the expected configuration of the 160 MW generator specified in the Market Procedure.

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

Hypothetical land sites were assessed 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 2018 and exclude transfer duty. AEMO has added the applicable transfer duty to the land parcel cost using the Office of State Revenue's online calculator.[6]

AEMO calculated the average of the six valuations and escalated this to 1 April 2021 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 = $2,295,990.53**

The LC estimate decreased by 4.1% from the 2018 BRCP. This is due to a reduction of 6.7%, 4.8% and 3.8% from last year's land cost estimate for the Pinjar, Kwinana and Geraldton regions respectively. Land cost estimates for other regions remained consistent with those determined for the 2018 BRCP[7].

2.2.5 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, plus easement costs. Western Power provided an independent 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 4.1% from the 2018 BRCP, due to a fall in land values in the Pinjar, Kwinana and Geraldton regions.

The shallow connection costs for the 2019 BRCP have increased by 1.6% compared to the 2018 BRCP.

The proposed value of **TC = $179,028.00 per MW**.

No escalation factors have been applied because Western Power has already escalated the TC estimate to 1 April 2021.

The TC estimate has increased by 2.4% from the 2018 BRCP value of $174,749. This is partly due to an increase in the escalation factor applied by Western Power. AEMO does not have visibility into other components of the TC estimate provided by Western Power for confidentiality reasons.

2.2.6 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 sufficient for 14 hours of operation. An estimate of FFC was calculated as at 30 June 2018, which is escalated to 1 April 2021 using the CPI escalation factor. The cost of diesel includes delivery and excise rebate, but excludes GST.

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[6] Available at: https://apps.osr.wa.gov.au/portal/0/home;jsessionid=JNLmA3sv1F6fF_IxDZGlNReN2myw-2WfuMjTFmdhv9lTnzH6gMoy!1192205439.

[7] Refer to Landgate report, *Land values for the 2019 Benchmark Reserve Capacity Price* (August 2018).

The proposed value of **FFC = $7,109,637.85**.

The FFC estimate increased by 2.0% from the 2018 BRCP. This is largely associated with an increase in the price of delivered diesel to $0.756 per litre (7% higher than the 2018 BRCP).

2.2.7 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[8]. The nominal risk free rate was determined using observed yields of Commonwealth Government bonds, while the DRP was derived using observed yields of corporate bonds. A corporate tax rate of 30% was assumed. Appendix A provides more detail on the steps for estimating the WACC.

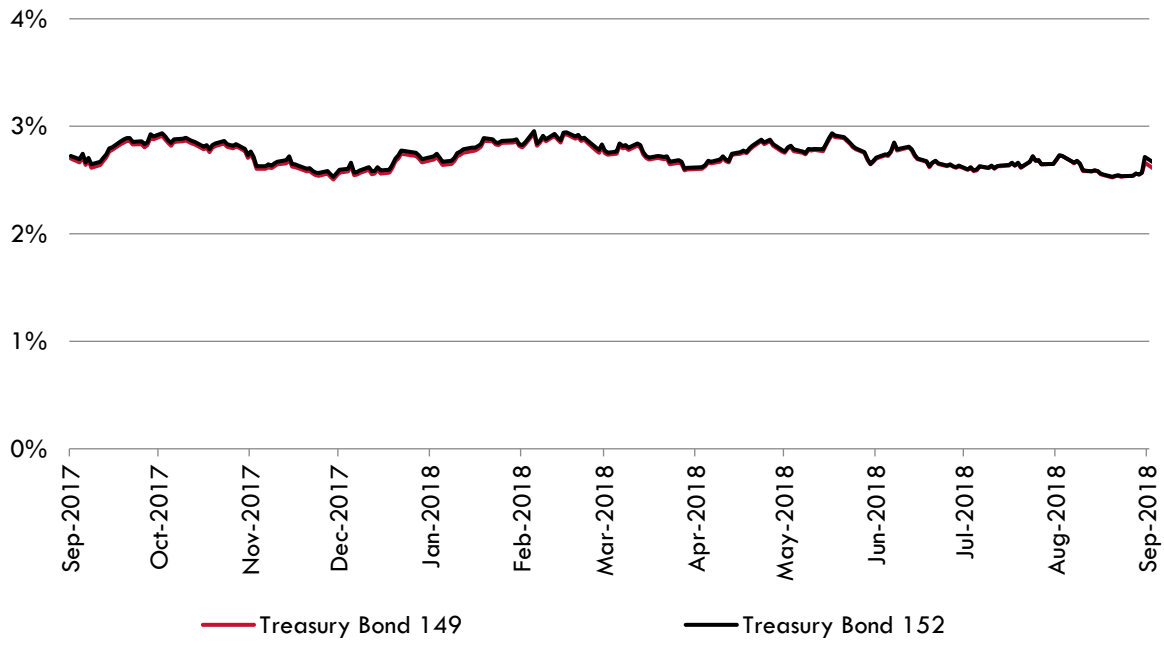
In the 2018 BRCP report, AEMO noted that the low values for the real risk free rate and subsequently the WACC did not reflect current Australian market conditions[9]. While this year's real risk free rate and WACC are slightly higher than last year, this note remains valid and is reflected in the methodology concerns detailed in Section 4.

Risk free rate of return methodology

The nominal risk free rate was calculated from the annualised yield of Commonwealth Government bonds with maturity dates of roughly 10 years. The rate was estimated using a 20-day average from market observations ending on 30 August 2018.

Commonwealth Government bond yields have remained relatively consistent since the 2018 BRCP, as shown in Figure 1. The nominal risk free rate calculated from these bonds is 2.60%, a drop from 2.67% in the 2018 BRCP.

Figure 1 Commonwealth Government bond yields, September 2017 to August 2018



The nominal rate was 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 2.42%.

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

[9] Refer to Section 2.2.7 of the 2017 BRCP report: http://www.aemo.com.au/-/media/Files/Electricity/WEM/Reserve_Capacity_Mechanism/BRCP/2017/Final-Report-Benchmark-Reserve-Capacity-Price-for-the-2019-20-Capacity-Year.pdf

The above parameter values have resulted in a real risk free rate of 0.18%.

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.

The ERA 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*[10]. AEMO considers this revised methodology to represent current accepted Australian regulatory practice, and the DRP has been calculated accordingly. This is the same methodology that was implemented for the 2018 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 2.07% from market observations ending on 30 August 2018. This is a preliminary figure, with the final DRP estimate to be produced using market observations ending on 26 October 2018 and published in the final 2019 BRCP report.

Capital Asset Pricing Model results

The proposed value of the **WACC (real terms) = 5.24%**.

This is slightly higher than the WACC (real terms) of 5.21% used in the 2018 BRCP.

Market Participants queried the WACC methodology outlined in the Market Procedure during the 2018 BRCP consultation period and previous BRCP determinations. AEMO has compiled a list of all other concerns regarding the methodology (see Chapter 4).

2.3 Operating and maintenance costs

2.3.1 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 2018, which are derived from similar recent OCGT projects. These costs are then escalated to 1 October 2021 using the generation O&M escalation factor.

The proposed value of **generation fixed O&M costs = $14,265.69 per MW per year**.

The estimated generation O&M cost increased by 0.15% from the 2018 BRCP.

2.3.2 Switchyard O&M costs

Switchyard O&M costs were 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 was used to estimate the switchyard costs, based on the annual charge for the connection infrastructure. The cost estimate included labour, machinery parts, and general overheads incurred during routine maintenance, which occurs one week per year on average.

The 330 kV switchyard was assumed to have an average asset life of 60 years. A 15-year annuity was calculated based on the cost estimate as at June 2018, which was then escalated to 1 October 2021 using the connection O&M escalation factor.

The proposed value of **switchyard O&M costs = $549.24 per MW per year**.

The estimated switchyard O&M cost increased by 4.7% from the 2018 BRCP, this is due to an increase in the connection asset O&M escalation factors (see section 2.1 for further information).

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

2.3.3 Transmission line O&M costs

The new transmission line was assumed to be a single circuit 330 kV construction with two conductors per phase, and was assumed to have an average asset life of 60 years. The rating of the line was selected to facilitate the transport of up to 200 MVA (power factor of 0.8).

The cost estimate included labour, machinery parts, and general overheads incurred during routine maintenance. A 15-year annuity was calculated based on the cost estimates as at June 2018, which was then escalated to 1 October 2021 using the connection O&M escalation factor.

The proposed value of **transmission line O&M costs = $34.29 per MW per year**.

The estimated switchyard O&M cost increased by 5.4% from the 2018 BRCP, this is due to an increase in the connection asset O&M escalation factors (see section 2.1 for further information).

2.3.4 Asset insurance costs

The fixed O&M component included 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 multiple independent brokers[11] and calculated an average insurance premium.

Premiums were calculated as follows:

- Asset replacement insurance was calculated as 0.24% of the limit of liability. The limit of liability was determined as the sum of the capital construction cost and value of fuel.
  - The capital cost and value of fuel were estimated as: PC x (1 + M) x CC + FFC.
  - AEMO calculated asset replacement insurance as **$424,447.13 per year**.
- Business interruption insurance included coverage for the potential refund liability for the facility for two years. While a construction period of one year was 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).
- AEMO calculates business interruption insurance as **$125,678.99 per year**.
- Public and products liability insurance is estimated as **$116,768.03 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 **$22,663.71 per year** for an annual insurance site survey is included.

The insurance premiums are assumed to cover:

- 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 were escalated where necessary to 1 October 2021 using the CPI escalation factor.

The proposed value of asset insurance costs = **$4,667.27 per MW per year**.

The insurance cost estimates have decreased by 13.3% from the 2018 BRCP. This year AEMO sourced multiple insurance quotes from independent brokers which resulted in a considerable range of insurance premiums. An average from all premiums was then calculated and applied. AEMO considers this to be more representative of current insurance market conditions.

[11] The brokers prefers to remain anonymous to protect their competitive position.

2.3.5 Fixed network access and on-going charges

Network access charges were estimated using Western Power's network access tariffs (Price List) data from the 2016–17 Price List approved by the ERA.[12] The relevant tariff that applies to generation facilities is the Transmission Reference Tariff 2.

As network access charges vary by location, AEMO considered the list of six regions outlined in the Market Procedure and applied the unit price for the most expensive location. Muja Power Station substation "Use of System" is the most expensive location and hence was selected as the base tariff input for the estimation of the fixed network access charges. The other two input component costs included control system and transmission metering service charges. Total annual costs per MW were calculated as at July 2018 and have been escalated by CPI to 1 October 2021.

The proposed value of **Fixed network access costs = $10,254.73 per MW per year.**

The fixed network access cost estimates have not changed from the 2018 BRCP.

[12] Available at https://www.erawa.com.au/electricity/electricity-access/western-power-network/annual-price-lists-for-network-charges.

3. Proposed value of the 2019 BRCP

This chapter includes the proposed value for the annualised capital costs, annualised fixed operating and maintenance costs and the 2019 BRCP for the 2021–22 Capacity Year.

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 2.2.2. 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 = $190,915,273**.

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

This produces an **ANNUALISED_CAP_COST = $18,692,284 per year.**

The annualised capital cost estimate has increased by 0.26% from the 2018 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 2.2.3. 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 = $29,771 per MW per year.**

The annualised fixed O&M cost estimate has decreased by 2.2% from the 2018 BRCP due to a decrease in asset insurance costs.

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 2019 BRCP is estimated to be $153,234 which is then rounded to the nearest $100.

The proposed **BRCP = $153,200 per MW per year.**

The proposed 2019 BRCP is 0.3% lower than the 2018 BRCP.

An overview of the variation of the components of the 2018 BRCP and 2019 BRCP is listed in Table 5.

Table 5 BRCP components for 2018 and 2019

	2018 BRCP	Draft 2019 BRCP	Unit
BRCP	153,600	153,200	AU$/MW/year
ANNUALISED_FIXED_O&M	30,437	29,771	AU$/MW/year
Generation O&M cost	14,244	14,266	AU$/MW/year
Switchyard O&M cost	525	549	AU$/MW/year
Transmission line O&M cost	32.53	34.29	AU$/MW/year
Asset insurance cost	5,381	4,667	AU$/MW/year
Fixed network access and on-going charges	10,255	10,255	AU$/MW/year
CAP_COST	190,747,133	190,915,273	AU$
Power station cost	846,751	843,379	AU$/MW
Margin M	17.12	17.15	%
Transmission cost	174,749	179,028	AU$/MW
Capacity credit allocation	151.4	151.4	MW
Fixed fuel cost	6,969,444	7,109,638	AU$
Land cost	2,394,088	2,295,991	AU$
WACC	5.21	5.24	%
ANNUALISED_CAPCOST	18,644,285	18,692,284	AU$/year
Term of finance	15	15	Years

The changes between the 2018 and draft 2019 BRCP values by input parameter are shown in Table 6. Majority of the change relates to a decrease in escalation factors.

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

Table 6 Breakdown of variance between 2018 and draft 2019 BRCP

	Impact ($)[13]	Impact (%)	BRCP (AU$)
2018 BRCP			**153,600**
Escalation factors	-2,800	-1.8%	150,800
Power station cost	2,200	1.4%	153,000
Margin M	100	0.1%	153,100
Fixed fuel cost	0	0.0%	153,100

[13] Rounded to the nearest $100, zero dollar values indicate an impact of less than $50.

Land cost	0	0.0%	153,100
Transmission cost	400	0.3%	153,500
WACC	200	0.1%	153,700
Fixed O&M	-500	-0.3%	153,200
2019 BRCP	**-400**	**-0.3%**	**153,200**

4. Stakeholder submissions and methodology concerns

This chapter highlights concerns with the current BRCP methodology.

AEMO and Market Participants have outlined concerns and provided feedback on the BRCP methodology during the annual public consultation process. Formal Market Participant submissions can be found here.

AEMO considers the methodology concerns in Table 7 should be reviewed as part of the 5 yearly review to be conducted by the ERA under clause 4.16.9 of the Wholesale Electricity Market (WEM) Rules, and the Market Procedure amended where necessary.

Table 7 Methodology Concerns

Component	Comment	Market Participant support
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 seven years, and that a power station of this configuration is no longer available for purchase on the market. Currently, AEMO selects a generator with a nameplate capacity close to 160 MW and scales this to a nameplate capacity of 160 MW to align with the requirements of the Market Procedure.	Tesla Corporation (2016, 2017) Synergy (2016) Community Electricity (2014, 2015)
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'. AEMO considers the DRP methodology should be reviewed.	Tesla Corporation (2016, 2017) Synergy (2017 Alinta (2014, 2015)
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 resulted in a lower than expected WACC, due to an irregular real risk free rate of return. This issue persisted in calculation of the 2018 BRCP. AEMO considers all components of the WACC methodology should be reviewed.	Perth Energy (2018) Tesla (2017) Perth Energy (2017) Alinta (2015)
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.	Perth Energy (2018) Community Electricity (2014, 2015)

TC	The TC cost methodology prescribed in the Market Procedure is currently based on actual connection costs and access offers identified by Western Power. However, there is limited new generation capacity being built in the WEM which meets the requirements of the current Market Procedure. This is resulting in less project data available when calculating TC costs. Since the 2017 BRCP the TC calculation has contained no actual project data.	

5. Invitation for submissions

This chapter details information on how to provide a submission on the proposed 2019 BRCP.

AEMO invites submissions on the proposed 2019 BRCP and all supporting documents. 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.

5.1 Submission guidelines

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, two versions are requested, with one clearly marked as confidential which will not be published.

5.2 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 WA Markets

PO Box 7096

Cloisters Square, Perth, WA 6850

The deadline for submissions is **5:00 PM (Western Standard Time)** on **24 October 2018**.

Enquiries may be directed to Katelyn Rigden or Neetika Kapani on (08) 9469 9800.

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

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

and the nominal return on equity is calculated as:

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

while the nominal return on debt is calculated as:

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

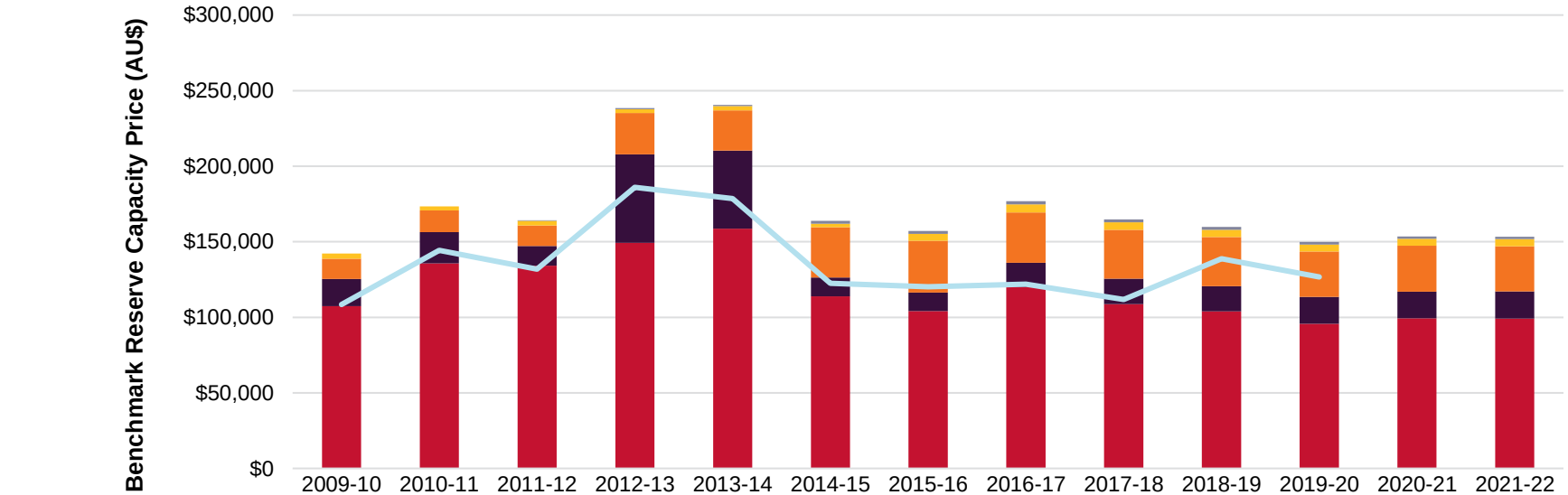
The WACC parameters applied in the 2018 BRCP and the proposed 2019 BRCP are shown in Table 8.

Table 8 WACC parameters for the 2018 and 2019 BRCP

Parameter	Notation	2018 value	2019 value
Nominal risk free rate of return (%)	R_f	2.67	2.60
Expected inflation (%)	i	2.42	2.42
Real risk free rate of return (%)	R_{fr}	0.24	0.18
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	1.80	2.07
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 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	2020-21	2021-22
Land cost (LC)	$-	$-	$293	$769	$818	$1,973	$1,783	$2,064	$1,912	$1,831	$1,650	$1,585	$1,523
Fixed fuel cost (FFC)	$3,456	$2,631	$3,151	$2,615	$2,825	$2,239	$4,680	$5,442	$5,061	$4,886	$4,620	$4,615	$4,717
Fixed O&M cost	$13,363	$14,392	$13,431	$27,335	$26,649	$33,384	$34,239	$33,238	$32,307	$32,582	$30,143	$30,437	$29,771
Transmission cost (TC)	$18,017	$20,672	$13,151	$58,493	$51,621	$12,329	$12,164	$16,127	$16,860	$16,624	$17,691	$17,520	$17,982
Power station cost (PC)	$107,404	$135,701	$134,091	$149,306	$158,710	$113,971	$104,178	$119,942	$108,649	$103,898	$95,745	$99,425	$99,241
Reserve Capacity Price	$108,459	$144,235	$131,805	$186,001	$178,477	$122,428	$120,199	$121,889	$111,753	$138,760	$126,683		

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

Abbreviation	Expanded name
WACC	Weighted average cost of capital
WEM	Wholesale Electricity Market