AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Draft Report: 2020 Benchmark Reserve Capacity Price for the 2022-23 Capacity Year

September 2019

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 2020 Benchmark Reserve Capacity Price for the 2022–23 Capacity Year, as at the date of publication.

DISCLAIMER

This document or the information in it may be subsequently updated or amended. This document does not constitute legal or business advice, and should not be relied on as a substitute for obtaining detailed advice about the Wholesale Electricity Market Rules, or any other applicable laws, procedures or policies. AEMO has made every effort to ensure the quality of the information in this document but cannot guarantee its accuracy or completeness.

Accordingly, to the maximum extent permitted by law, AEMO and its officers, employees and consultants involved in the preparation of this document:

- make no representation or warranty, express or implied, as to the currency, accuracy, reliability or completeness of the information in this document; and
- are not liable (whether by reason of negligence or otherwise) for any statements or representations in this document, or any omissions from it, or for any use or reliance on the information in it.

VERSION CONTROL

Version	Release date	Changes
1	27/10/19	

© 2019 Australian Energy Market Operator Limited.
The material in this publication may be used in accordance with the copyright permissions on AEMO's website.

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 2020 Reserve Capacity Cycle. The 2020 BRCP applies for the 2022-23 Capacity Year, covering the period from 8:00 am on 1 October 2022 to 8:00 am on 1 October 2023.

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 2020 BRCP for the 2022–23 Capacity Year

AEMO proposes a value of $142,500 per MW per year for the 2020 BRCP, 7.6% lower than the 2019 BRCP of $154,200 per MW per year.

Changes from the 2019 BRCP

Table 1 shows the year-on-year variation in BRCP relating to changes in the input parameters between the 2019 BRCP (for the 2021–22 Capacity Year) and the draft 2020 BRCP.

---

[1] The 'Market Procedure: Maximum Reserve Capacity Price' ("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 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. The status of this review is published here: https://www.erawa.com.au/electricity/wholesale-electricity-market/methodology-reviews/benchmark-reserve-capacity-price-and-energy-price-limits-review-2019.

Table 1 Breakdown of variance between 2019 and 2020 BRCP

	Impact ($)	Impact (%)	BRCP ($ ex GST)
2019 BRCP			154,200 *
Escalation Factors	-2,235	-1.4%	151,965
Power station cost	4,569	3.0%	156,534
Margin M	9	0.0%	156,543
Fixed fuel cost	100	0.1%	156,643
Land cost	169	0.1%	156,812
Transmission cost	277	0.2%	157,089
WACC	-15,356	-10%	141,733
CC allocation	-662	-0.4%	141,071
Fixed O&M	1,390	0.9%	142,461
Proposed 2020 BRCP	-11,739	-7.6%	142,500 *

*The BRCP values are rounded to the nearest $100.

The proposed 2020 BRCP is the lowest BRCP calculated since the 2006 BRCP, and has decreased by 7.6% compared to the 2019 BRCP. This decrease can mostly be attributed to the Weighted Average Cost of Capital (WACC)[3] which has reduced the 2020 BRCP by 10%, due to a negative risk-free rate (refer to Section 2.2.7).

This decrease is slightly offset by[4]:

- An increase in power station costs by 3% and transmission costs by 0.2%, due to a weakening AUD/USD exchange rate.
- An increase in fixed operation and maintenance (O&M) costs by 0.9%, due to an increase in insurance premiums.

Invitation for submission

AEMO invites submissions on the proposed 2020 BRCP and the supporting information by 5:00 pm (Australian Western Standard Time) on Friday, 11 October 2019. Further details on the required submission format are provided in Chapter 5.

[3] WACC has been calculated by AEMO in accordance with clause 2.9 of the Market Procedure.

[4] Percentages are in terms of the effect on the BRCP.

Contents

Tables

Figures

1. Introduction

The Benchmark Reserve Capacity Price (BRCP) establishes the marginal cost per year of adding 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 2020 Reserve Capacity Cycle, which applies to the 2022–23 Capacity Year. Following the public consultation process, AEMO must consider submissions before submitting a final 2020 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 2020 BRCP, AEMO has 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 Organisations and input parameters

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
Independent insurance broker	• Asset replacement insurance costs

Throughout this report, cost and price estimates are expressed in Australian dollars (AUD) excluding GST, unless otherwise specified.

1.2 Supporting documentation

The following documents relate to the calculation of the proposed 2020 BRCP and are available on AEMO's website[5]:

- 2020 BRCP calculation spreadsheet, draft report version.
- GHD report, *2020 Benchmark Reserve Capacity Price for the South West Interconnected System* (September 2019).
- PwC report, *Estimating the Escalation Factors for the 2020 Benchmark Reserve Capacity Price* (August 2019).
- PwC memo, *2020 Benchmark Reserve Capacity Price Debt Risk Premium for the South West Interconnected System* (August 2019).
- Landgate report, *Land values for the 2020 Benchmark Reserve Capacity Price* (July 2019).
- 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 2022/23* (September 2019).

[5] Available at: 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 2020 BRCP.

2.1 Escalation factors

The 2020 BRCP calculation is based on a theoretical power station that would commence operation on 1 October 2022. Costs have been determined as at 2019 and have been escalated to 2022.

Different escalation factors are used depending on the parameter to be escalated, as 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. As five years of actual data was not available for the 2020 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 2020 BRCP are listed in Table 4.

Table 4 Escalation factors by financial year

Escalation factor	2019-20	2020-21	2021-22	2022-23
Power station capital cost	5.40%	-3.10%	0.10%	3.60%
Generation O&M cost	4.00%	0.40%	1.30%	2.00%
Connection asset O&M cost	2.30%	2.00%	1.80%	2.60%
CPI	1.75%	2.00%	2.25%	2.50%
Transmission connection cost	1.19%	1.19%	1.19%	1.19%

The key changes in escalation factors from the 2019 BRCP are:

- An increase in power station capital cost and generation O&M cost in 2019-20 due to an expected depreciation of the AUD increasing the price of steel and copper. In subsequent years these escalation factors fluctuate relative to the 2019 BRCP.
- A decrease in connection asset O&M costs due to a decrease in labour cost escalation factors as a result of flatlining market expectations in the construction and utilities sectors.

More information may be found in GHD's report: *2020 Benchmark Reserve Capacity Price for the South West Interconnected System*[6], which provides detail on how these escalation factors are defined.

2.2 Capital costs

2.2.1 Power station capital cost (PC)

The Siemens SGT5-2000E (33MAC) OCGT was used as the reference equipment to determine the power station capital cost component of the 2020 BRCP, consistent with previous BRCP calculations. Since the 2019 BRCP the manufacturer, Siemens, has made improvements to the generator which has increased its output from 175.6 MW to 177.28 MW. The unit is considered to be the most appropriate machine available to meet the criteria for the BRCP calculation[7]. Version 28.2 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 2022 using the power station capital cost escalation factor.

The proposed value of PC = $859,629.35.

The estimated PC has increased by 1.9% (an increase of $16,250) from the 2019 BRCP, due to an increase in escalation factors as a result of the lower AUD/USD exchange rate.

2.2.2 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 = 152.28 MW

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

[7] There is currently no generator available in the market that matches the specifications of the Market Procedure. As a result, GHD has scaled the estimation for the 177.28 MW Siemens unit to represent the expected configuration of the 160 MW generator specified in the Market Procedure.

This proposed CC value has increased by 0.88 MW from the 2019 BRCP. This is due to a higher rate of water injection within the power station, and overall improvements to the reference generator made by the manufacturer since the 2019 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 = 17.16%.

The Margin M value in the proposed 2020 BRCP is similar to last year's value of 17.15%.

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.
- 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 2019 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[8].

AEMO calculated the average of the six valuations and escalated this to 1 April 2022 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 = $2,536,249.78.

The LC estimate has increased by 10.5% (an increase of $240,259) from the 2019 BRCP due to a change to the method for calculating the average land costs in response to the ERA's report "Decision on the benchmark reserve capacity price to apply in the 2021/22 capacity year"[9].

Previously, AEMO had taken two land sites (Eneabba and Geraldton) from the North Country given its significant size. However, this resulted in the average land value being more heavily weighted towards the region which is the least expensive in the SWIS[10]. In line with the recommendation in ERA's report, AEMO has now revised its approach and calculated the total LC estimate using an average estimate from the North Country.

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.

---

[8] Available at: https://apps.osr.wa.gov.au/portal/0/home;jsessionid=JNLmA3sv1F6fF_lxDZGINReN2myw-2WfuMjTFmdhv9ITnzH6gMoy!1192205439.

[9] Refer to Section 4.2 of "*Decision on the Benchmark Reserve Capacity Price Proposed by AEMO for the 2021/22 Capacity Year*", available at: https://www.erawa.com.au/electricity/wholesale-electricity-market/annual-price-setting/benchmark-reserve-capacity-price.

[10] Refer to Landgate report, *Landgate report, Land values for the 2020 Benchmark Reserve Capacity Price (July 2019).*

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 Market Participant may not need to purchase the entire 12 hectares for the generator, 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 increased by 10.8% from the 2019 BRCP due to the increase in LC (see Section 2.2.4 for further information). Shallow connection costs have increased by 2.8% from the 2019 BRCP, AEMO does not have visibility into the components of this calculation provided by Western Power for confidentiality reasons.

The proposed value of TC = $181,760.00.

The TC estimate has increased by 1.5% (an increase of $2,732) from the 2019 BRCP. AEMO expects this is due to the increase in easement costs, slightly offset by the increase in CC allocation.

No escalation factors have been applied because Western Power have already escalated the TC estimate to 1 April 2022.

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 2019, which is escalated to 1 April 2022 using the CPI escalation factor. The cost of diesel includes delivery and an excise rebate.

The proposed value of FFC = $7,213,563.80.

This value has increased by 1.5% (an increase of $103,926) since the 2019 BRCP due to the increase in the price of delivered diesel to $0.814 per litre (7.7% higher than the 2019 BRCP).

2.2.7 Weighted average cost of capital (WACC)

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 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 details the steps for estimating the WACC.

In line with previous BRCP reports, AEMO notes that a negative real risk-free rate, and subsequently a low WACC did not reflect Australian market conditions at that point in time[12].

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

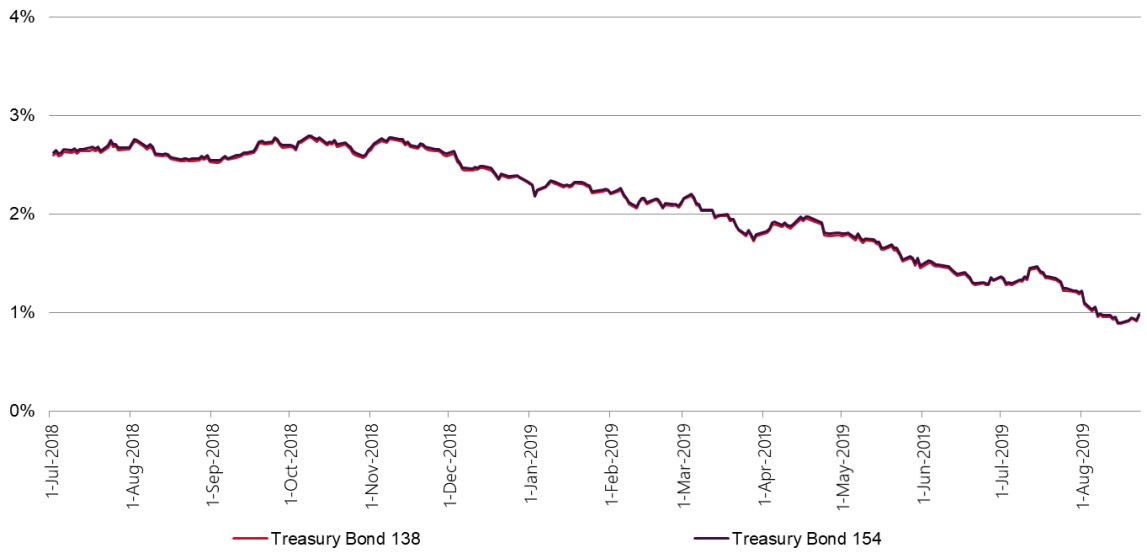
[12] Section 1.3.7 of the 2017 BRCP draft report, at https://www.aemo.com.au/-/media/Files/Stakeholder_Consultation/Consultations/Electricity_Consultations/2016/BRCP/Draft-Report-2017-Benchmark-Reserve-Capacity-Price.pdf

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 23 August 2019.

Commonwealth Government bond yields have declined since the 2019 BRCP, as shown in Figure 1.

Figure 1 Commonwealth Government bond yields, July 2018 to August 2019[13]



The nominal risk-free rate calculated from these bonds is 1.03%, a decrease from 2.71% in the 2019 BRCP. August 2019 was the lowest recording of Commonwealth Government bond yields of all time[14].

The nominal rate was then adjusted for inflation to determine the real risk-free rate of return. As per the Market Procedure, AEMO uses 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 2.36%.

This has resulted in a real risk-free rate of -1.30%. This decrease is primarily due to the low Commonwealth Government bond yields over the measurement period; however, the magnitude of this rate can also be partially attributed to the expected rate of inflation being heavily weighted towards the RBA's target rate of 2% to 3%, which is higher than the current inflation rate of 1.6% and not necessarily representative of market conditions[15]. If the expected rate of inflation is replaced with the current rate of inflation, the real risk-free rate would be -0.56%.

During the measurement period (26 July to 23 August) of the DRP and risk-free rate, riskier investments such as the Standard and Poors/Australian Stock Exchange 200 index (S&P/ASX 200) also declined in value. Outside of this period the S&P/ASX 200 experienced general increases above inflation rates from January 2019 to August 2019, which implies that a negative real risk-free rate does not represent the current market[16].

[13] Treasury bond data is available at: https://www.rba.gov.au/statistics/tables/xls/f16.xls?v=2019-09-23-16-04-03 and https://www.rba.gov.au/statistics/tables/xls-hist/f16hist-2009-2018.xls.

[14] See slide 19: https://www.rba.gov.au/chart-pack/pdf/chart-pack.pdf?v=2019-09-20-11-27-36.

[15] The June 2019 CPI figure is published by the RBA, available at https://www.rba.gov.au/publications/smp/2019/aug/economic-outlook.html.

[16] See https://www.asx.com.au/prices/charting/index.html?code=XJO&compareCode=&chartType=COMMONBASE&priceMovingAverage1=&priceMovingAverage2=&volumeIndicator=BAR&volumeMovingAverage=&timeframe=daily.

Debt risk premium (DRP) 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 methodology has remained the same since the 2018 BRCP determination. This is as a result of the ERA adopting 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*[17]. AEMO considers this revised methodology to be representative of the current accepted Australian regulatory practice, and has calculated the DRP accordingly.

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 2.33% from market observations ending on 23 August 2019. This is a preliminary figure, with the final DRP estimate to be developed using market observations ending on and including 18 October 2019 to be published in the final 2020 BRCP report.

Capital Asset Pricing Model results

The proposed value of the WACC (real terms) = 3.60%.

This is lower than the WACC (real terms) of 5.35% used in the 2019 BRCP, due to the negative risk-free rate calculated for this year. If a real risk-free rate of -0.56% is used (based on current inflation rates), then the WACC would be 4.38%[18]. While still low, AEMO considers this to be more reflective of the current market; however, the methodology must be in line with the Market Procedure.

Market Participants queried the WACC methodology outlined in the Market Procedure during previous BRCP determinations. AEMO has compiled a list of concerns regarding the methodology (refer to Chapter 4) and will provide this information to the ERA for consideration during the next review of the Market Procedure.

2.3 Operating and maintenance costs (O&M)

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 2019, which are derived from similar recent OCGT projects. These costs are then escalated to 1 October 2022 using the generation O&M escalation factor.

The proposed value of generation O&M costs = $14,354.77.

The estimated generation O&M costs increased by 0.6% (an increase of $89) relative to the 2019 BRCP, due to the slight escalation of wages and an increase in PC.

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.

[17] Available at https://www.erawa.com.au/gas/gas-access/mid-west-and-south-west-gas-distribution-systems/access-arrangements/access-arrangement-for-period-2014-2019/decisions-and-proposals.

[18] A WACC of 4.38% corresponds to a hypothetical BRCP of $149,200 per MW.

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 2019, which was then escalated to 1 October 2022 using the connection O&M escalation factor.

The proposed value of switchyard O&M costs = $543.83.

The estimated switchyard O&M costs decreased by 1% (a decrease of $5) relative to the 2019 BRCP, due to a decrease in the connection O&M escalation factor (refer to Section 2.1).

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 2019, which was then escalated to 1 October 2022 using the connection O&M escalation factor.

The proposed value of transmission line O&M costs = $33.95.

The estimated transmission line O&M costs decreased by 1% relative to the 2019 BRCP, due to a decrease in the connection O&M escalation factor (refer to Section 2.1).

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.

In the 2019 BRCP, insurance quotes were obtained from multiple independent brokers and an average insurance premium was calculated. For the 2020 BRCP, it was determined that quotes provided by multiple brokers were not directly comparable due to their differing policies, degrees of cover and the reputation of each broker. As a result, AEMO obtained a single quote from a vetted independent broker with a history in power generation insurance[19].

Premiums were calculated as follows:

- Asset replacement insurance was calculated as 0.29% of the limit of liability. This is an increase from the premium of 0.24% in the 2019 BRCP due to insurers aggressively changing their technical pricing models to account for trends in natural catastrophes and weather accumulations. These trends have recently caused losses across insurers' property portfolios. 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 $522,317.51.
- 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 $141,160.75 per year.

[19] AEMO uses this broker for its insurance policies therefore an internal vetting process has already been performed. This broker has requested to remain anonymous.

- Public and products liability insurance is estimated as $121,000.00 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 $20,000 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 2022 using the CPI escalation factor.

The proposed value of asset insurance costs = $5,397.38.

This insurance cost estimates have increased by 15.5% (an increase of $724) relative to the 2019 BRCP. This is due to an increase in the asset replacement premiums from 0.24% in the 2019 BRCP to 0.29% in the 2020 BRCP, as advised by AEMO's insurance broker.

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 2019–20 Price List approved by the ERA.[20] 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 "use of system" charge is based on the cost to Western Power of that generating asset's use of the SWIS, and is dependent on factors such as location, line-length and complexity of the grid connection. The other two input component costs include:

- Control system service charges - the general overhead of Western Power's control system costs applied proportionately per KW to generators.
- Transmission metering service charges – a fixed daily charge per revenue meter.

Total annual costs per MW were calculated as at July 2019 and have been escalated by CPI to 1 October 2022.

The proposed value of fixed network access costs = $10,596.32.

The fixed network access cost estimates have increased by 3.3% (an increase of $342) relative to the 2019 BRCP, due to an increase in "control system" and "use of system" service charges.

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

3. Proposed value of the 2020 BRCP

This chapter includes the proposed value for the annualised capital costs, annualised fixed operating and maintenance costs and the 2020 BRCP for the 2022–23 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 = $194,206,746.

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

This produces an ANNUALISED_CAP_COST = $16,984,441 per year.

The annualised capital cost estimate has decreased by 9.8% relative to the 2019 BRCP, due to a decrease in the WACC.

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 = $30,926 per MW per year.

The annualised fixed O&M cost estimate has increased by 3.9% relative to the 2019 BRCP, due to an increase 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 2020 BRCP is estimated to be $142,461 which is then rounded to the nearest $100.

The proposed BRCP = $142,500 per MW per year.

The proposed 2020 BRCP is 7.6% lower than the 2019 BRCP.

An overview of the variation of the components of the 2019 BRCP and the proposed 2020 BRCP is listed in Table 5.

Table 5 BRCP components for 2019 and 2020

	2019 BRCP	Proposed 2020 BRCP	Variance	Unit
BRCP	154,200	142,500	-7.6%	$/MW/year
ANNUALISED_FIXED_O&M	29,776	30,926	3.9%	$/MW/year
Generation O&M cost	14,266	14,355	0.6%	$/MW/year
Switchyard O&M cost	549	544	-1.0%	$/MW/year
Transmission line O&M cost	34	34	-1.0%	$/MW/year
Asset insurance cost	4,673	5,397	15.5%	$/MW/year
Fixed network access and on-going charges	10,255	10,596	3.3%	$/MW/year
CAP_COST	191,011,923	194,206,746	1.7%	$
Power station cost	843,379	859,629	1.9%	$/MW
Margin M	17.15	17.16	0.1%	%
Transmission cost	179,028	181,760	1.5%	$/MW
Capacity Credit allocation	151.4	152.28	0.6%	MW
Fixed fuel cost	7,109,638	7,213,564	1.5%	$
Land cost	2,295,991	2,536,250	10.5%	$
WACC (Real)	5.35	3.60	-32.7%	%
ANNUALISED_CAPCOST	18,835,625	16,984,441	-9.8%	$/year
Term of finance	15	15	0%	Years

Table 6 Breakdown of variance between 2019 and proposed 2020 BRCP

	Impact ($)	Impact (%)	BRCP ($ ex GST)
2019 BRCP			154,200 *
Escalation Factors	-2,235	-1.4%	151,965
Power station cost	4,569	3.0%	156,534
Margin M	9	0.0%	156,543
Fixed fuel cost	100	0.1%	156,643
Land cost	169	0.1%	156,812
Transmission cost	277	0.2%	157,089
WACC	-15,356	-10%	141,733
CC allocation	-662	-0.4%	141,071
Fixed O&M	1,390	0.9%	142,461
Proposed 2020 BRCP	-11,739	-7.6%	142,500 *

* BRCP values are rounded to the nearest $100.

A detailed breakdown of the historical BRCP since market start is provided in Appendix A2.

4. Stakeholder submissions and methodology concerns

This chapter presents concerns with the current BRCP methodology.

AEMO and Market Participants have outlined concerns and provided feedback on the BRCP methodology during previous public consultation processes[21].

The feedback provided by stakeholders as part of the BRCP public consultation process will be provided to the ERA for their consideration when conducting the 5 yearly review of the Market Procedure: *Maximum Reserve Capacity Price*, under clause 4.16.9 of the Wholesale Electricity Market (WEM) Rules. Following this review, the ERA may amend the Market Procedure accordingly, with the aim of facilitating a fair, competitive and efficient environment for Market Participants to operate within[22].

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 that the size of the reference power generator does not reflect future growth of peak demand in the WEM. AEMO notes that an OCGT power station has not been installed in the SWIS in the past 7 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) Merredin Energy (2019)
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 1 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 approach. This may result in a BRCP determination that is not	Perth Energy (2017, 2018, 2019) Tesla (2017) Alinta (2015)

[21] All submissions made till date by Market Participants can be found at: https://www.aemo.com.au/Electricity/Wholesale-Electricity-Market-WEM/Reserve-capacity-mechanism/Benchmark-Reserve-Capacity-Price.

[22] The status of this review is available at: https://www.erawa.com.au/electricity/wholesale-electricity-market/methodology-reviews/benchmark-reserve-capacity-price-and-energy-price-limits-review-2019

	reflective of the current economic situation. AEMO notes that the proposed 2020 BRCP calculation has resulted in a lower than expected WACC, due to an irregular real risk-free rate of return. This issue also occurred in the calculation of the 2017, 2018 and 2019 BRCP. AEMO considers that all components of the WACC methodology should be reviewed.	Merredin Energy (2019)
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 considers that the limit of $50 million is 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 that 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 2020 BRCP.

AEMO invites submissions on the proposed 2020 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 (Australian Western Standard Time) on 11 October 2019.

Enquiries may be directed to Trevor Griffiths or Neetika Kapani on (08) 9469 9800.

A1. 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:

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

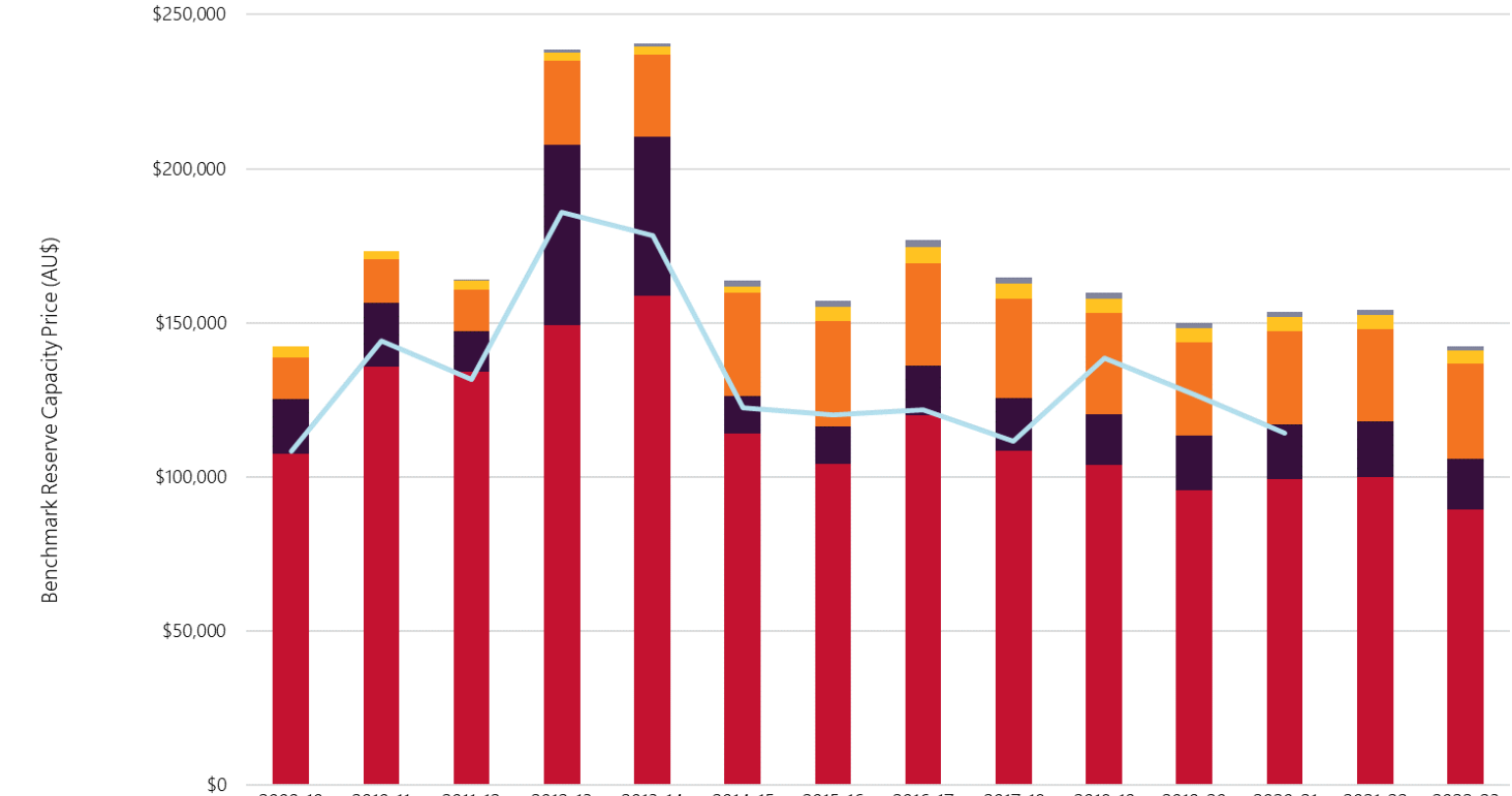
The WACC parameters applied in the 2019 BRCP and the proposed 2020 BRCP are shown in Table 8.

Table 8 WACC parameters for the 2019 and proposed 2020 BRCP

Parameter	Notation	2019 value	Proposed 2020 value
Nominal risk-free rate of return (%)	R_f	2.71	1.03
Expected inflation (%)	i	2.42	2.36
Real risk-free rate of return (%)	R_{fr}	0.28	-1.30
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*	2.02	2.33
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

A2. 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	2022-23
Land cost (LC)	$-	$-	$293	$769	$818	$1,973	$1,783	$2,064	$1,912	$1,831	$1,650	$1,585	$1,535	$1,483
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	$4,753	$4,217
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	$29,776	$30,926
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	$18,120	$16,180
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	$100,002	$89,655
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	$114,134		

Measures and abbreviations

Units of measure

Abbreviation	Unit of measure
$	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
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
WACC	Weighted average cost of capital
WEM	Wholesale Electricity Market