AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Draft Report: 2021 Benchmark Reserve Capacity Price for the 2023-24 Capacity Year

October 2020

Important notice

PURPOSE

AEMO has prepared this document under Section 4.16 of the Wholesale Electricity Market Rules to provide information about the proposed value for the 2021 Benchmark Reserve Capacity Price for the 2023–24 Capacity Year, as at the date of publication.

DISCLAIMER

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VERSION CONTROL

Version	Release date	Changes
1	22/10/2020	

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.

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.

This report presents the outcome of the draft determination of the BRCP for the 2021 Reserve Capacity Cycle. The 2021 BRCP applies for the 2023-24 Capacity Year, covering the period from 8:00 am on 1 October 2023 to 8:00 am on 1 October 2024.

The methodology applied to determine the BRCP is defined by the ERA, and remains unchanged since the last five-yearly review completed in 2011[2].

In May 2020[3], the Economic Regulation Authority (ERA) postponed the review of the methods for setting the annual BRCP and energy price limits until after 1 October 2022. This suspension was due to overlaps of their review with the Energy Transformation Implementation Unit's work stream on market power mitigation.

ERA consulted with the BRCP Working Group[4] in July 2020[5]. There was consensus at the BRCP Working Group meeting for ERA to limit the scope of their review of the Market Procedure to the Weighted Average Cost of Capital (WACC) and its underlying variables[6].

The ERA expects to publish the Procedure Change Report on 6 November 2020 with an expected commencement date of 9 November 2020 for the new Market Procedure. Limiting the scope allows the ERA to fast-track the amendment process, with the aim to publish a revised Market Procedure in time for AEMO to apply the revised WACC calculation to the final 2021 BRCP determination.

AEMO has followed the methodology that is current at the time of this publication. As such, the following costs are included in the calculation of the 2021 BRCP:

- Power Station balance of plant costs.

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[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 (ERA) 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 ERA 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 ERA 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.

[3] ERA notice, Suspension of the method reviews: https://www.erawa.com.au/cproot/21237/2/NOTICE---Suspension-of-BRCPEPL-method-reviews.pdf

[4] BRCP working group: https://www.erawa.com.au/rule-change-panel-brcp-working-group established by the Market Advisory Committee under clause 2.3.17 of the WEM Rules.

[5] Rule Change Panel – establishment of the BRCP working group: https://www.erawa.com.au/cproot/21385/2/BRCP-Working-Group----Terms-of-Reference-28-July-2020-.pdf

[6] Procedure change proposal: Calculation of Benchmark Reserve Capacity Price (EEPC_2020_02): https://www.erawa.com.au/cproot/21445/2/Review-of-BRCP-market-procedure-2020---BRCP-procedure-change-proposal---Approved-for-publishing.pdf

- 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 2021 BRCP for the 2023–24 Capacity Year

AEMO proposes a value of $136,300 per MW per year for the 2021 BRCP, 3.9% lower than the 2020 BRCP of $141,900 per MW per year.

Changes from the 2020 BRCP

Figure 1 shows the year-on-year variation in BRCP relating to changes in the input parameters between the draft 2021 BRCP (for the 2023–24 Capacity Year) and the 2020 BRCP (for the 2022-23 Capacity Year).

Figure 1 Breakdown of variance between the draft 2021 BRCP and 2020 BRCP

The proposed 2021 BRCP has decreased by 3.9% compared to the 2020 BRCP and is the lowest BRCP calculated since the 2006 BRCP. This decrease can mostly be attributed to the escalation factors which resulted in a reduction of 9.2% relative to the previous BRCP. The Weighted Average Cost of Capital (WACC)[7] of 3.34% resulted in a further 0.9% reduction of the BRCP. The main driver of the reduction in real WACC is that the nominal risk-free rate of return is significantly lower than the expected inflation.

The BRCP decrease is offset by:

- A relative increase of 5.4% due to higher power station costs caused by a weakening AUD/USD exchange rate.

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

- A relative increase of 1.3% due to higher fixed operation and maintenance (O&M) costs. The main driver for this is a big insurance premium increase.

Invitation for submission

AEMO invites submissions on the proposed 2021 BRCP and the supporting information by **5:00 pm** (Australian Western Standard Time) on Monday, 9 **November 2020**. Submission format details are provided in Chapter 4.

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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 130% 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 2021 Reserve Capacity Cycle, which applies to the 2023-24 Capacity Year. Following a public consultation process, AEMO must consider submissions before submitting a final 2021 BRCP to the Economic Regulation Authority (ERA) for approval in accordance with clause 4.16.7 of the Wholesale Electricity Market Rules (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 used to determine the BRCP has not changed since 2011 due to the deferral of the five-yearly review of the Market Procedure.

AEMO and Market Participants have previously highlighted concerns with the BRCP methodology, particularly the:

- Reference equipment used for the determination.
- The Weighted Average Cost of Capital (WACC), including the debt risk premium (DRP).
- Insurance costs.
- Transmission connection cost determination.

Currently, the ERA is completing a review of the Market Procedure with a focus on the WACC parameters[8]. Given the public consultation window for their Procedure change has closed, it is expected that changes in the WACC calculation would be available for inclusion by AEMO in the final 2021 BRCP report.

In determining the draft 2021 BRCP, AEMO has used a combination of publicly available information, 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 1.

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

[8] ERA 2020 procedure change proposal: https://www.erawa.com.au/cproot/21445/2/Review-of-BRCP-market-procedure-2020---BRCP-procedure-change-proposal---Approved-for-publishing.pdf.

Table 1 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 operation and maintenance (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 Corporation	• Transmission connection costs and relevant escalation factors • Network access charges
Independent insurance broker	• Asset replacement insurance costs

1.2 Supporting documentation

The following documents relate to the calculation of the proposed 2021 BRCP and are available on AEMO's website[9]:

- 2021 BRCP calculation spreadsheet, draft report version.
- GHD report, 2021 Benchmark Reserve Capacity Price for the South West Interconnected System (October 2020).
- PricewaterhouseCoopers (PwC) report, 2021 Benchmark Reserve Capacity Price Cost Escalation Factors (September 2020).
- PwC memo, 2021 Benchmark Reserve Capacity Price Debt Risk Premium for the South West Interconnected System (October 2020).
- Landgate memo, Land values for the 2021 Benchmark Reserve Capacity Price (August 2020).
- WACC parameter calculation spreadsheet for draft report.
- Western Power report, Total Transmission Cost Estimate for the Benchmark Reserve Capacity Price for 2023/24 (September 2020).

[9] 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 2021 BRCP.

2.1 Escalation factors

The 2021 BRCP calculation is based on a theoretical power station that would commence operation on 1 October 2023. Costs have been determined as at 2020 and have been escalated to 2023.

Different escalation factors are used depending on the parameter to be escalated, as summarised in Table 2.

Table 2 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 2021 BRCP are listed in Table 3.

Table 3 Escalation factors by financial year

Escalation factor	2020-21	2021-22	2022-23	2023-24
Power station capital cost	-7.84%	-3.65%	-0.03%	2.98%
Generation O&M cost	-0.73%	-0.15%	1.16%	1.84%
Connection asset O&M cost	0.96%	0.95%	1.68%	2.53%
CPI	3.00%	1.25%	2.00%	2.50%
Transmission connection cost	0.73%	0.73%	0.73%	0.73%

The key changes in escalation factors from the 2020 BRCP are:

- A sharp decrease in the power station capital cost escalation factors from 2020 until 2022 due to large decreases in steel and copper prices. These are a result of reduced international demand caused by COVID-19. In subsequent years, the forecast power station capital cost escalation factors are expected to recover slightly, with positive values from 2020 BRCP values.
- Both generation and connection asset operation and maintenance (O&M) escalation factors decrease as a result of COVID-19 flatlining market expectations in the construction and utilities sectors.
- The transmission connection escalation factors also decreased compared to the previous BRCP report, but do not influence the transmission cost. This cost is already escalated by Western Power to 1 April 2023.

More information on how these escalation factors are defined may be found under the 2021 BRCP related documents tab[10] which contains Western Power's report: *Total Transmission Cost Estimate for the Benchmark Reserve Capacity Price for 2023/24* and GHD's report: *2021 Benchmark Reserve Capacity Price for the South West Interconnected System*.

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 2021 BRCP, consistent with previous BRCP calculations. Since the 2019 BRCP, Siemens has made improvements to the generator and has increased its gross output from 175.6 MW to 177.30 MW. This unit is the most appropriate machine available to meet the criteria for the BRCP calculation[11]. Version 29.0 of Thermoflow's GTPro/PEACE 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 2023 using the power station capital cost escalation factor.

The proposed value of PC = $816,437 per MW.

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

[11] 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 177.30 MW Siemens unit to represent the expected configuration of the 160 MW generator specified in the Market Procedure.

The estimated PC has decreased by 5.0% from the 2020 BRCP (or a decrease of $43,192 per MW). This is caused by the global reduction in economic activity due to the COVID-19 pandemic, which resulted in sharp decreases in steel and copper prices. Government stimulus measures and a lower AUD/USD exchange rate are expected to contribute to higher inflation.

2.2.2 Capacity Credit (CC) allocation

GHD used Thermoflow's GTPro/PEACE to model the gross 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.

This proposed CC value remained unchanged from the 2020 BRCP. No further improvements by the manufacturer have been implemented to the reference generator since the 2020 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 = 16.69%.

Compared to last year's value of 17.16%, the Margin M value for the 2021 BRCP has decreased by -2.7%.

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 2020 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[12].

AEMO calculated the average of the six valuations and escalated this to 1 April 2023 using the Consumer Price Index (CPI) escalation factor. The size of the land parcels for all regions was three hectares.

The proposed value of LC = $2,421,886.

The COVID-19 pandemic has had significant impact on several sectors, particularly retail and entertainment, leading to increased unemployment and a retraction in Western Australia's economy. However, industries such as mining, and resources such as iron ore and gold, have increased, and the negative influences of the COVID-19 pandemic have not been as evident in the industrial real estate markets that support this sector. The LC estimate has decreased by 4.5% (a decrease of $114,363) from the 2020 BRCP, due to lower CPI escalation factors. The same method for calculating the average land costs was used as for the 2020 BRCP.

[12] Available at: https://apps.osr.wa.gov.au/portal/0/home.

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 for 160 MW OCGT's 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 independently audited 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 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) and includes transfer duty.
- A Market Participant may not need to purchase the entire 12 hectares for the generator, instead securing easement rights for some or all the land. AEMO estimates easement costs to be half of the land value.
- The land value includes transfer duty.

Easement costs have decreased by 3.6% from the 2020 BRCP, due to the decrease in LC (see Section 2.2.4 for further information). Shallow connection costs have increased by 1.4% from the 2020 BRCP, however AEMO does not have visibility into the components of this calculation provided by Western Power for confidentiality reasons.

The proposed value of TC = $180,927 per MW.

The TC estimate has decreased by 0.5% (a decrease of $833 per MW) from the 2020 BRCP. AEMO expects this is due to the decrease in transmission and line easement costs.

No escalation factors have been applied because Western Power has already escalated the TC estimate to 1 April 2023.

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 sufficient diesel for 14 hours of continuous operation. An estimate of FFC was calculated as at 30 June 2020, which is escalated to 1 April 2023 using the CPI escalation factor. The cost of diesel includes delivery and an excise rebate.

The proposed value of FFC = $6,966,444.

This value has decreased by 3.4% (a decrease of $247,120) since the 2020 BRCP, due to a significant decrease in the price of delivered diesel to $0.464 per litre (43.0% lower than the 2020 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 have been calculated using information available from the Reserve Bank of Australia (RBA) website[13]. 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.

[13] See RBA's statement of monetary policy available at: http://www.rba.gov.au/publications/smp/index.html.

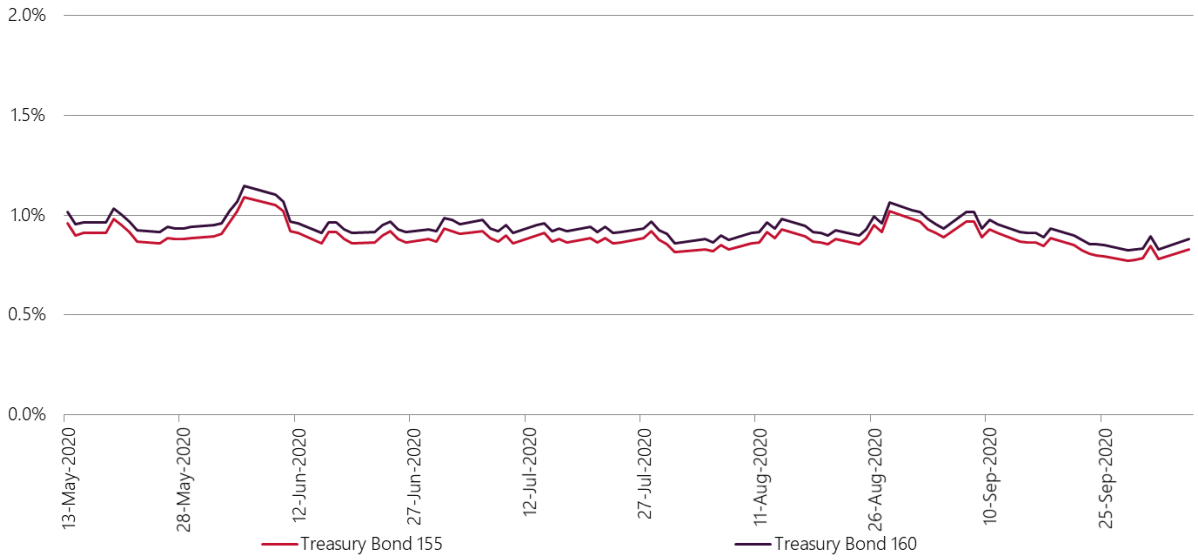
The ERA is reviewing the WACC and its underlying variables as part of its current review of the Market Procedure.

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 17 September 2020.

Commonwealth Government bond yields have remained constant over the May to September review period, as shown in Figure 2.

Figure 2 Commonwealth Government bond yields, May 2020 to September 2020[14]



The nominal risk-free rate calculated from these bonds is 0.94% and corresponds to a decrease of 4.2% (as a proportion) from the 2020 BRCP. September 2020 was the lowest recording of Commonwealth Government bond yields of all time[15].

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 2.39%.

The real risk-free rate is calculated by subtracting the current inflation from the yield of treasury bonds over the investment period. It is therefore the interest from a risk-free investment, and has a value of -1.42%, indicating that the Commonwealth Government bond yields over the measurement period do not out-pace assumed inflation. However, this is 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 -0.3% and not necessarily representative of market conditions[16].

Despite declines in the Standard and Poor's/Australian Stock Exchange 200 index (S&P/ASX 200)[17] over the measurement period, Government bond yields have remained constant. Therefore, government bonds have served as a safe haven despite the financial impacts of COVID-19.

[14] Treasury bond data is available at: https://www.rba.gov.au/statistics/tables/ and https://www.rba.gov.au/statistics/tables/xls/f16.xls?v=2020-10-13-15-45-32.

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

[16] The June 2020 CPI figure is published by the RBA, available at: https://www.rba.gov.au/publications/smp/2020/aug/economic-outlook.html.

[17] See: https://www2.asx.com.au/markets/company/xjo.

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*[18]. 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 2.01% from market observations ending on 17 September 2020. This is a preliminary figure, with the final DRP estimate to be developed using updated market observations for the final 2021 BRCP report.

Capital Asset Pricing Model results

The proposed value of the WACC (real terms) = 3.34%.

This is lower than the WACC (real terms) of 3.51% used in the 2020 BRCP, due to this year's nominal risk-free rate of return of 0.94%.

AEMO expects the outcomes of the Market Procedure Change Proposal[19] is likely to have impacts on the WACC calculation for the final 2021 BRCP.

2.3 Operating and maintenance (O&M)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 has been calculated based on individual component costs as at June 2020, which are derived from similar recent OCGT projects. These costs were then escalated to 1 October 2023 using the generation O&M escalation factor.

The proposed value of generation O&M costs = $13,931 per MW per year.

The estimated generation O&M costs decreased by 4.6% (a decrease of $669) relative to the 2020 BRCP, due to the decrease in wages and PC (refer to Section 2.2.1).

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.

[18] 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.

[19] Available at: https://www.erawa.com.au/electricity/wholesale-electricity-market/market-procedures/procedure-change-eepc_2020_02-review-of-the-benchmark-reserve-capacity-price-market-procedure.

The 330 kilovolt (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 2020, which was then escalated to 1 October 2023 using the connection O&M escalation factor.

The proposed value of switchyard O&M costs = $544 per MW per year.

The estimated switchyard O&M costs remained unchanged from the 2020 BRCP. The low asset price increase was counterbalanced by the sub-unitary escalation factors (refer to the connection asset O&M escalation factor in 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 megavolt amperes (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 2020, which was then escalated to 1 October 2023 using the connection O&M escalation factor.

The proposed value of transmission line O&M costs = $34 per MW per year.

The estimated transmission line O&M remained unchanged from the 2020 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[20].

Premiums were calculated as follows:

- Asset replacement insurance premium was calculated as 0.37% of the limit of liability. This represents a 61.7% relative increase from the 2020 BRCP premium. 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 $632,945 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 $172,806 per year.
- Public and products liability insurance is estimated as $133,089 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 $10,000 per year for an annual insurance site survey is included.

[20] AEMO uses this broker for its insurance policies, therefore an internal vetting process has already been performed. This broker has requested to remain anonymous under the agreement of the provision of the information

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 2023 using the CPI escalation factor.

The proposed value of asset insurance costs = $6,356 per MW per year.

Insurance cost estimates have decreased by 17.9% (an increase of $963 per MW per year) relative to the 2020 BRCP. Overall insurance pricing in the second quarter of 2020 in the Pacific region increased 31%, continuing an upward trend that began in 2015 and is the 14th consecutive increase. Underwriters continue to push for higher levels of pricing increases due to the combined effects of social inflation pressures (claims for the commercial liability business), persistently low yields, and a number of large underwriting losses, including from COVID-19 and bushfires.

2.3.5 Fixed network access and ongoing charges

Network access charges were estimated using Western Power's network access tariffs (Price List) data from the 2020-21 Price List approved by the ERA.[21] The relevant tariff that applies to generation facilities is the Transmission Reference Tariff 2 (TRT2).

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 is the most expensive location for Transmission Use of System charges and hence was selected as the base tariff input for the estimation of the fixed network access charges. The Transmission Use of System charges are based on the cost to Western Power of that generating asset's use of the SWIS, and are dependent on factors such as location, line-length and complexity of the grid connection.

The other two input component costs are:

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

Total annual costs per MW were calculated as at July 2020 and have been escalated by CPI to 1 October 2023.

The proposed value of fixed network access costs = $11,122 per MW per year.

The fixed network access cost estimates have increased by 5% (an increase of $525) relative to the 2020 BRCP, due to an increase in Control System and Transmission Use of System charges.

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

3. Proposed value of the 2021 BRCP

This chapter includes the proposed value for the annualised capital costs, annualised fixed operating and maintenance costs and the 2021 BRCP for the 2023-24 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 has been estimated from the component costs determined in Section 2.2.2. This is expressed as:

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

The proposed value of CAP_COST = $185,038,881

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

This produced an ANNUALISED_CAP_COST = $15,888,821 per year.

The annualised capital cost estimate decreased by 5.8% relative to the 2020 BRCP, due to decreases across most components.

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

The proposed value of ANNUALISED_FIXED_O&M = $31,987 per MW per year.

The annualised fixed O&M cost estimate increased 2.6% relative to the 2020 BRCP, primarily due to increases asset insurance costs.

3.3 BRCP Calculation

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

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

The proposed value of the 2021 BRCP is estimated to be $136,327 per MW per year, which is then rounded to the nearest $100.

The proposed BRCP = $136,300 per MW per year.

The proposed 2021 BRCP is 3.9% lower than the 2020 BRCP.

An overview of the variation of the components of the 2020 BRCP and the proposed 2021 BRCP is listed in Table 4 and Table 5.

Table 4 BRCP components for 2020 and 2021

	2020 BRCP	Proposed 2021 BRCP	Variance	Unit
BRCP	141,900	136,300	-3.9%	$/MW/year
ANNUALISED_FIXED_O&M	31,168	31,987	2.6%	$/MW/year
Generation O&M cost	14,600	13,931	-4.6%	$/MW/year
Switchyard O&M cost	544	544	0.0%	$/MW/year
Transmission line O&M cost	34	34	0.0%	$/MW/year
Asset insurance cost	5,393	6,356	17.9%	$/MW/year
Fixed network access and on-going charges	10,596	11,122	5.0%	$/MW/year
CAP_COST	194,116,340	185,038,881	-4.7%	$
Power station cost	859,629	816,437	-5.0%	$/MW
Margin M	17.16%	16.69%	-2.7%	%
Transmission cost	181,760	180,927	-0.5%	$/MW
Capacity Credit allocation	152.28	152.28	0.0%	MW
Fixed fuel cost	7,213,564	6,966,444	-3.4%	$
Land cost	2,536,250	2,421,886	-4.5%	$
WACC (Real)	3.51%	3.34%	-4.8%	%
ANNUALISED_CAPCOST	16,860,715	15,888,821	-5.8%	$/year
Term of finance	15	15	0%	Years

Table 5 Breakdown of variance between 2020 and proposed 2021 BRCP

	Impact ($)	Impact (%)	BRCP ($ ex GST)
2020 BRCP			**141,900 ***
Escalation Factors	-13,000	-9.2%	128,900
Power station cost	7,600	5.4%	136,500
Margin M	-400	-0.3%	136,100
Fixed fuel cost	-100	-0.1%	136,000
Land cost	-100	-0.1%	135,900
Transmission cost	-100	-0.1%	135,800
WACC	-1,300	-0.9%	134,500
CC allocation	-	0.0%	134,500
Fixed O&M	1,800	1.3%	136,300
Proposed 2021 BRCP	-5,600	-3.9%	**136,300 ***

* BRCP values are rounded to the nearest $100.

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

4. Invitation for submissions

This chapter details information on how to provide a submission on the proposed 2021 BRCP.

AEMO invites submissions on the proposed 2021 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.

4.1 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.

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 WA Markets

PO Box 7096

Cloisters Square, Perth, WA 6850

The deadline for submissions is **5:00 PM (Australian Western Standard Time)** on **9 November 2020**.

Enquiries may be directed by email to Andrei Costache or Neetika Kapani to wa.capacity@aemo.com.au.

A1. WACC

The pre-tax real WACC has been 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 2020 BRCP and the proposed 2021 BRCP are shown in Table 7.

Table 6 WACC parameters for the 2020 and proposed 2021 BRCP

Parameter	Notation	2020 value	Proposed 2021 value
Nominal risk-free rate of return (%)	R_f	0.98	0.94
Expected inflation (%)	i	2.36	2.39
Real risk-free rate of return (%)	R_{fr}	-1.35	-1.42
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*	2.23	2.01
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 3 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	2023-24
Land cost (LC)	$-	$-	$293	$769	$818	$1,973	$1,783	$2,064	$1,912	$1,831	$1,650	$1,585	$1,535	$1,472	$1,388
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	$4,186	$3,993
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	$31,168	$31,987
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	$16,062	$15,793
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	$89,002	$83,164
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	$78,573		

Abbreviations

Abbreviation	Expanded name/definition
$ or AUD	Australian dollar
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 coststandard
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
IMO	Independent Market Operator
kV	Kilovolts
kW	Kilowatts
LC	Land cost
M	Margin to cover legal, approval, financing and other costs and contingencies
MRCP	Maximum Reserve Capacity Price
MVA	Megavolt amperes
MW	Megawatt
OCGT	Open cycle gas turbine
O&M	Operating and maintenance
PC	Power station capital cost
PwC	PricewaterhouseCoopers Australia
RBA	Reserve Bank of Australia
S&P/ASX	Standard and Poor's/Australian Stock Exchange
SWIS	South West interconnected system
TC	Transmission connection costs
WACC	Weighted average cost of capital
WEM	Wholesale Electricity Market