Economic Regulation Authority

2022 benchmark reserve capacity price for the 2024/25 capacity year

Final determination

17 December 2021

D242073

Economic Regulation Authority

Level 4, Albert Facey House

469 Wellington Street, Perth WA 6000

Telephone 08 6557 7900

Email info@erawa.com.au

Website www.erawa.com.au

This document can also be made available in alternative formats on request.

National Relay Service TTY: 13 36 77

Contents

List of appendices

Executive summary

The Economic Regulation Authority has determined the 2022 benchmark reserve capacity price, applicable to the 2024/25 capacity year, to be $165,700 per megawatt (MW) per year. The Australian Energy Market Operator (AEMO) will use the 2022 benchmark reserve capacity price (BRCP) to determine the reserve capacity price for the 2024/25 capacity year.[1]

The Wholesale Electricity Market within the South West Interconnected System (SWIS) includes a capacity mechanism that uses a reserve capacity price to provide price signals for capacity providers to enter the market. The capacity mechanism ensures that there is enough capacity installed in the SWIS to guarantee that electricity is available when it is required. The BRCP is an input into the calculation of the reserve capacity price, which is the price paid to generators for each MW of capacity that they make available in that year.[2] The revenue from capacity payments combines with other revenue from generating electricity and providing essential system services to provide the overall return for investors.

The BRCP is calculated based on an estimate of the cost of a new generator - specified as a 160 MW open cycle gas turbine - connecting to the SWIS to provide additional reserve capacity.[3] The BRCP is estimated through a bottom-up, engineering-based cost assessment, with the method specified by the BRCP market procedure. This cost assessment is based on factors including materials prices, costs of labour, interest rates and exchange rates.

The 2022 BRCP of $165,700 per MW per year is 9.2 per cent higher than the 2021 price of $151,700 per MW per year.[4] This change is largely due to a higher cost of capital from rising interest rates in debt markets, increases in the forecast price of steel and copper, and increases to labour costs in Western Australia. The 2021 BRCP was determined during the COVID-19 pandemic when market prices worldwide were subdued as industrial activity, demand and supply chains were disrupted. As markets have started to recover from the pandemic, prices have risen and driven increases in the factors that affect the BRCP.

This report details how the ERA determined the BRCP as required by the market procedure. The ERA has used data and analysis from independent consultants (GHD, PwC and an insurance broker), Western Power and Landgate to determine the BRCP. These reports are available on the ERA's website.[5]

1 AEMO, 2021, *2021 and 2022 Reserve Capacity timetables*, pp 4-5.

2 All holders of capacity credits receive capacity payments. Although generators are the largest capacity credit holders, capacity credits can be provided to storage and demand side programmes. Generators that do not participate in the reserve capacity mechanism (or are ineligible) do not receive capacity payments.

3 Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020, section 2.1. The OCGT must be able to run on liquid fuel.

4 The 2021 BRCP price is in AEMO, 2020, *Final Report: 2021 Benchmark Reserve Capacity Price for the 2023-24 Capacity Year*, p.3.

5 Economic Regulation Authority, 'Benchmark Reserve Capacity Price', (online).

1. Introduction

The SWIS is a small, geographically isolated electricity system in Western Australia. To ensure a reliable supply of electricity, sufficient electricity generation must be available to continuously meet the demand of consumers, including during emergencies.

The reserve capacity mechanism provides a price signal for the ongoing supply of electricity generation capacity in the SWIS. Capacity suppliers, which are mostly generators, are paid to make their generating capacity available regardless of whether they are required to supply electricity.[6] The amount generators are paid for their generating capacity is based on the reserve capacity price, which is determined by reference to the BRCP.

The BRCP provides an estimate of the marginal cost of providing reserve capacity into the SWIS for a given capacity year, usually two years into the future. In line with the market procedure, the BRCP is calculated by conducting a bottom-up, engineering-based cost estimate of a 160 MW Open Cycle Gas Turbine (OCGT) with enough fuel to operate for 14 hours continuously at its maximum rated capacity.[7] The BRCP assessment includes all costs that are expected to be incurred when developing such a power station. These costs include:

- Fixed operating and maintenance costs for the power station, fuel handling, and transmission connection components.
- Land costs.
- Liquid fuel storage and handling facilities.
- Transmission connection costs.
- Other ancillary and infrastructure costs that are normally incurred when developing a power station.
- Allowances for legal, insurance, financing, and environmental costs including a contingency margin.

The BRCP is one input into the reserve capacity price determination process.[8] The reserve capacity price is the price paid to generators for each MW of capacity that they make available in that year. The 2024/25 reserve capacity price is based on the BRCP, and the amount of excess reserve capacity expected to be available in 2024/25.[9,10] The greater the excess capacity in 2024/25, the lower the reserve capacity price will be, relative to the BRCP.[11] This

6 For the ease of comprehension, the term ‘generators’ has been used to refer to suppliers of reserve capacity as they are the dominant group. All providers of capacity are remunerated through the reserve capacity mechanism, which includes demand side programmes and storage.

7 Exact details of the power station requirements are defined in section 2.1 of the Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020. The power station must be able to operate on distillate fuel. All OCGT references in this determination refer to an OCGT that must be able to run on distillate fuel.

8 AEMO conducts the reserve capacity price determination process. The timeline for setting the 2024/25 reserve capacity price is available: AEMO, 2021, *2021 and 2022 Reserve Capacity timetables*, pp 4-5.

9 The required amount of reserve capacity for a particular capacity year is based on the reliability standard which is part of the planning criterion in the Wholesale Electricity Market Rules (WA), 1 December 2021, Rule 4.5.9. Excess reserve capacity is based on how much more reserve capacity is being offered into the SWIS relative to the amount required under the planning criterion.

10 The amount of capacity required in a capacity year is determined by the Long Term Projected Assessment of System Adequacy study which AEMO conducts. The results are published in AEMO’s Electricity Statement of Opportunities.

11 The formula for the reserve capacity price is in Wholesale Electricity Market Rules (WA), 1 December 2021, section 4.29.

determination, which is for the 2022 reserve capacity cycle, sets the BRCP for the 2024/25 capacity year.[12,13]

Throughout this determination:

- References to the market procedure refer to the BRCP market procedure unless otherwise specified.[14]
- Cost and price estimates are in Australian dollars excluding Goods and Services Tax, unless otherwise specified.
- All references to the 2022 BRCP refer to the ERA's final determined price of $165,700 per MW per year applicable to the 2024/25 capacity year, unless otherwise specified.

1.1 Transfer of the BRCP calculation function to the ERA

The ERA became responsible for calculating and determining the BRCP from 1 July 2021. Prior to that, AEMO was responsible for calculating the BRCP, which it then submitted to the ERA for approval. The BRCP market procedure has not yet been updated to reflect this transfer of responsibilities. Regardless, the ERA has applied the BRCP market procedure as if the market procedure had been updated to show the change of function and has carried out the BRCP determination accordingly.

1.2 Stakeholder submissions

The ERA published a draft determination on 10 November 2021. No submissions were received on the draft determination.

1.3 Changes between the draft and final determinations

The ERA's final determination for the 2022 BRCP is based on the latest available information. Since the draft determination, the following updates have been made to arrive at the final 2022 BRCP:

- Increase in the weighted average cost of capital (WACC) mostly due to an increase in the risk free rate as interest rates on government bonds rose. Details are in section 4.1.
- Increase in the consumer price index (CPI) forecasts. This is detailed below.
- Revised asset insurance costs from refining the assessment of the asset replacement risk to Western Australia specifically and a 4 per cent increase in the business interruption insurable amount. This is detailed in Appendix 5.

The effect of these changes is a 3.5 per cent increase to $165,700 per MW per year from the draft determination of $160,100 per MW per year. A consolidated table showing the change in values between the draft and final determinations is at Appendix 7.

[12] The BRCP is also used in the calculation of the maximum price that can be offered into a Reserve Capacity Auction if an auction is required. A capacity year starts at 8:00am on 1 October and finishes at 8:00am on 1 October the subsequent year.

[13] The 2024/25 capacity year starts at 8:00am on 1 October 2024 and ends at 8:00am on 1 October 2025.

[14] Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020.

1.3.1 Increase in CPI forecasts

The market procedure requires CPI forecasts to be used in the escalation of costs not covered by the specific cost escalation factors discussed in section 4.2. CPI forecasts are used to escalate the fixed fuel costs, land costs, asset insurance costs and fixed network access and ongoing charges.[15] Escalation occurs to ensure that the BRCP cost components reflect costs in the 2024/25 capacity year.[16] The effect of the CPI forecast change on each of these cost components is discussed in the relevant sections of this report.[17]

This final determination is based on the Reserve Bank of Australia's CPI forecasts, released in November 2021.[18] The November CPI forecasts were higher than the August CPI forecasts used in the draft determination.[19]

The higher revised CPI forecasts are a small contributor to the increase in the final 2022 BRCP, compared to the draft determination.

15 The CPI escalation is different to the cost escalation applied to other cost components, such as the power station cost and transmission costs. These other cost components are escalated based on the cost escalation factors in Table 5 and GHD's report (Economic Regulation Authority, 2021, *Power station and associated* costs, Report prepared by GHD Advisory, chapter 2 (online)) which are estimated based on other factors, like materials and labour costs, and are not dependent on changes to CPI forecasts.

16 Costs associated with the construction of the power station (power station, M margin, transmission, fixed fuel and land costs) are escalated to 1 April 2024 and costs for operating and maintenance costs (generation, switchyard and transmission line O&M costs, asset insurance costs and fixed network access and ongoing charges) are escalated to 1 October 2024.

17 Fixed fuel costs and land costs are discussed in Appendix 4, and asset insurance costs and fixed network access and ongoing charges are discussed in Appendix 5.

18 Reserve Bank of Australia, 2021, *Statement on Monetary Policy – November 2021*, p 64.

19 Reserve Bank of Australia, 2021, *Statement on Monetary Policy – August 2021*, p 70.

2. Scope of the BRCP

The 2022 BRCP must include all reasonable costs expected to be incurred when developing a power station for the 2024/25 capacity year. The market procedure details how the components of the BRCP must be calculated.[20] The major components are:

- an annualised fixed operating and maintenance component, which includes:[21]
  - transmission connection costs
  - land costs
  - fixed fuel costs
  - a margin for other costs including approvals, legal and financing
- the annualised total capital cost of the power plant

To determine the 2022 BRCP, the ERA has followed the market procedure and used a combination of public information and advice from independent consultants, Western Power, and Landgate.

To calculate the BRCP by MW, the ERA must estimate the quantity of capacity credits the power plant is expected to receive in the 2024/25 capacity year.

Constrained network access will apply in the SWIS by 2024/25. As part of the implementation of constrained network access, Energy Policy WA (EPWA) developed and consulted on a framework clarifying how capacity credits will be allocated to generators given the network constraints that may exist in the SWIS. As part of a generator's capacity credit determination, each generator will be awarded a Network Access Quantity (NAQ). EPWA, Western Power and AEMO are currently working to identify the network limit advice and capacity constraint equations for the SWIS, which will affect the NAQs that generators will receive, including the calculation of NAQ for the BRCP reference generator.

EPWA is currently reviewing the reserve capacity mechanism, which includes the method for calculating the annual BRCP. The review could recommend changes to the type of BRCP reference generator and where the reference generator can locate itself within the SWIS, given the availability of NAQ within each part of the network. A generator's NAQ is affected by the available capacity that can be provided to the grid from that part of the network. The more congested a section of the network, the lower the NAQ available for new generators connecting in that section. The less congestion, the more NAQ will be available for a new entrant.

As EPWA releases information on network constraints and any changes to the method for determining the BRCP, the ERA will be able to consider how the BRCP will be calculated in the future, including how the NAQ may affect the capacity credits expected to be received by the reference generator. This may require changes to the BRCP market procedure, for which the ERA will undertake the required review and consultation process.

As this information is not yet available, the ERA has not applied the NAQ regime to the 2022 BRCP determination.

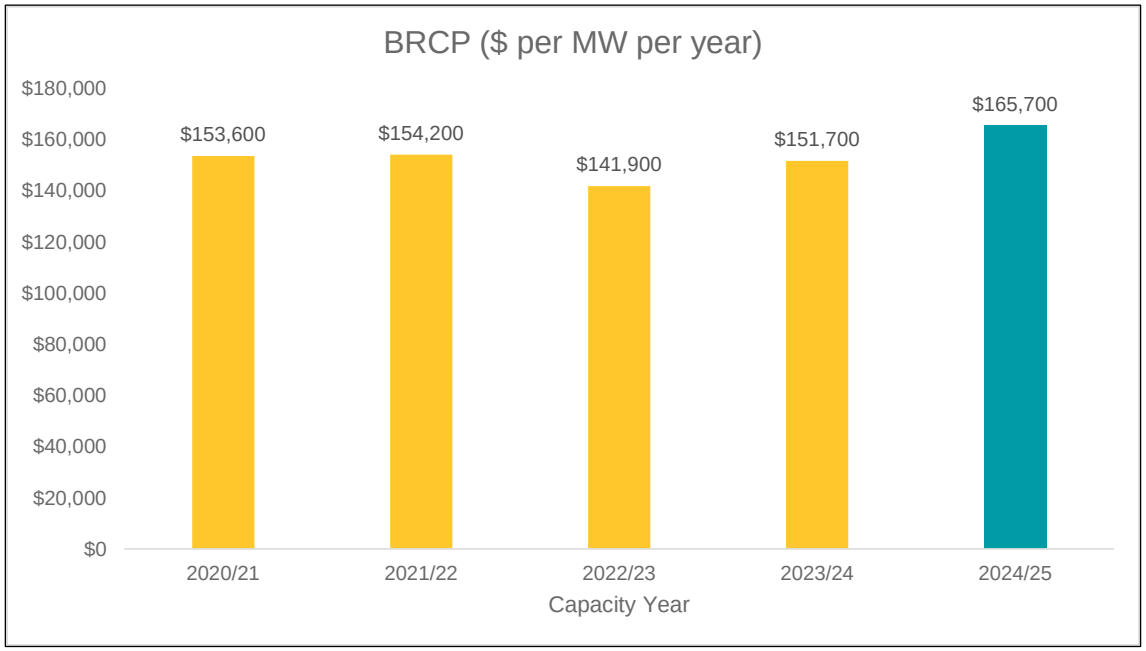
[20] Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020.

[21] The capital cost of the OCGT and the WACC are used to derive the fixed operating and maintenance costs.

3. The BRCP calculation

The ERA has calculated the BRCP to be $165,700 per MW per year for the 2024/25 capacity year.[22] Figure 1 shows the BRCP since the 2020/21 capacity year.

Figure 1: BRCP from 2020/21 by capacity year



Source: AEMO Benchmark Reserve Capacity Price webpage (online) and ERA analysis of BRCP data.

The formula for calculating the BRCP is stated in the market procedure as:[23]

$$BRCP = Annualised\ Fixed\ Operations\ and\ Maintenance + \frac{Annualised\ Capital\ Costs}{Expected\ Capacity\ Credits}$$

Table 1 provides a comparison of the 2022 BRCP and its components against the approved 2021 BRCP values.

[22] This is required by Wholesale Electricity Market Rules (WA), 1 December 2021, Rule 4.16.

[23] Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020, clause 2.10.1

Table 1: 2022 BRCP values compared with the approved 2021 BRCP values

Component	2022 BRCP	2021 BRCP	Change from 2021
BRCP ($/MW/Year)	**165,700**	**151,700**	**14,000** **+9.2%**
Annualised capital costs ($/Year)	19,887,082	18,222,883	1,664,199 +9.1%
Annualised fixed O&M costs ($/MW/Year)	34,131	32,028	2,103 +6.6%
Expected capacity credits (MW)	151.12	152.28	-1.16 capacity credits -0.8%

Source: ERA analysis of BRCP data

The breakdown of the different components underlying the annualised capital costs is detailed in Chapter 4 and Appendix 4, with the annualised fixed operations and maintenance (O&M) costs discussed in Chapter 5 and Appendix 5. The change in expected capacity credits is discussed below.

3.1 Expected capacity credits

The expected capacity credits for a 160 MW open cycle gas turbine entering the SWIS is 151.12 MW. This is based on GHD's analysis, which assessed different generators and recommended a suitable proxy for the reference generator (see section 4.2).[24] The reference generator's expected capacity credits were determined based on the net output of the generator when adjusted for site conditions as required by the market procedure.[25]

[24] Economic Regulation Authority, 2021, *Power station and associated* costs, Report prepared by GHD Advisory, sections 3.2 to 3.4 (online).

[25] See Economic Regulation Authority, 2021, *Power station and associated* costs, Report prepared by GHD Advisory, section 3.4 (online); and Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020, clause 2.3.1.

4. Annualised capital costs of the power station

The annualised capital costs of the reference generator for the 2022 BRCP are $19.9 million, 9.1 per cent or $1.7 million higher than the annualised capital costs calculated for the 2021 BRCP. This is the largest component contributing to the increase in the 2022 BRCP. The increase in annualised capital costs is mostly driven by an increase in financing costs and underlying power station costs.

Table 2: Annualised capital cost components against approved 2021 BRCP values

Component	2022 BRCP	2021 BRCP	Change from 2021
Annualised capital cost ($/year)	**19,887,082**	**18,222,883**	**1,664,199 +9.1%**
Power station cost ($/MW)	844,150	816,437	27,713 +3.4%
Margin (%)	16.21	16.69	Down 48 basis points -2.9%
Transmission cost ($/MW)	186,877	180,927	5,950 +3.3%
Fixed fuel cost ($)	7,398,376	6,915,717	482,659 +7.0%
Land cost ($)	2,699,666	2,404,251	295,415 +12.3%
WACC (%)	6.08	5.20	Up 88 basis points +16.9%
Expected capacity credits (MW)	151.12	152.28	-1.16 capacity credits -0.8%

Source: ERA analysis of BRCP data

Note: The change in the values do not directly correspond to changes in the BRCP due to the operation of the calculation specified in the BRCP market procedure.[26] For example, although land costs have increased by 12.3 per cent, this has a smaller effect on the BRCP than the 3.4 per cent increase in power station costs as the power station component is a larger part of the annualised capital cost component.

Table 2 shows the change in the cost components between the 2021 BRCP and the 2022 BRCP. The main drivers affecting the capital cost components of the BRCP (the WACC and power station costs) are discussed below with the remaining items discussed in Appendix 4.

4.1 WACC

The cost of capital represents the minimum return that a company must earn on an existing asset to satisfy its creditors, owners, and other providers of capital. A WACC weights a company's cost of capital in line with its debt to equity financing structure. For the BRCP, the WACC is used to estimate the financing costs of the power station and represents the

[26] Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020, clause 2.10.1.

long-term required rate of return when determining the power station's annualised cost. Consequently, small changes in the WACC can have a large effect on the BRCP, as the power station's life is projected over 50 years.

The ERA has reviewed and calculated the annual WACC components: the nominal risk free rate, the debt risk premium and the corporate tax rate.[27] For the 2022 BRCP, the nominal pre-tax WACC is 6.08 per cent (see Table 3), an increase on the 5.20 per cent nominal pre-tax WACC calculated for the 2021 BRCP.[28] This is mostly due to the increase in the nominal risk free rate (up 92 basis points) and is discussed in more detail below.

The increase in the WACC is the largest driver of the increase in annualised capital costs for the 2022 BRCP. Further details on the calculation of the WACC is in Appendix 6.

Table 3: WACC values for the 2022 BRCP compared to the 2021 BRCP WACC values

Parameter	2022 BRCP value	2021 BRCP value[29]	Change
WACC			
Nominal pre-tax WACC (%)	**6.08**	**5.20**	**Up 88 basis points**
Cost of equity parameters			
Nominal risk free rate (%)	1.72	0.80	Up 92 basis points
Equity beta	0.83	0.83	-
Market risk premium (%)	5.90	5.90	-
Pre-tax return on equity (%)	7.78	6.70	Up 108 basis points
Cost of debt parameters			
Nominal risk free rate (%)	1.72	0.80	Up 92 basis points
Debt risk premium (%)	1.697	2.040	Down 34.3 basis points
Debt issuance costs (%)	0.100	0.100	-
Pre-tax return on debt (%)	3.52	2.94	Up 59 basis points
Other parameters			
Debt proportion (gearing) (%)	40	40	-
Franking credits (gamma) (%)	50	50	-
Corporate tax rate (%)	30	30	-

Source: ERA analysis of BRCP data

[27] The WACC components that are required to be reviewed by the ERA are in Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020, section 2.9.

[28] AEMO, 2020, *Final Report: 2021 Benchmark Reserve Capacity Price for the 2023-24 Capacity Year*, p.4.

[29] Ibid, p.23.

4.1.1.1 Nominal risk free rate

The risk free rate is the return an investor expects from investing in an asset with no risk and is a fundamental component to calculate the WACC. The market procedure requires the ERA to use 10-year Commonwealth Government bonds as a proxy for risk free assets in Australia to estimate a long-term risk free rate of return.[30] This aligns the WACC with a long-term rate of return for the capital costs of the BRCP power station. The BRCP WACC calculation uses a nominal risk free rate, which includes the market's inflation expectations.

For this final determination, the ERA's estimate for the nominal risk free rate is 1.72 per cent, which is higher than the 0.80 per cent nominal risk free rate calculated by AEMO for the 2021 BRCP.[31,32] The increase is due to interest rates on the 10-year Commonwealth Government bonds used to calculate the 2022 BRCP WACC being higher than the interest rates assessed for the 2021 BRCP WACC.

4.1.1.2 Debt risk premium

The debt risk premium is the rate of return above the risk free rate that lenders require to compensate them for lending funds to a firm.[33] The debt risk premium compensates debt holders for the possibility of default by the issuer and is closely aligned with the risk of the business. The market procedure requires the ERA to assess corporate bonds that have a credit rating of BBB (or equivalent).[34,35] A bond's credit rating reflects the probability of default of the issuer, which is the risk that the bondholder bears. The ERA's approach to determining the debt risk premium for the BRCP is detailed in Appendix 6.

For this final determination, the ERA calculated the debt risk premium to be 1.697 per cent, which is lower than 2.040 per cent calculated by AEMO for the 2021 BRCP.[36,37] This difference is due to changes in credit markets since the 2021 BRCP determination.

4.1.1.3 Corporate tax rate

The corporate tax rate has not changed from 30 per cent.

4.1.2 Changes to the WACC between the draft and final determination

Table 4 shows the difference between the final and draft 2022 BRCP WACC and its components. The change in the WACC calculated for the draft and final 2022 BRCP

30 Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020, clause 2.9.7. To calculate the risk free rate, the market procedure uses indicative mid rates published by the Reserve Bank of Australia. Where there are no Commonwealth Government bonds with a maturity of exactly 10 years the ERA interpolates the risk free rate on a straight line basis.

31 The nominal risk free rate of 1.72 per cent is based on a 20-trading day averaging period up to 29 October 2021.

32 AEMO, 2020, *Final Report: 2021 Benchmark Reserve Capacity Price for the 2023-24 Capacity Year*, p.23.

33 This assumes that the firm being lent to has greater risk than lending to the Government.

34 Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020, clause 2.9.7(h).

35 BBB is a credit rating designated by Standard and Poor's and indicates that a business is of medium credit quality and is investment grade – Investopedia, 'Investment Grade', (online) [accessed 26 November 2021].

36 The debt risk premium of 1.697 per cent is based on a 20-trading day averaging period up to 29 October 2021.

37 AEMO, 2020, *Final Report: 2021 Benchmark Reserve Capacity Price for the 2023-24 Capacity Year*, p.23.

determination reflects the updated nominal risk free rate and the debt risk premium assessment.[38]

Table 4: Changes to the WACC and annual components since the draft determination

Parameter	Final 2022 BRCP	Draft 2022 BRCP	Change to draft
Nominal pre-tax WACC (%)	**6.08**	**5.45**	**Up 63 basis points**
Nominal risk free rate (%)	1.72	1.14	Up 58 basis points
Debt risk premium (%)	1.697	1.729	Down 3.2 basis points
Corporate tax rate (%)	30	30	-

Source: ERA analysis of BRCP data

4.2 Power station costs

The increase in power station costs to $844,150 per MW (up 3.4 per cent from 2021) is largely driven by increases in the input costs that make up the total cost of the plant.[39] Since the BRCP reference generator is to be built in the future, forecasts for these input costs are required to estimate the cost of the power plant in the 2024/25 capacity year.[40] The ERA engaged PwC to forecast these input costs, referred to as cost escalation factors, for the 2022 BRCP (Table 5).[41]

Table 5: Financial year cost escalation factors used to calculate the 2022 BRCP

Cost Escalation Factor	2021/22	2022/23	2023/24	2024/25	2025/26
Labour costs – operations and maintenance (% change)	2.45	2.45	2.70	2.70	2.42
Labour costs – construction (% change)	2.01	2.01	2.26	2.26	1.98
AUD/USD ($)	0.7700	0.7863	0.7663	0.7663	0.7663
Steel price (% change)	20.70	-27.97	-10.21	-6.98	-2.79
Copper price ($ change)	4.40	-8.61	-1.61	-3.84	2.34

Source: Economic Regulation Authority, 2021, 2022 Benchmark Reserve Capacity Price, Report prepared by PwC (online)

These cost escalation factors were provided to GHD who used them to calculate the cost escalation factors for the power station (Table 6).

38 The October 2021 debt market and interest rates are the latest available set of data used in the WACC calculation.

39 This is the total capital cost escalated to 1 April 2024 divided by the expected capacity credits of 151.12 MW. Expected capacity credits for the power station is discussed in section 3.1.

40 This approach of applying cost escalation factors to the BRCP reference generator priced at today's costs has been used consistently for previous BRCP determinations.

41 Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020, section 2.3

Table 6: Power station escalation factors

Cost escalation	Total applicable power station escalation factor (%)
2021 BRCP[42]	-11.20
2022 BRCP[43]	-2.36

Source: Economic Regulation Authority, 2021, Power station and associated costs, Report prepared by GHD Advisory, chapter 2 (online); and AEMO, 2020, 2021 Benchmark Reserve Capacity Price for the SWIS Report – 2021 BRCP for a 160MW OCGT, Report prepared by GHD Advisory, Chapter 2 (online).

The power station cost increased as a higher power station escalation factor was used in the 2022 BRCP. The higher power station escalation factor is driven by the short-term forecast increase in steel and copper prices and longer-term forecast growth in labour costs. These are due to current supply shortages for steel and copper, and restrictions on the movement of personnel due to the pandemic combined with shortages of skilled labour.[44]

Additionally, the ERA engaged GHD to assess the appropriate machine for the 2022 BRCP. GHD selected the Siemens SGT5-2000E, which is consistent with the machine chosen for the 2021 BRCP, as it most closely matches the power station requirements in the market procedure.[45] The power station requirements are that it:

- Is an industry standard OCGT power station with a nominal nameplate capacity of 160 MW prior to installing any inlet cooling system.
- Can use distillate for its fuel.
- Has a capacity factor of 2 per cent. This means that the BRCP reference generator is expected to generate at its maximum capacity for 2 per cent of the year.

When determining the capital costs of this power station, GHD incorporated the other power station requirements, which include:[46]

- Technologies that are required to demonstrate good practice for developing this type of power station, like nitrous oxide burners.
- An inlet air cooling system and water receival and storage facilities to allow 14 hours of continuous operation where this would be cost effective.

4.3 Other capital cost components

The other components underlying the power station costs, including land costs and fixed fuel costs, did not significantly contribute to the increase in power station capital costs. These

[42] The -11.20 per cent annualised total applicable power station escalation factor is calculated using the 2021 (-7.837 per cent); 2022 (-3.645 per cent); and 2023 (-0.025 per cent) values - AEMO, 2020, *2021 Benchmark Reserve Capacity Price for the SWIS Report – 2021 BRCP for a 160MW OCGT*, Report prepared by GHD advisory, Chapter 2, p.3. (online)

[43] The -2.36 per cent annualised total applicable power station escalation factor is calculated using the 2022 (3.15 per cent); 2023 (-7.53 per cent); and 2024 (2.37 per cent) values - Economic Regulation Authority, 2021, *Power station and associated costs*, Report prepared by GHD Advisory, chapter 2 (online).

[44] Economic Regulation Authority, 2021, *2022 Benchmark Reserve Capacity Price,* Report prepared by PricewaterhouseCoopers (online).

[45] Economic Regulation Authority, 2021, *Power station and associated* costs, Report prepared by GHD Advisory, chapter 3 (online).

[46] Ibid.

components are covered in Appendix 4 and are in line with but marginally higher than the 2021 BRCP values.

5. Annualised fixed O&M costs

The annualised fixed operating and maintenance costs for the 2022 BRCP is $34,131 per MW per year, up 6.6 per cent from the 2021 BRCP ($32,028 per MW per year). This increase is mostly due to a rise in the generation O&M costs and Western Power's network access and ongoing charges.

The operating and maintenance costs component consist of five parts: generation O&M costs, switchyard O&M costs, transmission line O&M costs, asset insurance costs, and network charges. These are costs expected to be incurred in operating and maintaining the reference generator annually and are detailed in Table 7.[47]

Table 7: Comparison of 2022 BRCP annualised fixed O&M costs to approved 2021 BRCP values

Component	2022 BRCP	2021 BRCP	Change from 2021
Annualised fixed O&M costs ($/MW/year)	**34,131**	**32,028**	**2,103 +6.6%**
Generation O&M costs ($/MW/year)	15,318	13,931	1,387 +10.0%
Switchyard O&M costs ($/MW/year)	576	544	32 +5.8%
Transmission line O&M costs ($/MW/year)	36	34	2 +5.7%
Asset insurance costs ($/MW/year)	6,426	6,477	-51 -0.8%
Fixed network access and ongoing charges ($/MW/year)	11,775	11,041	734 +6.6%

Source: ERA analysis of BRCP data

5.1 Generation O&M cost

Generation O&M costs are an estimate of the operating and maintenance costs of a 160 MW OCGT reference generator operating on diesel fuel as required by the market procedure.[48] These costs are estimated over the generator's operating life of up to 60 years with the generator operating at its maximum output for 2 per cent of each year.[49] Additionally, an allowance for balance of plant costs is included, which comprises items like the servicing of pumps, water plants and fire systems.

47 These fixed operation and maintenance costs have been escalated to 1 October 2024.

48 Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020, section 2.1.

49 Details on fixed operating and maintenance costs are in Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020, section 2.5. This excludes the costs of gas connections as the market procedure requires the OCGT to run on diesel for the purposes of the BRCP calculation.

The increase in generation O&M cost is largely driven by the increase in labour costs (see Table 5) for services including plant operations, electrical sub-contractors, and engineering support.[50] Partially offsetting the increase was the decrease in balance of plant costs, which are calculated as a portion of the capital cost of the power station. Since the non-escalated capital cost of the power station is lower than the amount for the 2021 BRCP, this resulted in lower balance of plant costs.[51,52]

5.2 Fixed network access and ongoing charges

The other main contributor to the rise in fixed O&M costs is the increase in Western Power's fixed network access and ongoing charges to $11,775 per MW per year, an increase of 6.6 per cent, or $734 per MW per year, compared to the 2021 BRCP value ($11,041 per MW per year).

Network access charges were determined using Western Power's network access tariffs data from the 2021/22 price list.[53] The Transmission Reference Tariff 2 was used as it applies to generators.

In line with AEMO's previous practice for assessing network access charges, the ERA applied the highest Transmission Reference Tariff 2 unit price from across the six regions, prescribed by the market procedure, in which the BRCP can be located.[54] The Muja Power Station substation has the highest unit price, and the ERA used this tariff to estimate the fixed network access charges applicable to the BRCP. This use of system charge for transmitting electricity is based on the cost to Western Power of that generator using the SWIS network and is dependent on factors including the location, transmission line-length and the complexity of the grid connection.

The other two cost inputs for this cost component are:

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

Table 8 provides a comparison of these cost inputs against the 2021 BRCP values for fixed network access and ongoing charges.

50 Economic Regulation Authority, 2021, *Power station and associated* costs, Report prepared by GHD Advisory, section 4.3 (online) – for details of these costs.

51 This is not to be confused with the capital cost of the power station (see Chapter 4) which has increased relative to the 2021 BRCP. This is because that capital cost has been escalated based on the cost escalation factors in section 4.1. The calculation of the balance of plant costs is not based on the escalated capital cost of the power station.

52 The non-escalated cost of the power station is available in: Economic Regulation Authority, 2021, *Power station and associated* costs, Report prepared by GHD Advisory, section 3.5 (online).

53 Western Power, 2021, *2021/22 Price List*, (online) [accessed 20 October 2021].

54 These regions are Collie, Kemerton Industrial Park, Pinjar, Kwinana, North Country (Eneabba and Geraldton) and Kalgoorlie – Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020, clause 2.7.1.

Table 8: Comparison of 2022 BRCP fixed network and ongoing charges to approved 2021 BRCP values

Component	2022 BRCP	2021 BRCP	Change from 2021
Control system service charge ($/year)	121,349	118,390	2,959 +2.5%
Transmission metering ($/year)	3,209	3,271	-62 -1.9%
Use of system charge ($/year)	1,519,625	1,460,700	58,925 +4.0%
Total annual Western Power charges ($)	1,644,183	1,582,361	61,822 +3.9%
Cost per MW per year[55]	11,775	11,041	734 +6.6%

Source: ERA analysis of BRCP data

These costs were calculated as of July 2021 with the total cost per MW figure escalated by the forecast inflation rates to 1 October 2024 as required by the market procedure.

5.2.1 Changes to the fixed network access and ongoing charges since the draft determination

As noted in section 1.3.1, the update to the CPI forecast increased the escalation factor applied to the network access and ongoing charges value. The change between the draft and final determination values is entirely due to the increase in CPI, shown in Table 9.

Table 9: Changes to the fixed network access and ongoing charges since the draft determination

Component	Final 2022 BRCP	Draft 2022 BRCP	Change since draft
Fixed Network Access and ongoing charges ($/MW/year)	11,775	11,590	185 +1.6%

Source: ERA analysis of BRCP data

5.3 Other operating and maintenance components

The other components making up the fixed operating and maintenance costs (switchyard O&M, transmission line O&M, and asset insurance costs) did not significantly contribute to its increase. These components are covered in Appendix 5 and are in line with the 2021 BRCP values.

[55] Includes escalation by forecast inflation.

Appendix 1 List of Tables

Appendix 2 List of Figures

Appendix 3 Components of the 2022 BRCP compared to 2021 BRCP

Table 10 is a single table that consolidates and compares the different components of the BRCP between 2022 and 2021.

Table 10: Comparison of the 2022 BRCP and 2021 BRCP components

Component	2022 BRCP	2021 BRCP	Change from 2021
Expected capacity credits (MW)	151.12	152.28	-1.16
Weighted Average Cost of Capital	6.08%	5.20%	Up 88 basis points
Power station cost ($/MW)	844,150	816,437	27,713
Margin for legal, financing, and other costs	16.21%	16.69%	Down 48 basis points
Transmission Costs ($/MW)	186,877	180,927	5,950
Fixed Fuel Costs ($)	7,398,376	6,915,717	482,659
Land Costs ($)	2,699,666	2,404,251	295,415
Generation O&M cost ($/MW/year)	15,318	13,931	1,387
Switchyard O&M cost ($/MW/year)	576	544	32
Transmission Line O&M cost ($/MW/year)	36	34	2
Asset Insurance Costs ($/MW/year)	6,426	6,477	-51
Fixed Network Access and ongoing charges ($/MW/year)	11,775	11,041	734
Total Capital Costs ($)	**192,172,433**	**186,622,114**	**5,550,319**
Annualised capital costs ($/Year)	**19,887,082**	**18,222,883**	**1,664,199**
Annualised fixed O&M ($/MW/year)	**34,131**	**32,028**	**2,103**
BRCP ($/MW/Year)	**165,700**	**151,700**	**14,000**

Source: ERA analysis of BRCP data

Appendix 4 Annualised capital costs

The formula for calculating the capital costs is:[56]

$$CAPCOST = ((PC \times (1 + M) + TC) \times CC + FFC + LC) \times (1 + WACC)\hat{}0.5$$

The values for each input in the capital cost formula is provided in Table 11. An explanation of each of the unshaded input values is provided below the table.[57]

Table 11: Comparison of the 2022 BRCP and 2021 BRCP capital costs

Component	2022 BRCP	2021 BRCP	Change from 2021
Power station cost (PC) ($/MW)	844,150	816,437	27,713
Weighted Average Cost of Capital (WACC)	6.08%	5.20%	88 basis points
Expected capacity credits (CC) (MW)	151.12	152.28	-1.16
Margin for legal, financing, and other costs (M) (%)	16.21	16.69	Down 48 basis points
Transmission Costs (TC) ($/MW)	186,877	180,927	5,950
Fixed Fuel Costs (FFC) ($)	7,398,376	6,915,717	482,659
Land Costs (LC) ($)	2,699,666	2,404,251	295,415
Total Capital Costs ($)	**192,172,433**	**186,622,114**	**5,550,319**
Annualised capital costs ($/Year)	**19,887,082**	**18,222,883**	**1,664,199**

Source: ERA analysis of BRCP data

Note: Shaded components are discussed in section 3.1 or Chapter 4.

This appendix covers the other components that were minor contributors to the overall increase in the power station capital costs (collectively around five per cent of the increase).[58]

56 Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020, clause 2.10.1.

57 The power station costs and WACC are discussed in Chapter 4, and expected capacity credits in section 3.1.

58 The increase in the WACC and power station cost are the major contributors to the rise in capital cost component.

Margin cost (M)

The 'M' margin includes costs for regulatory approval, financing, contingencies and legal.[59] This margin is added as a fixed percentage of the capital cost of developing the power station and is 16.2 per cent for the final 2022 BRCP determination. This is lower than the 2021 BRCP M margin as the capital cost of the power station, before being escalated, is lower, which reduces the M margin accordingly.[60]

Transmission costs

Western Power estimated the shallow connection costs for the 2022 BRCP at $24.2 million or $186,877 per MW. Shallow connection costs include the construction of a substation, two kilometres of overhead line and the associated easement for that line.[61] The increase of 3.3 per cent compared to the 2021 BRCP is driven by increases in land, substation, and transmission line costs. The increase in substation and transmission line cost reflects the increases in the cost of materials like steel and copper and increases in labour costs for constructing and installing equipment. The land costs increased in line with the increase in land costs for the 2022 BRCP (discussed later in this Appendix).

Western Power provided an independently audited report to verify the accuracy of their estimates as the underlying data is confidential and cannot be published. Western Power's report is available on the ERA's website.[62]

Fixed fuel costs

Fixed fuel costs are estimated at $7.4 million for the 2022 BRCP, 7.0 per cent higher than for the 2021 BRCP. This increase is due mostly to the recovery of the diesel price which fell significantly in 2020 due to COVID-19.

The fixed fuel costs include the development and construction of an onsite liquid fuel storage and supply facility with supporting infrastructure. In addition, 14 hours of fuel is added to the costs, as required by the market procedure, and includes the cost of delivery and any excise rebate.[63]

Land costs

The land costs provided by Landgate for the six regions assessed under the market procedure increased to $2.7 million for the 2022 BRCP. This was $295,415 higher than the 2021 BRCP

---

59 Full details are in Economic Regulation Authority, 2021, *Power station and associated* costs, Report prepared by GHD Advisory, section 6 (online).

60 Details on the capital cost of the power station is in Economic Regulation Authority, 2021, *Power station and associated* costs, Report prepared by GHD Advisory, section 3.5 (online).

61 The ERA provided the land costs to Western Power for their calculation. The land costs are from Economic Regulation Authority, 2021, *Land values for the 2022 Benchmark Reserve Capacity Price*, Report prepared by Landgate (online).

62 Economic Regulation Authority, 2021, *Total Transmission Cost Estimate for the Benchmark Reserve Capacity Price for 2024/25*, Report prepared by Western Power, (online).

63 Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020, section 2.6.

land costs due to increases in the costs for land in the Pinjar, Kwinana, and Kalgoorlie regions. Landgate's assessment is available on the ERA's website.[64]

The hypothetical land sites were assessed for each region specified in the market procedure (Collie, Kalgoorlie, Kemerton Industrial Park, Kwinana, North Country, and Pinjar) that would be suitable for the BRCP reference generator. These assessments were made as at 30 June 2021 with the ERA applying the applicable transfer duty. The per hectare cost for the BRCP is averaged over the regions and escalated to 1 April 2024 as per the market procedure.[65]

Changes to fixed fuel costs and land costs since the draft determination

As noted in section 1.3.1, the update to the CPI forecast increased the escalation factor applied to the fixed fuel costs and land costs. The change between the draft and final determination values is entirely due to the increase in CPI, shown in Table 12.

Table 12: Changes to the fixed fuel and land costs since the draft determination

Component	Final 2022 BRCP	Draft 2022 BRCP	Change since draft
Fixed Fuel Cost ($)	7,398,376	7,283,789	114,587 +1.6%
Land Cost ($)	2,699,666	2,657,853	41,813 +1.6%

Source: ERA analysis of BRCP data

64 Economic Regulation Authority, 2021, *Land values for the 2022 Benchmark Reserve Capacity Price*, Report prepared by Landgate (online).

65 The land costs are escalated to 1 April 2024 as the land must be acquired prior to construction of the BRCP reference generator. This is specified in Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020, clause 2.7.5.

Appendix 5 Other operating and maintenance costs

This appendix covers the other components that contributed to the increase in the fixed operating and maintenance costs detailed in Chapter 5 and are detailed in Table 13.

Table 13: Comparison of 2022 BRCP annualised fixed O&M costs to approved 2021 BRCP values

Component	2022 BRCP	2021 BRCP	Change from 2021
Annualised fixed O&M costs ($/MW/year)	**34,131**	**32,028**	**2,103 +6.6%**
Generation O&M costs ($/MW/year)	15,318	13,931	1,387 +10.0%
Fixed network access and ongoing charges ($/MW/year)	11,775	11,041	734 +6.6%
Switchyard O&M costs ($/MW/year)	576	544	32 +5.8%
Transmission line O&M costs ($/MW/year)	36	34	2 +5.7%
Asset insurance costs ($/MW/year)	6,426	6,477	-51 -0.8%

Source: ERA analysis of BRCP data

Note: Shaded components are discussed in Chapter 5.

Switchyard operating and maintenance costs

The estimated switchyard O&M cost ($576 per MW per year) did not significantly contribute to the increase in the annualised fixed O&M costs for the 2022 BRCP. The increase is based on the change in cost escalation factors, particularly the increase in labour costs (see Table 5).[66]

The switchyard O&M costs are derived from the isolator on the high voltage side of the generator's transformer and does not include any generator transformer or switchgear costs. These costs are based on the annual charge for connection assets and includes estimates of overheads, machine hire and labour for maintenance services. Details are available in GHD's report.[67]

[66] Economic Regulation Authority, 2021, *Power station and associated* costs, Report prepared by GHD Advisory, sections 2.4 and 4.3 (online) – discusses how the cost escalation for switchyard O&M is derived and applied.

[67] Economic Regulation Authority, 2021, *Power station and associated* costs, Report prepared by GHD Advisory, section 4.4 (online).

Transmission line operating and maintenance costs

The estimated transmission line O&M cost ($36 per MW per year) did not significantly contribute to the increase in annualised fixed O&M costs for the 2022 BRCP. The increase is based on the change in cost escalation factors for both materials and labour (see Table 5).[68]

The transmission line O&M is derived from a transmission line that is assumed to be a single circuit 330 kilovolt construction with two conductors per phase with a 60-year asset life. The line can transport up to 200 megavolt amperes with a power factor of 0.8.

Asset insurance costs

The asset insurance costs cover power station asset replacement, business interruption and public and products liability insurance. To maintain consistency with previous insurance estimates for the BRCP, the ERA sourced the insurance quote from an independent insurance broker, which is one of the leading global insurance brokers with expertise in power generation insurance, particularly in Western Australia.[69] The asset insurance cost components are in Table 14.

Table 14: Comparison of 2022 BRCP asset insurance costs to approved 2021 BRCP values

Component	2022 BRCP	2021 BRCP	Change from 2021
Asset insurance costs ($/MW/Year)	**6,426**	**6,477**	**-51** **-0.8%**
Asset replacement insurance ($/Year)	588,066	632,734	-44,668 -7.1%
Business interruption insurance ($/Year)	228,984	192,330	36,654 +19.1%
Public and products liability insurance ($/Year)	142,452	150,364	-7,912 -5.3%

Source: ERA analysis of insurance cost information provided for the 2022 BRCP

Asset insurance costs for the 2022 BRCP fell by 0.8 per cent to $6,426 per MW per year when compared to the asset insurance costs for the 2021 BRCP. This is mostly due to falling asset replacement insurance which is partly offset by an increase in business interruption insurance.

The asset replacement insurance decreased due to a lower estimated risk of asset replacement for a 160 MW OCGT reference generator located in the SWIS.[70] For the 2021 BRCP, the asset replacement insurance was assessed on a higher risk estimate, which is based on asset replacement risks for electricity generators located across Australia generally. For the 2022 BRCP final determination, this assessment was refined to a more targeted assessment of the reference generator being located in Western Australia, which has a lower

[68] Economic Regulation Authority, 2021, *Power station and associated* costs, Report prepared by GHD Advisory, sections 2.4 and 4.3 (online) – discusses how the cost escalation for switchyard O&M is derived and applied.

[69] The insurance broker is the same broker used by AEMO for determining past BRCPs. For confidentiality, the broker has requested to not be named.

[70] This power station costs are the escalated figures up to 1 October 2024.

bushfire risk than for electricity assets in the Eastern States of Australia.[71] This decrease in asset replacement risk leads to a lower asset replacement insurance cost. The lower insurance cost was partly offset by an increase in the terrorism levy due to a change in the method for determining the levy. Previously, the terrorism levy calculation was based on a single site that was representative of the six regions prescribed in the market procedure. This was changed to be an average of the terrorism levies over these six land regions as this provides a more accurate assessment of the terrorism risk of a generator being constructed in any of these six regions in the SWIS.[72] As some of these regions have a higher terrorism risk due to being located closer to other physical properties, such as business and industrial areas, the overall terrorism levy is higher when averaged over the six regions.[73]

Business interruption insurance increased due to the higher value of the power station, which increases the business interruption value being insured against. This increase in BRCP required the business interruption insurance to be assessed on a $25 million business interruption value which is higher than the $24 million of business interruption assessed for the 2021 BRCP.

The decrease in public and products liability insurance is due to a fall in the price of this insurance, which had a high value estimate for the 2021 BRCP. Combined with a general downward trend in the prices of this type of insurance for assets like the BRCP reference generator, this led to the overall decrease in this part of the insurance cost.

Changes to asset insurance costs since the draft determination

Table 15 shows the changes in asset insurance costs between the ERA's draft and final determination for the 2022 BRCP.

Table 15: Changes to asset insurance costs between the 2022 BRCP draft and final determinations

Component	Final 2022 BRCP	Draft 2022 BRCP	Change
Asset insurance costs ($/MW/Year)	**6,426**	**6,792**	**-366** **-9.7%**
Asset replacement insurance ($/Year)	588,066	666,727	-78,661 -11.8%
Business interruption insurance ($/Year)	228,984	207,431	21,553 +10.4%
Public and products liability insurance ($/Year)	142,452	140,246	2,206 +1.6%

Source: ERA analysis of insurance cost information provided for the 2022 BRCP

Asset replacement insurance was revised down as the asset replacement insurance was revised to assess Western Australia only, which has a lower bushfire risk than the Eastern

[71] The Eastern States refers to Queensland, New South Wales, Victoria, and Tasmania.

[72] These regions are Collie, Kemerton Industrial Park, Pinjar, Kwinana, North Country (Eneabba and Geraldton) and Kalgoorlie – Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020, clause 2.7.1.

[73] The terrorism levy is assessed on the generator's replacement and business interruption costs. The business interruption insurance premium was assessed on $25 million of business interruption insurance.

States. At the time of the draft determination, an Australian wide risk assessed figure was used to determine the asset replacement insurance costs. The revision to a Western Australia specific assessment lowered the applicable asset insurance cost for the BRCP reference generator.

The change to the business interruption insurance is due to the increase in the BRCP to $165,700 per MW per year which changed the business interruption value to $25 million from the $24 million value. The $24 million business interruption value was used for the draft determination and 2021 BRCP.

The change in the public and products liability insurance is due to updated CPI figures which increased the cost escalation factor that led to the marginal 1.6 per cent increase.

Overall, the combination of the above changes led to a 9.7 per cent decrease in the asset insurance costs for the annualised fixed operations and maintenance component for the 2022 BRCP. The overall effect on the BRCP was minor as this component is a small part of the overall BRCP calculation.

Appendix 6 Weighted average cost of capital

The weighted average cost of capital (WACC) is a calculation of a company's cost of capital in which each component of capital, debt and equity, is proportionately weighted.

When calculating the BRCP, the WACC is used in:

- Estimating financing costs, which are added into the reference power station's capital expenditures. This accounts for project financing costs before the commissioning of the power station and the realisation of revenues from participation in the wholesale electricity market.
- Converting the power station's capital costs into an annualised cost that can be recovered over the assumed life of the power station. In this annuity approach, the WACC represents a long-term required rate of return over the life of the asset.

Calculation of the WACC in the market procedure

Section 2.9 of the market procedure directs the ERA on how the WACC for the BRCP is to be calculated.[74]

Specifically, clauses 2.9.6 and 2.9.7 of the market procedure detail the high-level framework to be used:

> 2.9.6 [ERA] shall compute the WACC on the following basis:
>
> (a) The WACC shall use the Capital Asset Pricing Model (CAPM) as the basis for calculating the return to equity.
>
> (b) The WACC shall be computed on a Pre-Tax basis.
>
> (c) The WACC shall use the standard Officer WACC method as the basis of calculation.
>
> 2.9.7 The pre-tax Officer WACC shall be calculated using the following formulae:
>
> $$WACC_{\ nominal} = \frac{1}{(1 - t(1 - \gamma))} R_e \frac{E}{V} + R_d \frac{D}{V}$$
>
> Where:
>
> (a) R_e is the nominal return on equity (determined using the Capital Asset Pricing Model) and is calculated as:
>
> $$R_e = R_f + \beta_e \times MRP$$
>
> Where:
>
> R_f is the nominal risk free rate for the Capacity Year;
>
> β_e is the equity beta; and
>
> MRP is the market risk premium.
>
> (b) R_d is the nominal return on debt and is calculated as:

[74] Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020, section 2.9.

$$R_d = R_f + DM$$

Where:

R_f is the nominal risk free rate for the Capacity Year;

DM is the debt margin, which is calculated as the sum of the debt risk premium (DRP) and debt issuance cost (d).

(c) *t* is the benchmark rate of corporate income taxation, established at either an estimated effective rate or a value of the statutory taxation rate;

(d) γ is the value of franking credits;

(e) $\frac{E}{V}$ is market value of equity as a proportion of the market value of total assets;

(f) $\frac{D}{V}$ is market value of debt as a proportion of the market value of total assets;

(g) The nominal risk free rate, for a Capacity Year is the rate determined for that Capacity Year by [ERA] on a moving average basis from the annualised yield on Commonwealth Government bonds with a maturity of 10 years:

- using the indicative mid rates published by the Reserve Bank of Australia; and
- averaged over a 20-trading day period;

(h) The debt risk premium, DRP, for a Capacity Year is a margin above the risk free rate reflecting the risk in provision of debt finance. This will be estimated by [ERA] as the margin between the observed annualised yields of Australian corporate bonds which have a BBB (or equivalent) credit rating from Standard and Poor's and the nominal risk free rate. [ERA] must determine the methodology to estimate the DRP, which in the opinion of [ERA] is consistent with current accepted Australian regulatory practice.[75]

(i) If there are no Commonwealth Government bonds with a maturity of 10 years on any day in the period referred to in step 2.9.7(g), [ERA] must determine the nominal risk free rate by interpolating on a straight line basis from the two bonds closest to the 10 year term and which also straddle the 10 year expiry date.

(j) If the methods used in step 2.9.7(i) cannot be applied due to suitable bond terms being unavailable, [ERA] may determine the nominal risk free rate by means of an appropriate approximation.

Since the ERA is responsible for calculating the 2022 BRCP onwards, the ERA must estimate the WACC following the market procedure. The ERA's annual BRCP review involves two sets of components listed in clause 2.9.3:

- Annual components, which require review each year which comprises of the risk free rate, debt risk premium and corporate tax rate.

[75] Given observed issues with Bloomberg data, the ERA has adopted an alternative 'Bond-Yield Approach' to establishing the DRP and has applied this since its Final Decision on revisions proposed by WA Gas Networks (WAGN) to the access arrangement for the Mid West and South West gas distribution systems in 2011. This methodology was broadly upheld on appeal to the Australian Competition Tribunal in June 2012.

- Structural components, which are fixed in the market procedure and remain constant between the ERA's five-yearly methodology reviews of the BRCP. As part of the annual review, the ERA may review and determine values for structural components that differ from those specified in the market procedure if it considers that a significant economic event has influenced those components. These structural components include the market risk premium, equity beta, debt issuance costs, franking credit value and gearing ratio.

Clause 2.9.8 of the market procedure details the parameters that the CAPM must use as variables each year (see Table 16):

Table 16: CAPM parameters for the BRCP calculation

CAPM Parameter	Notation	Review frequency	Value
The following variables are to be determined[76]			
Nominal risk free rate (%)	R_f	Annual	
Debt risk premium (%)	DRP	Annual	
Corporate tax rate (%)	t	Annual	
The following variables are specified in the market procedure			
Market risk premium (%)	MRP	5-Yearly	5.90
Asset beta	β_a	5-Yearly	0.5
Equity beta	β_e	5-Yearly	0.83
Debt issuance costs (%)	d	5-Yearly	0.100
Franking credit value	γ	5-Yearly	0.50
Debt to total assets ratio (%)	$\frac{D}{V}$	5-Yearly	40
Equity to total assets ratio (%)	$\frac{E}{V}$	5-Yearly	60

Source: ERA analysis of BRCP data

Updated annual WACC

The ERA has reviewed and calculated the annual components listed in the market procedure, which are the nominal risk free rate, the debt risk premium, and the corporate tax rate.

Nominal risk free rate

The risk free rate is the return an investor would expect when investing in an asset with no risk. This is the rate of return an investor receives from holding an asset with a guaranteed payment stream. Since there is no likelihood of default, the return on risk free assets compensates investors for the time value of money.

[76] See Table 17 for these values for the 2022 BRCP.

The market procedure uses Commonwealth Government bonds as the proxy for risk free assets in Australia for estimating the risk free rate of return. To calculate the risk free rate, the market procedure uses indicative mid rates published by the Reserve Bank of Australia. Where there are no Commonwealth Government bonds with a maturity of exactly 10 years the ERA interpolates the risk free rate on a straight line basis.

The use of a 10-year term for the risk free rate is to reflect a long-term rate of return for the capital costs of the reference generator. This is consistent with the purposes of the BRCP calculations and aligns the WACC to represent a long-term rate of return for the capital costs over the life of the reference plant.

The BRCP process uses a nominal risk free rate, which includes a component for the market expectations of inflation.

For the 2022 BRCP WACC, the ERA determined a nominal risk free rate of 1.72 per cent.[77] This is higher than to 0.80 per cent risk free rate calculated in the 2021 BRCP which applies to the 2023/2024 capacity year.[78]

Debt risk premium

The debt risk premium is the rate of return above the risk free rate that lenders require to compensate them for lending funds to a firm. The debt risk premium compensates debt holders for the possibility of default by the issuer.

The debt risk premium is closely aligned with the risk of the business. When issuing debt in the form of bonds, a credit rating can be assigned that reflects the probability of default of the issuer, and therefore the risk present in that entity's bonds. The market procedure requires the use of a BBB (or equivalent) credit rating from Standard and Poor's.[79]

The ERA uses a "revised bond yield approach" to determine the debt risk premium at a point in time by: [80, 81]

- Determining the benchmark sample, which requires identifying a sample of relevant corporate bonds that have a BBB credit rating (or equivalent).[82]
- Converting the bond yields from the benchmark sample into Australian dollar equivalent yields.
- Calculating an average Australian dollar equivalent bond yield for each bond across the averaging period.
- Estimating yield curves on the bond data by applying various techniques including Gaussian Kernel, Nelson-Siegel and Nelson-Siegel-Svensson techniques.[83]

---

77 The nominal risk free rate of 1.72 per cent is based on a 20-trading day averaging period up to 29 October 2021.

78 AEMO, 2020, *Final Report: 2021 Benchmark Reserve Capacity Price for the 2023-24 Capacity Year*, p.23.

79 Market Procedure: Benchmark Reserve Capacity Price, 9 November 2020, clause 2.9.7(h).

80 Economic Regulation Authority, *Final Gas Rate of Return Guidelines Explanatory Statement*, December 2018, Chapter 10.

81 Economic Regulation Authority, *Final Determination 2018 and 2019 Weighted Average Cost of Capital for the Freight and Urban Networks and Pilbara Railways*, August 2019, Chapter 7.3.

82 The market procedure details that a benchmark generator for the purposes of BRCP having a credit rating of BBB.

83 The Gaussian Kernel method recognises that the observed spreads on bonds with residual maturities close to the target tenor (or maturity) contains more relevant information for estimation. The Nelson-Siegel model

- Estimating the 10-year cost of debt by averaging the three yield curves of 10-year cost of debt based on the techniques used in the previous point.
- Calculating the debt risk premium by subtracting the 10-year risk free rate (or base rate) from the 10-year cost of debt.

The ERA calculates the latest value of the debt risk premium over the specified averaging period each year for the BRCP.

For the 2022 BRCP WACC, the ERA determined a debt risk premium of 1.697 per cent.[84] This is lower than the 2.040 per cent debt risk premium calculated in the 2021 BRCP for the 2023/2024 capacity year.[85]

Corporate tax rate

The ERA has reviewed the corporate tax rate which has not changed from the 30 per cent rate.

Updated BRCP WACC

This appendix provides a WACC for the BRCP based on the approach detailed in the market procedure and the 20-trading day averaging period to 29 October 2021.

For the 2022 BRCP, the indicative nominal pre-tax WACC is 6.08 per cent (see Table 17). This is higher than the 5.20 per cent nominal pre-tax WACC calculated for the 2021 BRCP.[86]

captures many of the typical observed shapes that the yield curve assumes over time. As an extension of the Nelson-Siegel model, the Nelson-Siegel-Svensson method incorporates additional flexibility to more precisely capture the movement of the yield curve in a more volatile market.

84 The debt risk premium of 1.697 per cent is based on a 20-trading day averaging period up to 29 October 2021.

85 AEMO, 2020, *Final Report: 2021 Benchmark Reserve Capacity Price for the 2023-24 Capacity Year*, p.23.

86 Ibid, p.4.

Table 17: WACC for the 2022 BRCP compared to the approved 2021 BRCP WACC values

Parameter	2022 value	2021 value[87]
Cost of equity parameters		
Nominal risk free rate (%)	1.72	0.80
Equity beta	0.83	0.83
Market risk premium (%)	5.90	5.90
Pre-tax return on equity (%)	7.78	6.70
Cost of debt parameters		
Nominal risk free rate (%)	1.72	0.80
Debt risk premium (%)	1.697	2.040
Debt issuance costs (%)	0.100	0.100
Pre-tax return on debt (%)	3.52	2.94
Other parameters		
Debt proportion (gearing) (%)	40	40
Franking credits (gamma) (%)	50	50
Corporate tax rate (%)	30	30
Weighted Average Cost of Capital		
Nominal pre-tax WACC (%)	**6.08**	**5.20**

Source: ERA analysis of BRCP data

87 AEMO, 2020, *Final Report: 2021 Benchmark Reserve Capacity Price for the 2023-24 Capacity Year*, p.23.

Appendix 7 Components of the 2022 BRCP final determination compared to 2022 BRCP draft determination

Table 18 a single table that consolidates and compares the different components of the 2022 BRCP final determination and the 2022 BRCP draft determination.

Table 18: Comparison of the final 2022 BRCP and draft 2022 BRCP components

Component	Final 2022 BRCP	Draft 2022 BRCP	Change from draft
Expected capacity credits (MW)	151.12	151.12	-
Weighted Average Cost of Capital	6.08%	5.45%	Up 63 basis points
Power station cost ($/MW)	844,150	844,150	-
Margin for legal, financing, and other costs	16.21%	16.21%	-
Transmission Costs ($/MW)	186,877	186,877	-
Fixed Fuel Costs ($)	7,398,376	7,283,789	114,587
Land Costs ($)	2,699,666	2,657,853	41,813
Generation O&M cost ($/MW/year)	15,318	15,318	-
Switchyard O&M cost ($/MW/year)	576	576	-
Transmission Line O&M cost ($/MW/year)	36	36	-
Asset Insurance Costs ($/MW/year)	6,426	6,792	-366
Fixed Network Access and ongoing charges ($/MW/year)	11,775	11,590	185
Total Capital Costs ($)	**192,172,433**	**191,441,579**	**730,854**
Annualised capital costs ($/Year)	**19,887,082**	**19,007,908**	**879,174**
Annualised fixed O&M ($/MW/year)	**34,131**	**34,311**	**-180**
BRCP ($/MW/Year)	**165,700**	**160,100**	**5,600**

Source: ERA analysis of BRCP data