Department of Energy and Economic Diversification

GOVERNMENT OF WESTERN AUSTRALIA

Energy Policy WA

2025 Benchmark Capacity Providers Review

Consultation Paper

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Working together for a brighter energy future.

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Abbreviations

Term	Definition
BESS	Battery Energy Storage System
BCP	Benchmark Capacity Provider
CCGT	Combined Cycle Gas Turbine
CONE	Cost of New Entry
DBNGP	Dampier to Bunbury Natural Gas Pipeline
DSM	Demand Side Management
DWER	Department of Water and Environmental Regulation
EPWA	Energy Policy WA
ERA	Economic Regulation Authority
ESOO	Electricity Statement of Opportunities
ESR	Electric Storage Resource
ESS	Essential System Services
FOM, Fixed O&M	Fixed Operating and Maintenance costs
FCESS	Frequency Co-Optimised Essential System Services
HEGT	High Efficiency Gas Turbine
LDC	Load Duration Curve
LP	Linear Programme
MDQ	Maximum Daily Quantity
OCGT	Open Cycle Gas Turbine
OTSG	Once Through Steam Generator
PV	Photovoltaic
RCM	Reserve Capacity Mechanism

Term	Definition
SCGT	Simple Cycle Gas Turbine[1]
SG	Steam Generator
SRMC	Short-Run Marginal Cost
tCO2e	Tonnes Carbon Dioxide Equivalent
WACC	Weighted Average Cost of Capital
WEM	Wholesale Electricity Market
WEMSIM	Wholesale Electricity Market Simulation

[1] The more technically accurate name for what is often called OCGT

Executive summary

The Benchmark Capacity Providers / Reference Technologies

The Benchmark Capacity Providers (BCPs) are the reference technologies used to set the Benchmark Reserve Capacity Prices (BRCPs) for Peak Capacity and Flexible Capacity. As defined in the Energy System and Market Rules (ESM Rules), the BCPs are *notional* technology types. Under clause 4.16.11(c) of the ESM Rules, the BCPs must be reviewed every three years, or more frequently if certain conditions have been met. For the remainder of this document the BCPs are referred to as the “reference technologies”.

The Coordinator of Energy (Coordinator) must select the reference technologies on the basis that they represent the lowest annual capital cost, and annual fixed operating and maintenance costs. The reference technologies are determined for a notional new facility that meets the criteria, and do not represent an expectation of the actual technologies what will or should enter the market in the future. Therefore, other project parameters, such as lead times are not taken into account in the selection process.

The selected reference technologies will be able to recover all of their capital and fixed costs without any other market revenue. All other technologies, with higher capital and fixed costs, will still be able to recover their costs by receiving energy and ESS market revenue.

Under clause 4.16.11(b) of the ESM Rules, the Coordinator must review the Benchmark Capacity Providers within six months of a changed Electric Storage Resource (ESR) Duration Requirement being published in the Electricity Statement of Opportunities (ESOO).

In the 2025 ESOO, the ESR Duration Requirement changed from 4 hours to 6 hours. The Coordinator is therefore now reviewing the Benchmark Capacity Providers.

The objective of the review is to determine the reference technologies for the Benchmark Capacity Providers, used to set the Peak and Flexible BRCPs, which ensure system reliability is maintained at the most efficient cost.

Consultation

The Wholesale Investment Certainty Review Working Group discussed the draft analysis conducted in this review at its meeting on 14 August 2025. The discussion included:

- the approach to shortlisting technologies for each capacity product and the shortlist determined through this approach;
- capacity service requirements, including those drawn from the published minimum eligibility requirements for Flexible Capacity providers, and the appropriate size for assumed new build;
- the expected technical and economic life of the shortlisted technologies; and
- the estimates for the upfront capital costs and other fixed costs for each shortlisted technology.

A draft of this consultation paper was sent to the MAC out of session for comment. The feedback received is reflected in this Consultation Paper.

Proposed Determination

The results of the analysis indicated that:

- the Benchmark Capacity Provider for both Peak Capacity and Flexible Capacity should be a 200MW/1200MWh lithium battery energy storage system (BESS);
- the results of the analysis indicating that BRCP should continue to be calculated based on gross Cost of New Entry (CONE).

This consultation paper outlines the Coordinator of Energy's proposals for the reference technologies for Peak and Flexible BRCPs, and the approach to CONE. These proposals are summarised in Table 1.

Table 1: Proposals - Benchmark Capacity Providers

Proposals	Rationale
Proposal A: The proposed reference technologies for the Peak and Flexible BRCPs are: • 200 MW / 1200 MWh Lithium BESS connected at 330 kV.	The 200 MW/1200 MWh BESS has the lowest capital cost and fixed operations and maintenance cost per MW per annum for both Peak Capacity and Flexible Capacity. This technology is capable of meeting the requirements of both the Peak and Flexible services as defined.
Proposal B: Retain a gross CONE approach.	We do not expect the proposed reference technology to be earning significant net revenue from the WEM other than its RCM revenue. The growing volume of ESR capacity in the WEM means that a new entrant ESR is likely to discharge energy at or near its cost to charge. Therefore, it is not expected to receive much significant contribution towards its fixed costs outside capacity payments in the future. Implementing net CONE would add significant complexity and uncertainty to the BRCP determination procedure, without significantly decreasing costs to consumers. This uncertainty may deter investment, undermining cost efficiency and reliability.

Call for Submissions

Stakeholder feedback is invited on the proposals and analysis of this Review, as outlined in Parts 2-3 of this paper.

Submissions can be emailed to energymarkets@deed.wa.gov.au. Any submissions received will be made publicly available on www.energy.wa.gov.au, unless requested otherwise.

The consultation period closes at **5:00pm WST on 19 September 2025**. Late submissions may not be considered.

1. Introduction

1.1 Reason for the review

The Benchmark Capacity Providers (BCPs) are the reference technologies used to set the Benchmark Reserve Capacity Prices (BRCPs) for Peak Capacity and Flexible Capacity. As defined in the Energy System and Market Rules (ESM Rules), the BCPs are notional technology types. Under clause 4.16.11(c) of the ESM Rules, the BCPs must be reviewed every three years, or more frequently if certain conditions have been met. For the remainder of this document the BCPs are referred to as the “reference technologies”.

The Coordinator of Energy (Coordinator) must select the reference technologies on the basis that they represent the lowest annual capital cost, and annual fixed operating and maintenance costs. The reference technologies are determined for a notional new facility that meets the criteria, and do not represent an expectation of the actual technologies what will or should enter the market in the future. Therefore, other project parameters, such as lead times are not taken into account in the selection process.

The selected reference technologies will be able to recover all of their capital and fixed costs without any other market revenue. All other technologies, with higher capital and fixed costs, will still recover their costs by receiving energy and ESS market revenue.

Under clause 4.16.11(b) of the ESM Rules, the Coordinator must review the Benchmark Capacity Providers within six months of a changed Electric Storage Resource (ESR) Duration Requirement being published in the Electricity Statement of Opportunities (ESOO).

In the 2025 ESOO, the ESR Duration Requirement changed from 4 hours to 6 hours. The Coordinator is therefore now reviewing the Benchmark Capacity Providers.

The review must be concluded in time to allow the Economic Regulation Authority (ERA) to amend the relevant WEM Procedure and determine and publish the BRCPs for the 2026 Reserve Capacity Cycle by 15 March 2026.

1.2 Scope of the review

The objective of the review is to determine the reference technology(s) for the Benchmark Capacity Providers, used to set the Peak and Flexible BRCPs, which ensure system reliability is maintained at the most efficient cost. The following aspects related to the BRCPs are out of scope for this review:

- the methods for setting BRCPs based on the reference technologies;
- the Reserve Capacity Price regime; and
- the Reserve Capacity Cycle timeline.

The reference technologies Review consists of two key items:

1. Peak reference technology:
    a. review of the reference technology for the Peak Capacity product and assess whether the current reference technology is still appropriate or if a different reference technology should be selected to represent the most efficient new entry.
    b. review whether gross Costs Of New Entry (CONE) or net CONE should apply to the Peak BRCP.
2. Flexible reference technology:

a. Review of the reference technology for the Flexible Capacity product and assess whether the current reference technology is still appropriate or if a different reference technology should be selected to represent the most efficient new entry.
b. review whether gross CONE or net CONE should apply to the Flexible BRCP.

1.3 Approach to the analysis

The following analysis has been undertaken for the reference technologies Review:

1. Establish a long list of available technologies.
2. Filter the long list based on expected capital costs and/or emissions.
3. Create potential configurations of remaining technologies for assessment.
4. Identify cost data (based on the existing BRCP determination approach) for each configuration to deliver each capacity service.
5. Identify the requirements that must be met to provide each capacity service.
6. Filter configurations based on service requirements.
7. Identify additional data for determination of net CONE assessment.
8. Conduct market modelling to inform proposals regarding gross/net CONE.
9. Develop reference technologies and gross/net CONE proposals.

2. Benchmark Capacity Providers analysis

2.1 Long list of potential technologies

The long list of reference technologies was developed with consideration of the following factors:

- The technology must be able to be certified for the provision of Reserve Capacity under the existing ESM Rules, as amended by the ESM Amending Rules implementing the outcomes of the RCM Review.
- The technology must be able to be configured in a way that limits its largest network contingency to 330 MW. This is because Contingency Reserve Raise costs are allocated based on a Facility's contribution to the requirements for the service. Currently, the largest generator in the SWIS has 331 MW of Capacity Credits.
- The technology must have the potential to meet the emission threshold requirements proposed during the WEM Investment Certainty Review. While a decision about the emission thresholds has not yet been made, this reflects what a reasonable investor would consider.
- The technology must work with existing infrastructure in the WEM to reflect the fact that an efficient new entrant is most likely to be an incremental development of existing technologies. It is unlikely that an efficient new entrant would be establishing supporting infrastructure from scratch.

2.1.1 Long list evaluated in 2023

The generation technology long list applied in the 2023 review has been revisited and reassessed for the present review, as shown in Table 2:

Table 2 Previous generation technology long-list (2023 review)

Technology	Evaluation outcome in 2023	2025 evaluation
Open Cycle Gas Turbine (OCGT) Heavy duty (same as Industrial Simple Cycle Gas Turbine(SCGT)	Not short listed on the basis of its carbon emissions intensity	Re-evaluated on the basis of the higher efficiency units available than were evaluated in 2023
OCGT Aeroderivative (same as Aero SCGT)	Short listed	Evaluated
High Efficiency Gas Turbine (HEGT) (same as LMS100PB)	Short listed	Evaluated
Reciprocating engine	Short listed	Evaluated
Combined Cycle Gas Turbine (CCGT) with once through steam generator (OTSG)	Short listed for Peak service	Replaced by alternative drum-type boiler configuration using bypass stacks which is a proven and common technology[2].
CCGT Drum SG	Evaluated for Peak service	Evaluated
Fuel cell	Not short listed	Not likely to be competitive withing the timeframe
Lithium based (BESS)	Short listed	Evaluated

2 OTSG configurations are rare in practice and suffer operational difficulties with maintaining water quality in the steam cycle

Technology	Evaluation outcome in 2023	2025 evaluation
Vanadium based Battery Energy Storage System (BESS)	Short listed but with high costs	Not likely to be competitive within the timeframe
Pumped storage	Excluded due to sizing issues and cost	Excluded
Solar thermal	Not short listed	Not likely to be competitive withing the timeframe
Solar PV	Not short listed	Not competitive due to low allocation of Capacity Credits per MW of plant capacity
Wind	Not short listed	Not competitive due to low allocation of Capacity Credits per MW of plant capacity

2.1.2 Long list of candidate configurations in the 2025 review

For this review EPWA has used a filtered long list to specify a set of candidate technology configurations.

The choice of the configuration sizes considers the scale and configuration of gas turbine-based developments that are generally applied. Most gas turbine-based plants are designed on a multiple unit basis rather than a single unit. Multiple units provide efficient use and cost of facilities and infrastructure, sharing of spare parts and operating procedures and operator knowledge, and assists owners to manage the contingency risks. Of the 72 significant gas turbine power stations in Australia more than 80% are multi-unit stations, and only 12 stations are based on a single unit. This approach means larger industrial SCGT installations are considered than historically evaluated in the BRCP processes.

The Aeroderivative SCGT and reciprocating engine options could readily be developed as smaller facilities. The costs would be slightly higher due to loss of economies of scale.

The BESS could be developed as a larger or smaller facility. The scale economy effects are small for BESS and largely only the electrical connection costs ($/MW) would be affected for a smaller or larger six-hour BESS.

The configuration selections aim to limit the maximum single contingency to 330 MW. This is achieved through considering the related electrical connection configuration, though this was not possible for the 1+1 CCGT configuration.

We have assumed that the candidate facilities are built at a location that is close to existing gas pipeline (if required) and electricity transmission infrastructure, and that the infrastructure has sufficient capacity for the facility. The ERA will need to determine an actual location when determining the BRCP values. We have assumed a transmission connection at 330 kV in line with the 2023 reference technologies review[3].

The candidate configurations and their parameters are shown in Table 3:

[3] https://www.wa.gov.au/government/document-collections/benchmark-capacity-providers-review

Table 3 Candidate configurations (performance at 41°C, 20% RH, clean-as-new)

	Industrial SCGT		Aero SCGT				CCGT		Recip.		Storage
	2xGT13E2	2xSGT5-2000E	2xGE 9FA.04	4xLMS100PB	6xLM6000PF-SPRINT	12xLM2500 G4 DLE	2xGT13E2 2+1 w/. Bypass stacks	1xGE 9FA.04 1+1 ss	12xWartsila medium speed	24xJenbach medium speed	6h BESS
Gross MW	346.2	353.0	523.9	367.4	268.4	386.3	500.6	399.2	220.5	249.3	
Net MW	341.2	347.8	516.5	356.2	264.1	380.2	489.3	389.5	217.4	244.3	200
# network connections	2	2	2	2	1	2	2	1	1	1	1
Single contingency loss, MW[4]	170	174	260	178	264	190	326	390	217	244	200
HR, net, LHV kJ/kWh	9,771	10,057	9,609	8,720	8,979	9,392	6,818	6,319	7,868	7,882	
GHG clean-as-new t/MWh	0.557	0.574	0.548	0.497	0.512	0.536	0.389	0.360	0.449	0.450	0
GHG, incl. degradation	0.57	0.59	0.56	0.51	0.52	0.55	0.40	0.37	0.45	0.45	0
Land Ha (excl switchyard)[5]	3.4	3.4	10	2.0	3.0	12	4.0	4.0	2.0	2.5	6.4
Technical life (assumed)	35	35	35	35	35	35	35	35	35[6]	35[6]	20[7]
Economic life (assumed)	25	25	25	25	25	25	25	25	25	25	15
Build time[8]	1.5	1.5	1.5	1.5	1.5	1.5	2	2	1.1	1.1	1.3

The economic life assumed for the BESS is based on the life assumed in the ERA's WEM Procedure: BRCP[9]. This reflects the fact that in the WEM, the BESS may be cycling more than once per day, and competition from future BESS facilities developed at lower (future) costs than current BESS developments. Economic lives for gas turbine and gas engine-based plants are consistent with those applied in the 2023 review[10], and reflect an expectation that fossil-fuelled generation will be largely phased out by around 2050, in line with the government's emission

[4] Assume grouped onto step up transformers, max. 4 transformers per configuration

[5] Land areas have been provided based on actual plants in Australia. Since scope differences exist (such as with/without liquid fuel storage) some inconsistencies are evident however the impact on the calculations is not material.

[6] In peaking duty

[7] Substantial mid-life capex required if operation beyond 20 years envisaged

[8] From CSIRO GenCost 2025: https://www.csiro.au/en/research/technology-space/energy/Electricity-transition/GenCost. This is the construction time on-site. The period from Notice to proceed (NTP) to Commercial Operation Date (COD) is longer. This is provided for reference only, as build time is not factored into the BRCP calculation, so does not affect this determination.

[9] https://www.erawa.com.au/cproot/24231/2/BRCP-Rev-2024-Wholesale-Electricity-Market-Procedure-Benchmark-Reserve-Capacity-Price-Approved-for-publishing.PDF

[10] https://www.wa.gov.au/government/document-collections/benchmark-capacity-providers-review

reduction targets[11]. While it may be possible that low-emissions fuels may be sourced to keep these facilities in operation post-2050, there is insufficient certainty around the availability and costs of this to include in the current analysis.

The economic lives from Table 3 are reflected in the amortisation periods applied in the proxy-BRCP calculations in section 2.5 below.

While the storage capacity of the BESS will decline with the number of cycles experienced, only the as-new nominal storage duration is considered in this review. BESS suppliers can now offer warranties for life and performance to 20 years (generally based on one cycle/day) with the supplier factoring in the costs and degradation under the expected duty in their service agreement costs and/or in providing increased initial capacity to meet the warranted duty at the end of the term.

Previously, the ERA has determined that refurbishment (including replacement of battery cells to maintain capacity) is to be considered a variable maintenance cost and is therefore not a factor in calculating the BRCP. Therefore, we have not considered degradation any further in this analysis.

Gas turbine based plants also experience capacity degradation with operation but to a lesser degree than current BESS technologies. The method to calculate BRCP does not historically make an adjustment for this impact.

For comparison purposes, the four-hour BESS configuration, which is the current reference technologies, has also been included. The input parameters (Table 3) are the same as the six-hour BESS except the land area required is reduced.

2.2 Capacity service requirements

Definitions of the requirements of the Peak and Flex Services were necessary to evaluate the candidate configurations. Some requirements are defined by the ESM Rules or AEMO's WEM Procedure. For the purpose of the reference technology evaluations, EPWA has used the service definitions shown in Table 4, Table 5 and Table 6.

Table 4. Service requirements for Peak service - non-storage

Parameter	Setting	Comments	Implications for benchmark provider
Operational Duration	14 hours		Requirement for gas transport contract / line pack
Operating Temperature	41° Celsius		Capacity rated at site
NOx emissions	150 mg/ m3	DWER approval at Kwinana	Requirement for Dry Low NOx or water NOx control

[11] https://www.wa.gov.au/organisation/department-of-water-and-environmental-regulation/reducing-emissions

Parameter	Setting	Comments	Implications for benchmark provider
Carbon emissions intensity	0.55 tCO2e/MWh	Based on latest proposal for emissions thresholds[12]	Will exclude diesel fuels and, likely, heavy duty gas turbines

Table 5. Service requirements for Peak service - Storage

Parameter	Setting	Comments	Implications for benchmark provider
Operational Duration	6 Hours	New ESR duration requirement in 2025 ESOO	Battery storage configuration
Operating Temperature	41° Celsius		Capacity rated at site
NOx emissions	None	Not required	None
Carbon emissions intensity	None	Not required	None

Table 6. Service requirements - Flex service - All technologies

Parameter	Setting	Comments	Implications for benchmark provider
Must meet all Peak Service Requirements			
Start time	30 minutes	Per minimum eligibility requirements for the 2025 Reserve Capacity Cycle	Excludes some CCGT
Ramp rate	3% of nameplate per minute		Excludes some CCGT

[12] The Wholesale Investment Certainty Review includes an initiative to introduce emission thresholds in the WEM. This would include a rate threshold (kg/MWh) and a quantity threshold (kg/MW installed), similar to the approach in the UK and Europe. The key threshold for peaking generation is the rate threshold. EPWA's indicative proposals set this at the rate of a new CCGT – 0.55 tCO2e/MWh (https://www.wa.gov.au/government/document-collections/wholesale-electricity-market-investment-certainty-review). Alternative approaches to valuing emissions reductions in line with the State Electricity Objective, such as the Interim value of emissions reduction (VER) methodology employed by the Australian Energy Regulator (AER), were not considered owing to the open WIC policy position.

Parameter	Setting	Comments	Implications for benchmark provider
Minimum online generation	46%		
Capacity factor	Daily operation	Flex service required daily	Increases variable costs

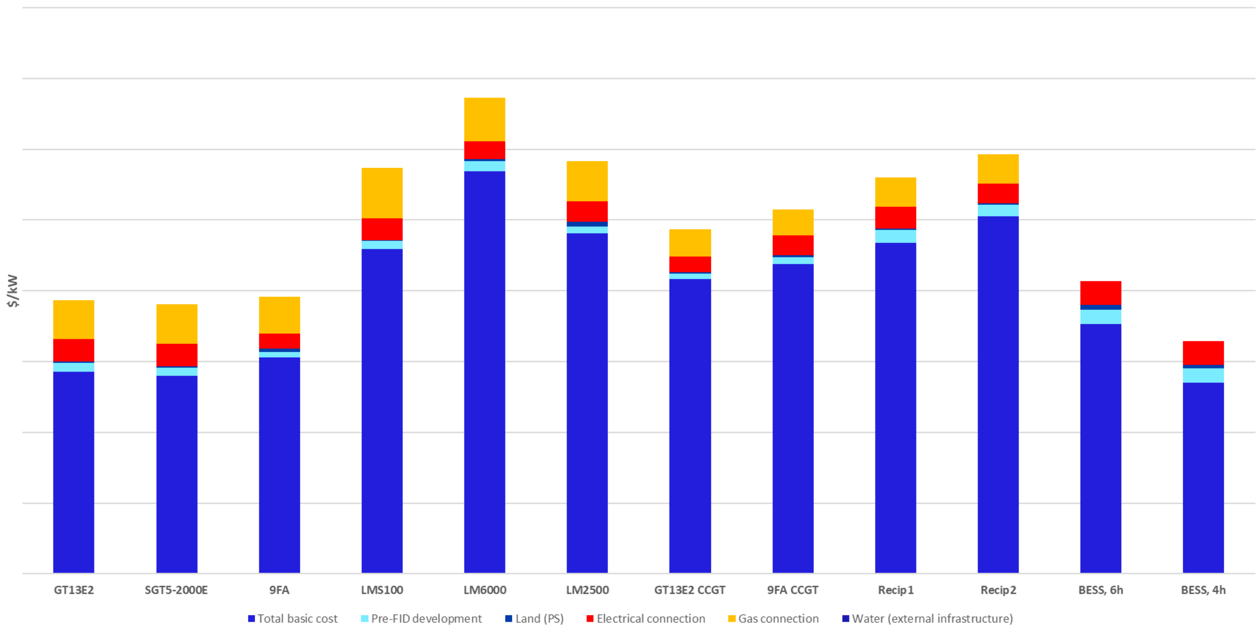
2.3 Technology cost results

2.3.1 Total plant capex

Relative capital costs per kW Capacity Credit are shown in Figure 1[13]. Costs represent capital expenditure for the plant inside-the-fence line on an "expected" basis, and the estimates would be considered an AACE[14] Class 4 or Class 5 estimate without risk-contingency.

Costs shown for the 4hr BESS are for the 200MW/800MWh existing reference technologies, and do not account for the reduction in capacity credits that would result from the new 6-hour ESR Duration Requirement.

Figure 1 Candidate configurations – total specific capex



Exclusions

The following considerations have not been included in the evaluation:

- Biodiversity offsets (This is bespoke to a particular project site)

[13] The purpose of this review is to determine the lowest cost reference technologies, relative to other technologies. It is the ERA's role to determine the actual costs that go into the BRCP determination. Numeric values are not provided here so as not to pre-empt the ERA's determination.

[14] https://web.aacei.org/

- Escalation and Interest During Construction (IDC) (the costs above are on an “overnight” basis, consistent with the ERA’s BRCP Procedure)
- Transaction costs (such as for Project Finance, assuming many projects are corporate financed, so not required)

Given that amortisation of the capex is assumed over only 15 years for BESS capex and only 25 years for thermal plants, we have not included mid-life nor end-of-life costs.

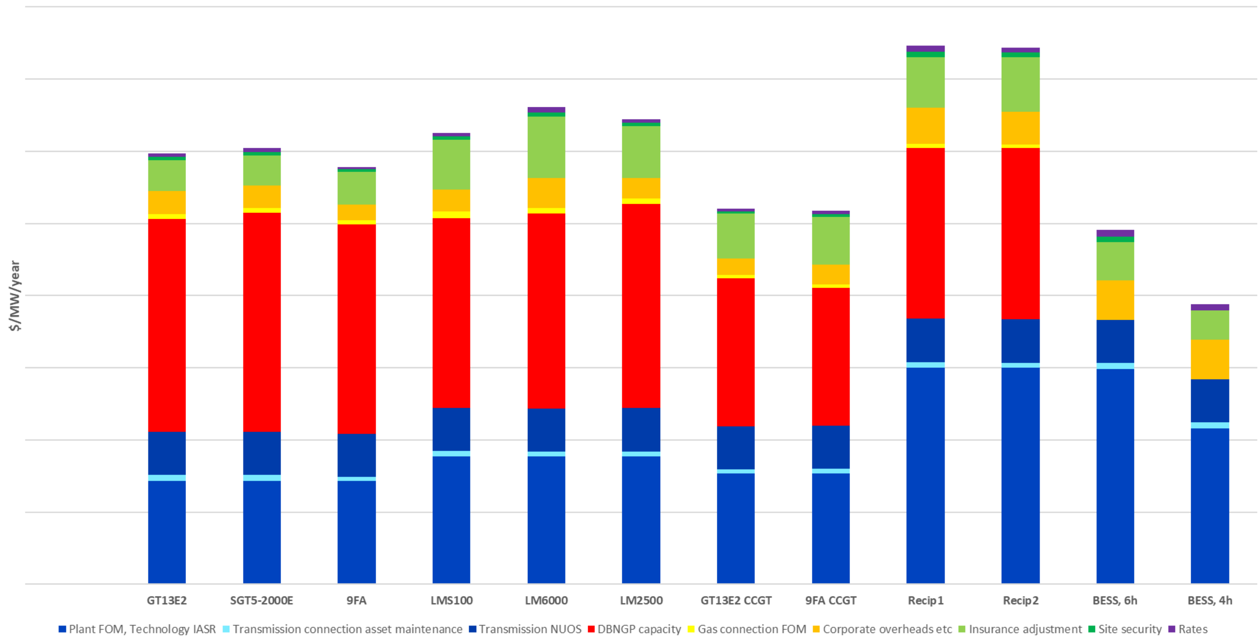
2.3.2 Fixed operations and maintenance costs

Fixed operating and maintenance (FOM) costs for the BESS were sourced from the ERA’s 2025 BRCP report[15].

For the natural gas fuelled options, allowance has been made for fixed charges on the Dampier to Bunbury Natural Gas Pipeline (DBNGP), using the Full Haul T1 Reference Tariff for 2025[16]. The Maximum Daily Quantity (MDQ) assumes holding sufficient gas to service the 14-hour run time, or drawing gas to replenish the local storage (gas lateral) over three days. An allowance for the FOM on the gas lateral is included, but compressor maintenance and power for compression are treated as variable costs.

Applying these parameters to the candidate configurations provides the calculated FOM costs shown in Figure 2[17]:

Figure 2. Candidate configurations – fixed operating and maintenance costs



15 https://www.erawa.com.au/cproot/24513/2/BRCP-2025-2025-Benchmark-Reserve-Capacity-Prices-for-the-2027-28-capacity-year-Final-determination-For-publication.PDF

16 https://www.erawa.com.au/gas/gas-access/dampier-to-bunbury-natural-gas-pipeline/tariff-variations

17 The purpose of this review is to determine the lowest cost reference technologies, relative to other technologies. It is the ERA’s role to determine the actual costs that go into the BRCP determination. Numeric values are not provided here so as not to pre-empt the ERA’s determination.

2.4 Candidate configurations shortlist

2.4.1 Evaluation against requirements

The candidate configurations are assessed against Peak service requirements in Table 7, and for the additional requirements of the Flex service in Table 8.

Table 7 Candidate configurations – Peak service

	Industrial SCGT			Aero SCGT			CCGT		Recip.		Storage	
	2xGT13E2	2xSGT5-2000E	2xGE 9FA.04	4xLMS100PB	6xLM6000PF-SPRINT	12xLM2500 G4 DLE	2xGT13E2 2+1 w/. Bypass stacks	1xGE 9FA.04 1+1 ss	12xWartsila med speed	24xJenbacher med speed	6h BESS	4h BESS
Single contingency < 330 MW[18]	☑	☑	☑	☑	☑	☑	☑	X	☑	☑	☑	☑
0.55t/MWh-net, 41oC, with degradation	X	X	X	☑	☑	☑	☑	☑	☑	☑	N/A	N/A
6-hour rating (storage)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	☑	2/3 cap only

Table 8 Candidate configurations – Flex service

	Industrial SCGT			Aero SCGT			CCGT		Recip.		Storage	
	2xGT13E2	2xSGT5-2000E	2xGE 9FA.04	4xLMS100PB	6xLM6000PF-SPRINT	12xLM2500 G4 DLE	2xGT13E2 2+1 w/. Bypass stacks	1xGE 9FA.04 1+1 ss	12xWartsila med speed	24xJenbacher med speed	6h BESS	4h BESS
Peak service compliance (Table 7)	X	X	X	☑	☑	☑	☑	X	☑	☑	☑	2/3 cap only
Min stable load 46% for non-intermittent[19]	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	N/A	N/A
Ramp rate 3%/min up & down	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

18 This is not a regulated limit, however exceeding this size would impose larger Contingency Raise Reserve causer-pays costs that are not considered in this review
19 Note while the gas turbine-based plant can generally operate down to 20% (typ.) load, the Dry Low Emissions burners will generally switch to a high emitting mode (diffusion configuration – results in higher NOx emissions) below about 50% load. It is not considered good environmental practice to operate on a sustained basis in such a mode.

Dispatch time, 30 mins[20]	☑	☑	☑	☑	☑	☑	2/3 cap only	X	☑	☑	N/A	N/A

The resulting eligible shortlisted candidate configurations are the configurations that meet the evaluation criteria above, as shown in Table 9:

Table 9 Short-listed candidate configurations

	Aero SCGT			CCGT	Recip.		Storage	
	4xLMS100PB	6xLM6000PF-SPRINT	12xLM2500 G4 DLE	2xGT13E2 2+1 w/. Bypass stacks	12xWartsila med speed	24xJenbacher med speed	6h BESS	4h BESS
Peak service	☑	☑	☑	☑	☑	☑	☑	☑ Only 2/3 of capacity eligible
Flex service	☑	☑	☑	☑ Only 2/3 of capacity eligible	☑	☑	☑	☑ Only 2/3 of capacity eligible

20 **Fast Start Facility:** A Scheduled Facility or Semi-Scheduled Facility that is capable of:

(a) synchronizing and changing its rate of Injection or Withdrawal within 30 minutes of receiving a Dispatch Instruction from AEMO; and

(b) shutting down within 60 minutes from the time the Dispatch Instruction to synchronise was issued.

2.5 Determining the least cost new entrant capacity provider

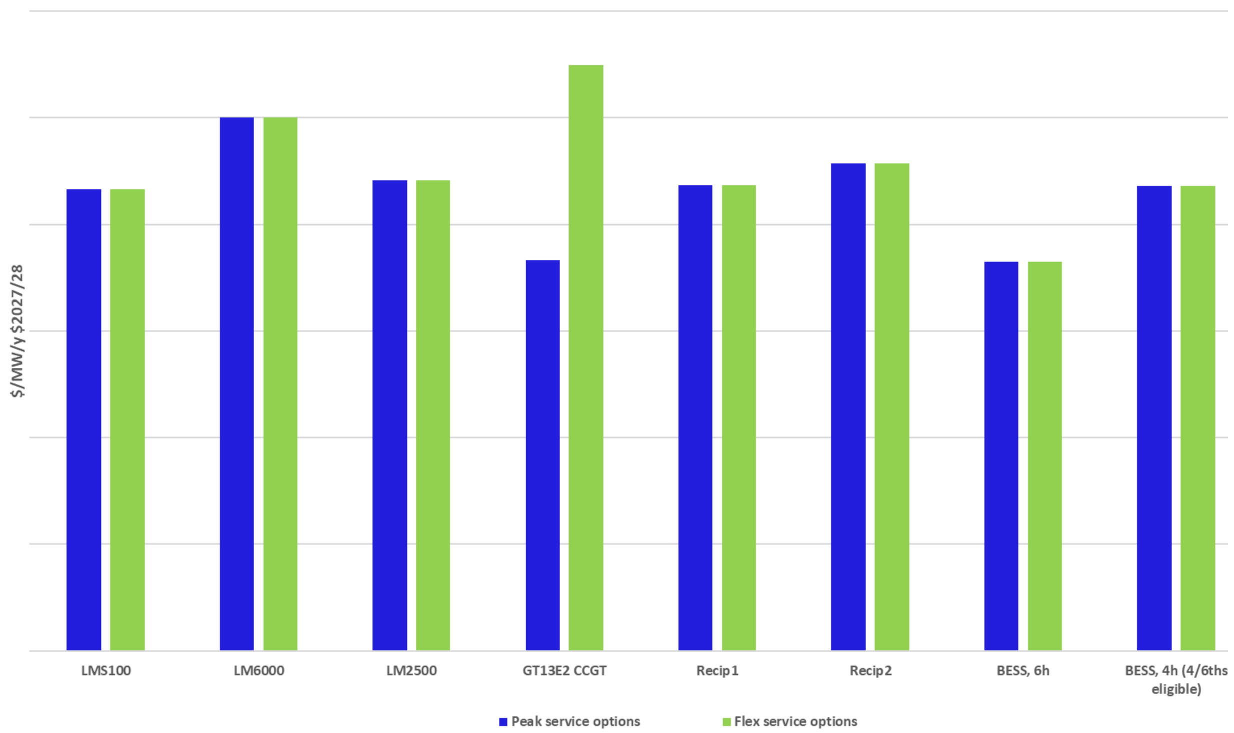
In order to determine the least cost new entrant technologies, cost per MW per year were determined for each of the shortlisted candidates, according to the ERA's BRCP Procedure[21]. This calculation uses:

- Annualised capex calculated using a nominal WACC of 10.46%.
- Amortisation period of 15 years for BESS, and 25 years for gas-fired generation.
- A weighted average cost of capital factor, being "x(1+WACC)^0.5" applied to capex components.
- No additional legal, financing and insurance costs (the "M" factor in the BRCP Procedure) - the relevant factors are included within the basic capital costs).

The resulting relative costs are shown in Figure 3.

Note that in considering the 2xGT13E2 2+1 with bypass stacks CCGT configuration, for the Flex service the value shown is multiplied by 3/2 reflecting that only 2/3rds of the capacity of this plant would qualify. Similarly, the four-hour BESS cost is scaled up to reflect that its capacity would be derated to only 4/6ths of its nameplate capacity based on the current ESR Duration Requirement of 6 hours.

Figure 3 Cost per MW per year for short listed candidates



2.6 Identified BRCP technologies

Considering the eligibility assessment and the calculated BRCP values above, the indicated least-cost candidate options are:

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[21] https://www.erawa.com.au/cproot/24231/2/BRCP-Rev-2024-Wholesale-Electricity-Market-Procedure-Benchmark-Reserve-Capacity-Price-Approved-for-publishing.PDF

- Peak service: Six- hour BESS 200 MW / 1,200 MWh
- Flex service: Six- hour BESS 200 MW/ 1,200 MWh

For the Peak service, an E class industrial gas turbine in CCGT format with bypass stacks is very close to the six-hour BESS calculated value, as shown in Figure 3 above.

The four-hour BESS (i.e. the current BRCP technologies) has higher effective cost as only 2/3rds of its capacity is now eligible.

2.7 Proposed Benchmark Capacity Provider Technologies

Proposal A:

The proposed reference technologies for the Peak and Flexible BRCPs are:

- 200 MW / 1200 MWh Lithium BESS connected at 330 kV.

Consultation questions:

1. Based on the analysis, do stakeholders agree with the proposed reference technology for the Peak Capacity product?
2. Based on the analysis, do stakeholders agree with the proposed reference technology for the Flexible Capacity product?

2.7.1 WICRWG Feedback

The Wholesale Investment Certainty Review Working Group discussed the draft analysis conducted in this review at its meeting on 14 August 2025. The discussion included:

- the approach to shortlisting technologies for each capacity product and the shortlist determined through this approach;
- capacity service requirements, including those drawn from the published minimum eligibility requirements for Flexible Capacity providers, and the appropriate size for assumed new build;
- the expected technical and economic life of the shortlisted technologies; and
- the estimates for the upfront capital costs and other fixed costs for each shortlisted technology.

Key discussion points were as follows:

- The economic life assumed in the analysis (15 years for BESS and 25 years for gas-fired generators) and whether a 35-year economic life should be considered for gas-fired generation.
  - 25 years has been used for gas-fired generation due to emissions thresholds becoming binding in 2050. While it may be possible that low-carbon fuels are available in the future to extend the life of these generators past that date, there is too much uncertainty around the availability and price of such fuels to account for this at this stage.
- The treatment of build times in the analysis was questioned, given recent build times in the SWIS, and current long lead times for gas turbine orders.
  - The treatment used in this analysis is consistent with the ERA's BRCP Procedure, in that only construction time is used, not the time from notice to proceed (NTP).
  - The reference technologies are determined for a notional new facility that meets the criteria, and do not represent an expectation of the actual technologies that will or should enter the market in the future. Project-specific parameters, such as procurement lead times and delays in obtaining network connections are, therefore, not considered.
- There was discussion regarding the source of energy to charge the BESS and the concern that not enough generation capacity would be incentivised to enter the market.

- Cost to charge a BESS is a variable cost, so it is not considered in setting the reference technologies.
- The Coordinator must select the reference technologies on the basis that they represent the lowest annual capital cost, and annual fixed operating and maintenance costs.
- The selected reference technologies will be able to recover all of their capital and fixed costs without any other market revenue. All other technologies, with higher capital and fixed costs, will still be able to recover their costs by receiving energy and ESS market revenue.
- EPWA notes that the ESM Rules have been recently changed to enable AEMO to address shortfalls in Capability Class 1 and Capability Class 3 capacity.

- These was discussion regarding the network location assumed for the analysis.
  - The analysis does not use a specific network location but assumes an uncongested location in the SWIS. Determining a specific location is part of the ERA's process when determining the BRCP.
- Regarding the Gross vs Net CONE analysis (section 3 of this paper), it was asserted that the current BESS facilities were earning substantial revenue through energy arbitrage and ESS, so a Net CONE approach would reduce costs for consumers.
  - Such revenues are unlikely to continue, with substantial quantities of BESS capacity entering the market. This will likely supress arbitrage and ESS prices and divide any available revenue between more facilities. This is confirmed by the market modelling.
- The degradation of BESS capacity over time was discussed. It was noted that, while gas turbine degradation was also not considered, the rate of degradation of a lithium-based BESS is significantly higher than that of a gas turbine.
  - The ERA member of the Working Group confirmed that refurbishment (including replacement of battery cells to maintain capacity) is to be considered a variable maintenance cost and is therefore not a factor in calculating the BRCP. Therefore, EPWA has not considered degradation any further in this analysis.

2.7.2 Market Advisory Committee Feedback

A draft of this consultation paper was sent to the MAC out of session for comment. The feedback received is reflected in this Consultation Paper. Key issues raised were as follows:

- Regarding the Gross vs Net CONE analysis (section 3 of this paper), it was again raised whether current BESS facilities were earning substantial revenue through energy arbitrage and ESS, and whether such historical revenues should be calculated for the current plant.
  - As noted above, such revenues are unlikely to continue, with substantial quantities of BESS capacity entering the market. Therefore, historical revenues of existing BESS facilities are not indicative of future revenues.
- The concern that the BRCP resulting from this determination will not incentivise sufficient investment in the capacity required to meet the reliability requirements was raised again.
  - In the 2025 ESOO, the ESR Duration Requirement changed from 4 hours to 6 hours. This indicates that 6 hour ESR is still capable of maintaining reliability. The objective of the review is to determine the reference technologies used to set the Peak and Flexible BRCPs, which ensure system reliability is maintained at the lowest cost.

3. Gross vs Net CONE analysis

3.1 Introduction

This section details the analysis performed to address the question of whether gross or net CONE should be adopted for the BRCP.

Historical revenues earned by existing facilities do not provide a reliable forecast of revenues received by future facilities, due to the complex and evolving nature of the WEM. Therefore, financial modelling using RBP's WEMSIM model of the WEM was performed to analyse whether the proposed new reference technologies would be the marginal energy supplier in the Real Time Market and to estimate the BRCP levels that would result from the gross or net CONE approaches.

3.2 Criteria

The criteria applied to decide whether gross or net CONE should be applied are as follows:

- For Peak BRCP:
  - If the reference technology would be the marginal energy supplier (under the ESM Rules expected to be in place under the ESM Amending Rules implementing the RCM Review) – gross CONE should be applied.
  - If not, further assess whether applying net CONE would be more appropriate.
- For Flexible BRCP:
  - If the reference technology would be the marginal energy supplier in the intervals Flexible Capacity would be required (under the ESM Rules expected to be in place under the ESM Amending Rules implementing the RCM Review) – gross CONE should be applied.
  - If not, further assess whether applying net CONE would be more appropriate.

3.3 Methodology

The modelling methodology used is as follows:

- Perform market modelling of the WEM under the new Market Rules. The modelling is performed using RBP's WEMSIM model – an update of the same model used for the RCM review.
- Include a facility representing a unit of the recommended reference technologies – i.e., 200MW/1200MWh lithium BESS.

WEMSIM is a tool which simulates and optimises the dispatch of resources in a multi-regional transmission framework to meet the required demand. WEMSIM uses Linear Programming (LP) and/or Mixed Integer Programming (MIP) for solving the optimal dispatch problem while taking into account transmission and other technical constraints.

For the purposes of this review, the WEM from 2024 to 2034 has been modelled and the following market results have been forecast:

- Energy market prices – average and captured by the facility
- Marginal cost of generation for the BESS facility, including captured prices at time of charging
- Net market revenue for the BESS facility, including captured prices at time of discharging, and ESS revenues
- Gross CONE and net CONE

3.4 Assumptions

Modelling assumptions are documented in Appendix A.

3.5 Modelling results

The following sections show the key results of the modelling.

3.5.1 Marginal Energy Supplier

If the reference technologies are the marginal energy supplier, it is expected that the spot energy price to be reflective of these technologies' short-run marginal costs (SRMC). In this case, the SRMC for a BESS is inclusive of the cost of energy to charge the battery – i.e. the captured price at the time of charging.

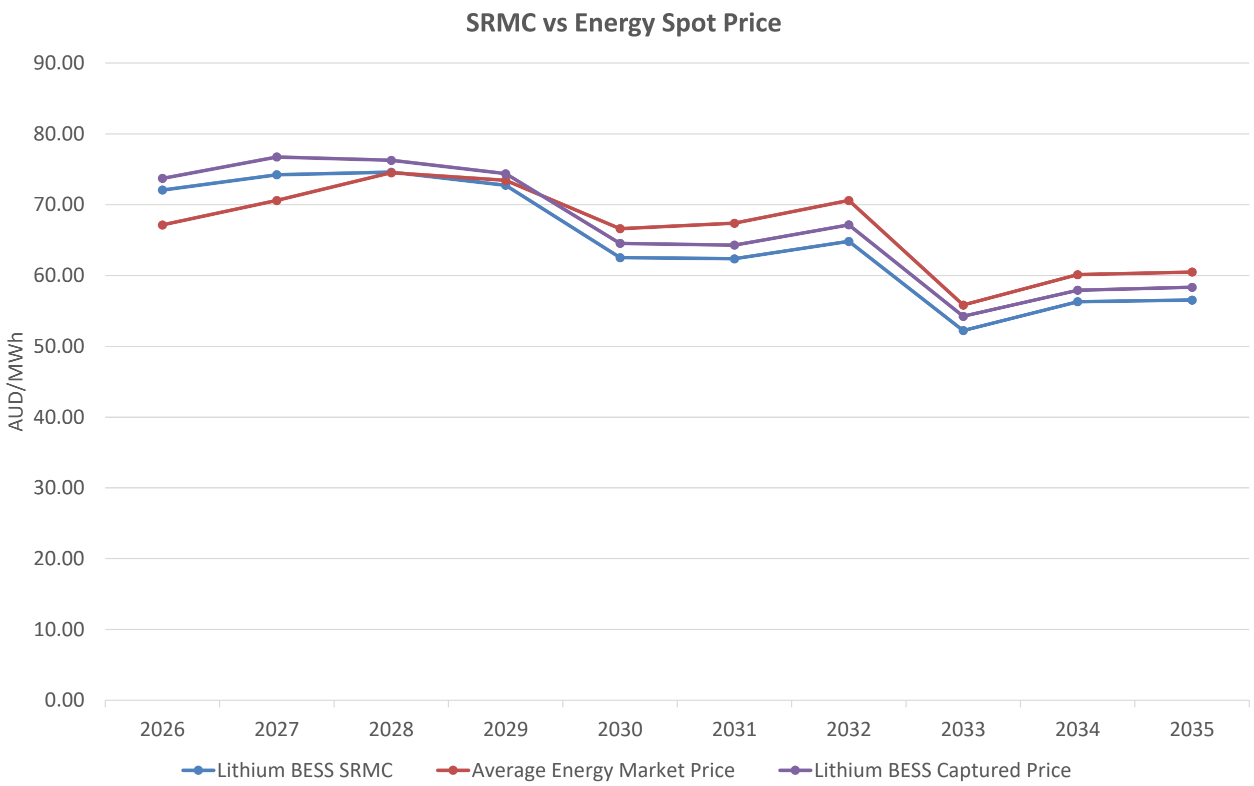


Figure 4. SRMC vs Energy Spot Price

Figure 4 shows that the average energy spot price follows the SRMC of the BESS (including the cost of charging). This indicates that the BESS is a marginal supplier of energy.

3.5.2 Gross and Net CONE

This section provides the gross and net CONE results from the market modelling.

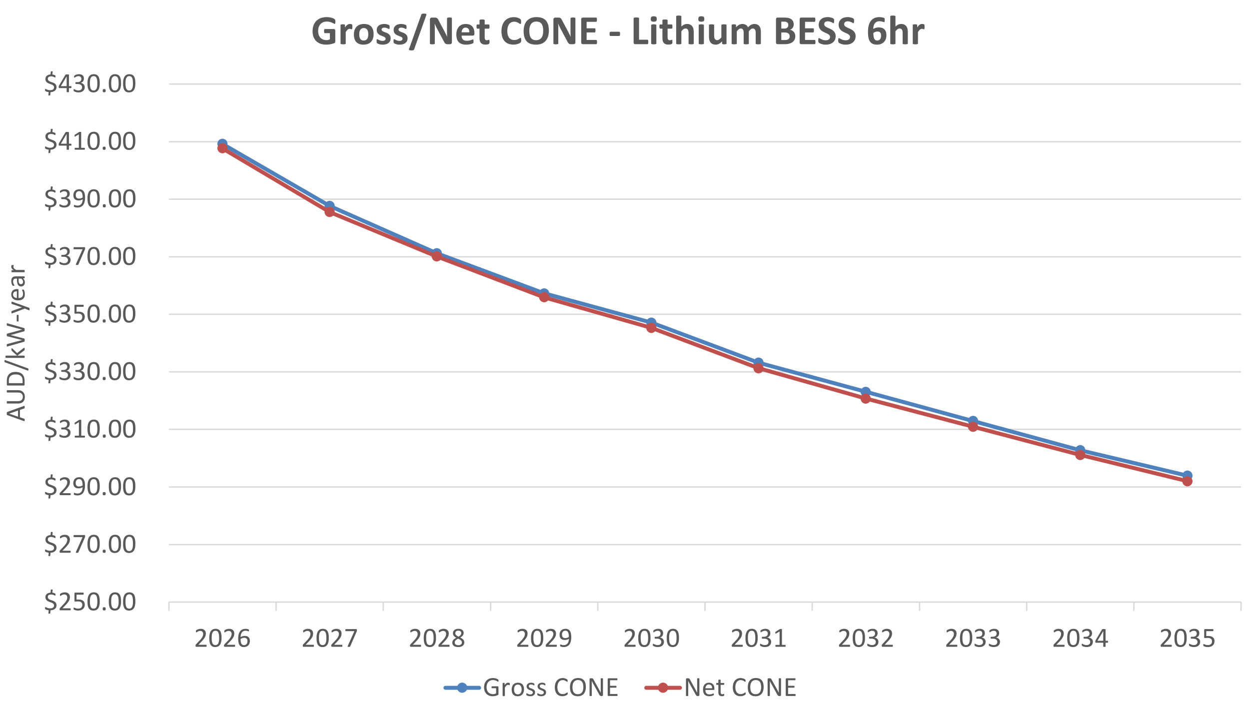


Figure 5. Gross and Net CONE - Lithium BESS

Figure 5 shows that in all years, net CONE is only slightly lower than gross CONE, indicating that the facility is not making substantial net revenue from the energy and Essential System Service markets. Therefore, net CONE would not result in significant savings for consumers.

3.6 Further Assessment

The following is an assessment of the relative advantages and disadvantages of the gross CONE and net CONE approaches:

Net CONE Advantages

- Potentially lower cost to consumers

Net CONE Disadvantages

- Requires forward-looking modelling to forecast net revenues
- This is highly sensitive to input assumptions, such as cost changes, other new build, retirements, renewables output, fuel prices, etc.
- Consensus will be difficult to achieve
- Resulting uncertainty may deter investment, undermining cost savings and reliability

Gross CONE Advantages

- Relatively predictable BRCPs provide investment certainty
- More straightforward BRCP determination process
- Consistent with current BRCP methodology

Gross CONE Disadvantages

- Potentially higher cost to consumers

3.7 Conclusion and recommendation

From the above analysis, EPWA has drawn the following conclusions:

- Modelling indicates that it is likely that the reference technologies will be the marginal energy supplier.
- While in theory, net CONE may result in lower costs to consumers, the amount of reduction is likely to be very small.
- Implementing net CONE adds significant complexity and uncertainty to the BRCP determination procedure.
- The resulting uncertainty may deter investment, undermining cost savings and reliability.

Consequently, EPWA proposes to retain a gross CONE approach.

Proposal B:

Retain a gross Cost Of New Entry approach to the BRCP determination.

Consultation questions:

1. Do stakeholders agree with the proposal to retain the gross Cost Of New Entry approach to the BRCP determination?

Appendix A. Modelling assumptions

A.1 Load assumptions

The demand profile is obtained from the 2025 WEM Electricity Statement of Opportunities (ESOO) published by AEMO. Demand traces for the Expected 50% POE scenario are used[22], with some processing to obtain a single complete demand trace for 10 calendar years[23].

The resulting annual, peak and minimum demand values by calendar year are as follows:

Table 10: Demand Assumptions

Calendar Year	Annual Demand (GWh)	Peak Demand (MW)	Minimum Demand (MW)
2026	17,500	4,565	193
2027	17,588	4,600	107
2028	18,031	4,645	65
2029	18,542	4,727	-24
2030	19,113	4,806	-40
2031	19,645	4,896	-57
2032	20,444	4,992	-73
2033	21,050	5,096	-71
2034	22,075	5,233	-52
2035	23,374	5,373	-33

A.2 Fuel Prices

A.2.1 Natural Gas

Natural gas prices were provided by the 'Expected' case of the *Gas, liquid fuel, coal and renewable gas projections* report commissioned by AEMO, dated 25 February 2025. Prices differ regionally and are separated into five groups:

Group	Plants
Central	New Peaking Plant
	Neerabup Peaker
	Pinjar A B
	Pinjar C
	Pinjar D

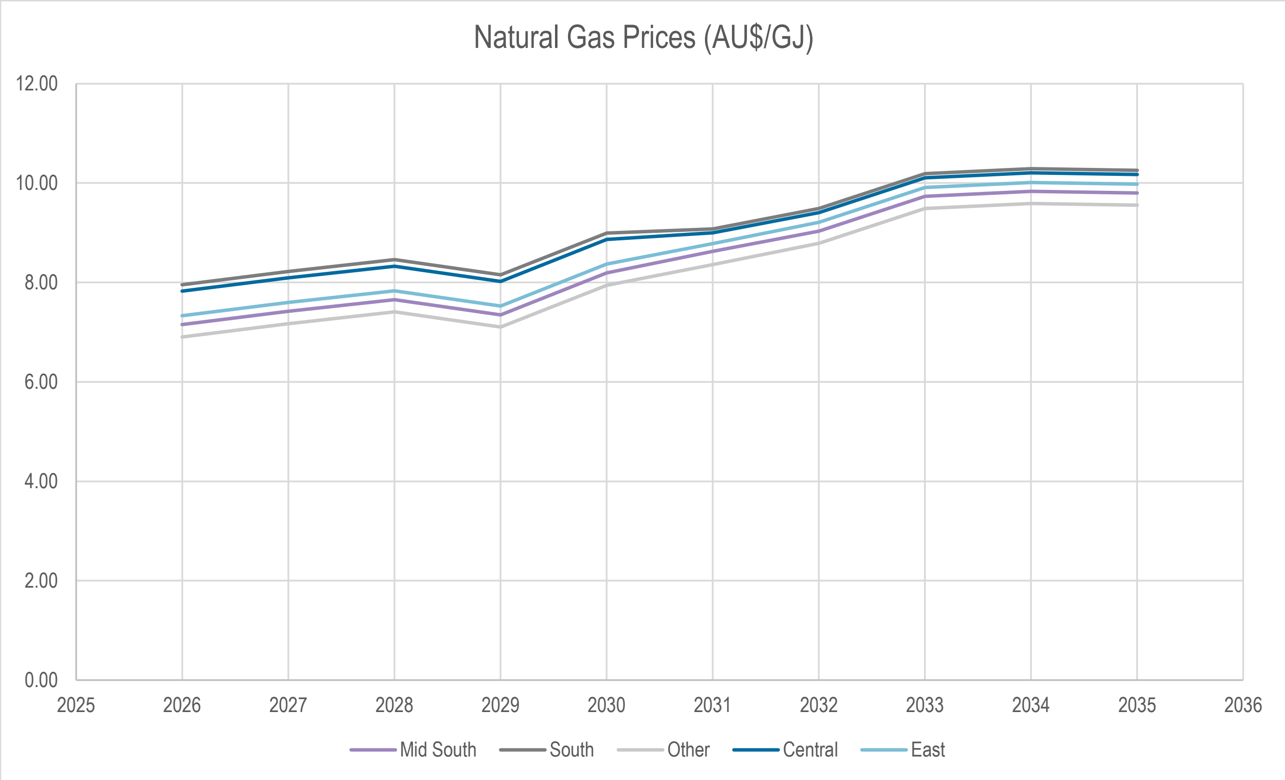
[22] 10% POE traces are used to set the Reserve Capacity Target, but for the purposes of forecasting future outcomes, 50% POE is more appropriate as the forecast that is considered more likely to occur.

[23] Specific processing is as follows: (1) The ESOO demand traces are truncated at a minimum demand value of just above 300 MW, based on ESFs being dispatched to ensure a minimum operational demand of 300 MW. As we will be simulating the dispatch of the ESFs in our model, we need to restore the sub-300MW values. We have done so using a simulation based on the forecast minimum demand values in the ESOO. (2) The demand traces finish at 1 Oct 2035. To obtain a complete set of values for the 2035 calendar year, we have estimated the missing values by scaling the corresponding values from the previous year by the annual growth rate. (3) 10 demand traces are provided in the ESOO based on 10 historical demand years; we have selected the trace based on the 2017-18 base year, as this year presents an average degree of demand volatility.

Group	Plants
East	Parkeston SCE
	Kalgoorlie Nickel
Mid South	Pinjarra Alinta Cogen
	Kwinana A
	Kwinana B
	Kwinana C
	Kwinana HEGT
	New CCGT
	Newgen Power
	BP Cogen
	Strike_Recip
	Worsley SWCJV
	Tiwest Cogen
Other	Cockburn
	Mungarra
South	Wagerup Alinta Peaker
	Kemerton

Based on these forecasts, the gas prices used in the model are illustrated in Figure 6.

Figure 6: Gas Price Projection



A.2.2 Coal

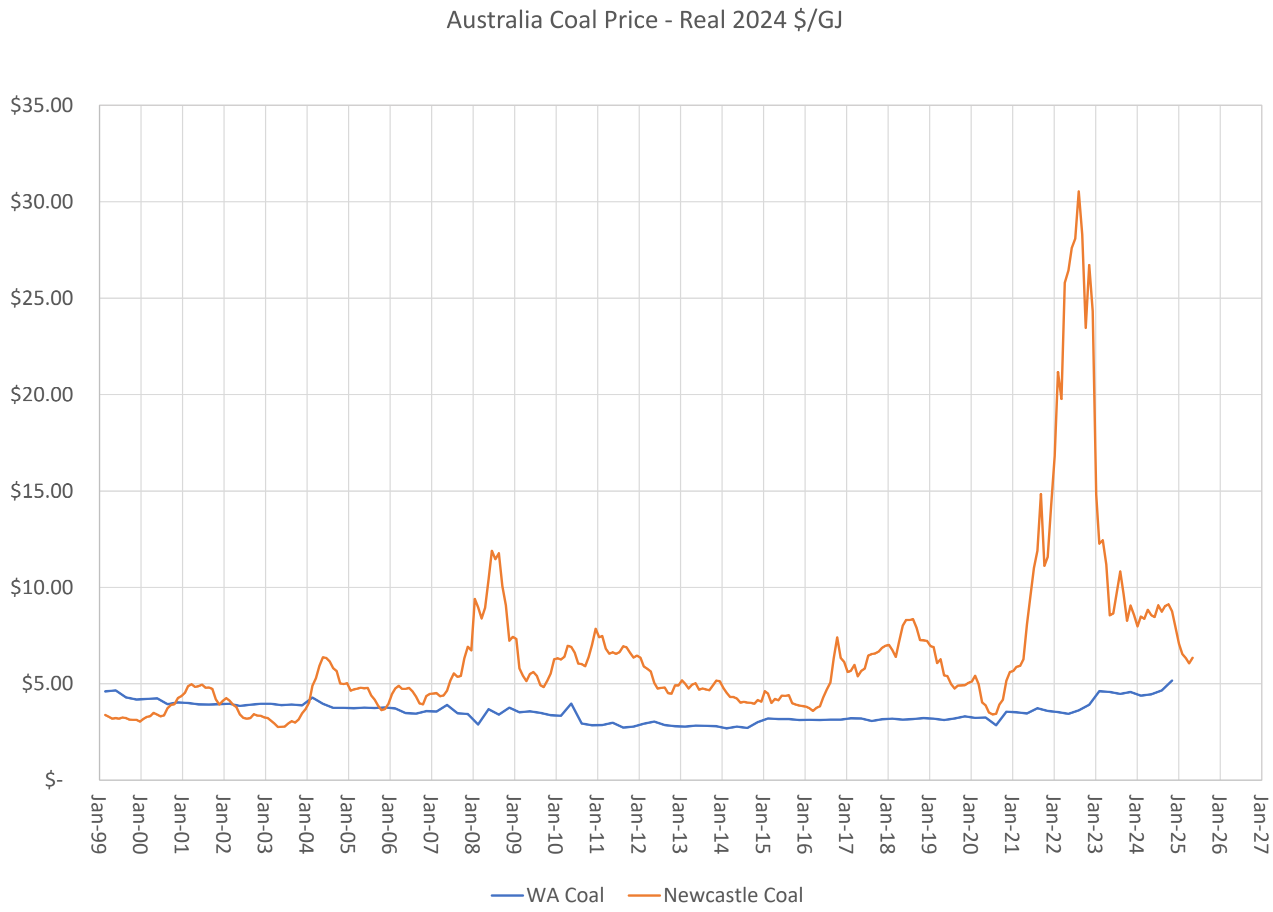
Coal-fired generators in WA receive coal directly from WA coal mines under a contract. The terms of these contracts are not public, so the cost of this coal must be estimated for modelling purposes.

Coal trading beyond WA is very limited, so WA coal prices do not follow global prices (such as the Newcastle price). Importing coal is a possibility but would require upgrading of port facilities. Data on the quantity and value of coal produced in WA is provided in the *Major Commodities Data File*, published by the Government of Western Australia Department of Mines, Petroleum and Exploration.[24] Historical WA and Newcastle prices are shown in Figure 7 (assuming a calorific value of 19.7 GJ/t for WA coal).[25]

24 https://www.dmp.wa.gov.au/About-Us-Careers/Latest-Statistics-Release-4081.aspx

25 Guide to the Australian Energy Statistics 2017: https://www.energy.gov.au/sites/default/files/guide-to-australian-energy-statistics-2017_0.docx

Figure 7: Coal Price History



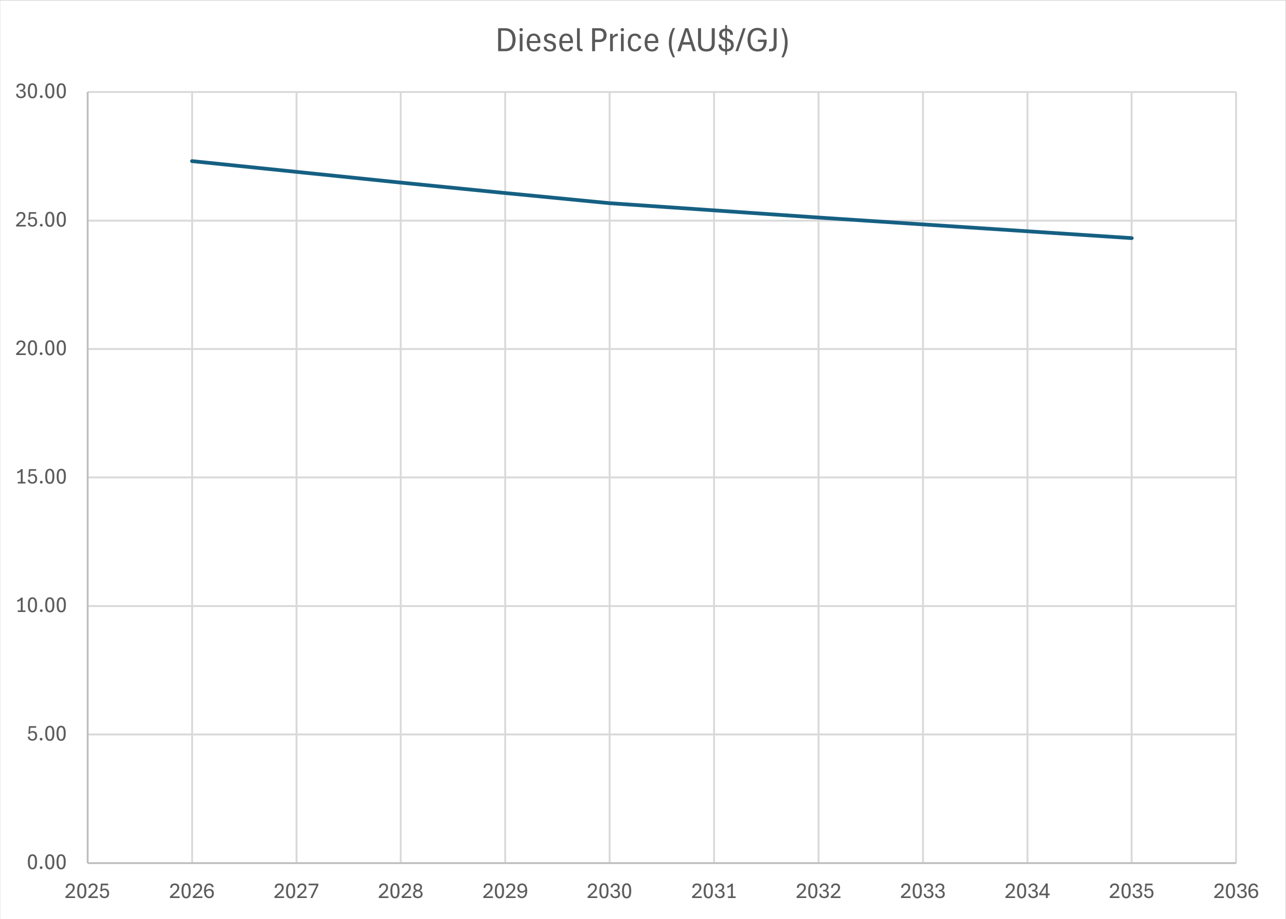
Given recent price volatility, we will assume a constant real price of AU$5/GJ for WA coal.

A.2.3 Diesel

Diesel prices are obtained from the same *Gas, liquid fuel, coal and renewable gas projections* report commissioned by AEMO, dated 25 February 2025, as used for the natural gas projections.

The 'Step Change' scenario was used from these projections as the mid-point between the other two scenarios.

Figure 8: Distillate Price Projection



A.3 Retirements

The retirements used in the modelling are based on known retirement dates according to state government announcements.

A.4 New Build

First, the model assumes the candidate facility is being built in 2026, which in this case is a 200MW/1200 MWh Lithium BESS.

Specific committed new build facilities from the ESOO are included as listed in Table 11.

Table 11: Committed new build facilities

Facility	Generation Capacity (MW)	Storage Capacity (MWh)	COD
2024-26 Peak Demand NCESS – DSP	120	-	March 2025
2025-27 Peak Demand NCESS – DSP	98	-	Mar-25
Kwinana Waste to Energy Project	36	-	May 2025
2024-26 Peak Demand NCESS – ESR	50	200	October 2025
2025-27 Peak Demand NCESS – ESR	312	1212	October 2025

Facility	Generation Capacity (MW)	Storage Capacity (MWh)	COD
2025-27 Peak Demand NCESS – ESR/DSP	19	-	October 2025
Electricity Generation and Retail Corporation Collie Battery	500	2000	December 2025
East Rockingham RRF Project Co Pty Ltd	29	-	October 2026
Kingia Plains Energy's Arrowsmith gas project	85	-	October 2026
Nomad Energy Merredin ESR	100	400	November 2026
King Rocks Wind Firm	150	-	June 2027
Warradarge Wind Firm upgrade	102	-	October 2027
Other ESR Facilities as assessed with 2025 WEM ESOO FIR and 2025 EOI information	25	40	October 2027

If the model identified energy/reserve shortfalls, then additional capacity was added to limit unserved energy to acceptable levels. Figure 9 and Table 12 show the new build required to meet these targets.

Figure 9: Assumed New Build

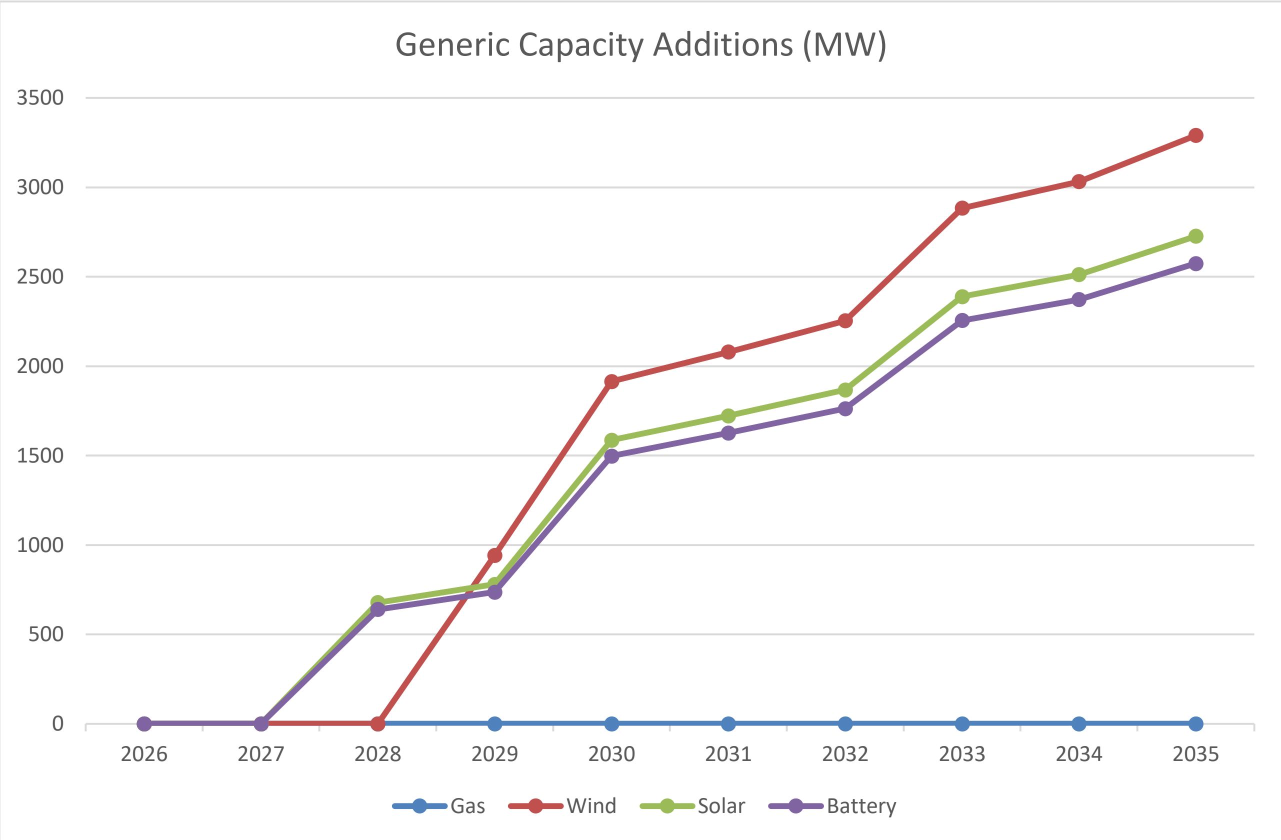


Table 12: Generic New-build Capacity (MW, Cumulative)

Year	Gas	Wind	Solar	Battery
2026	0	0	0	0
2027	0	0	0	0

Year	Gas	Wind	Solar	Battery
2028	0	0	678	640
2029	0	942	780	737
2030	0	1915	1587	1498
2031	0	2080	1723	1627
2032	0	2254	1867	1763
2033	0	2884	2389	2256
2034	0	3033	2513	2372
2035	0	3291	2727	2575

A.5 Service provision

The modelling assumes that:

- FCESS are only provided by gas facilities and storage facilities.
- wind and solar facilities do not provide flexible capacity services.
- storage facilities can provide synthetic inertia, as otherwise by the end of the modelling horizon there are no facilities left to provide the RoCoF service.

A.6 Commercial parameters

A.6.1 Weighted average cost of capital

When calculating the CONE for each facility type, a nominal pre-tax weighted average cost of capital (WACC) of 10.46% was assumed, as specified by the ERA for the 2025 BRCP Determination for the 2027/28 Capacity Year.

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