GOVERNMENT OF WESTERN AUSTRALIA

Department of **Energy, Mines, Industry Regulation and Safety**
Energy Policy WA

The Wholesale Electricity Market Investment Certainty Review (Initiatives 1 and 2)

Consultation Paper

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Working together for a **brighter** energy future.

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Abbreviations

Term	Definition
AEMO	Australian Energy Market Operator
BRCP	Benchmark Reserve Capacity Price
CONE	Cost of New Entry
Coordinator	Coordinator of Energy
CRC	Certified Reserve Capacity
DSR	Demand Side Response
EE	Energy efficiency
EPWA	Energy Policy WA
ERA	Economic Regulation Authority
ESOO	Electricity Statement of Opportunities
ESR	Electric Storage Resource
ESS	Essential System Services
EV	Electric Vehicle
EUE	Expected Unserved Energy
ICAP	Installed capacity
ICR	Installed capacity requirement
LICR	Locational minimum installed capacity requirement
MAC	Market Advisory Committee
MAPC	Maximum Auction Clearing Price
NAQ	Network Access Quantity
PV	Photovoltaic
POE	Probability of Exceedance
PRD	Price responsive demand
RCM	Reserve Capacity Mechanism
RCP	Reserve Capacity Price
RCT	Reserve Capacity Target
SWIS	South West Interconnected System
SRC	Supplementary Reserve Capacity
VRR	Variable resource requirement mechanism
WACC	Weighted average cost of capital
WEM	Wholesale Electricity Market
WIC Review	WEM Investment Certainty Review

Term	Definition
WICRWG	WIC Review Working Group

Executive Summary

The Wholesale Electricity Market Investment Certainty Review

Electricity markets around the world are undergoing a major transition in the move to a net zero emissions energy sector. Significant network, renewable generation and Energy Storage Resource (ESR) investment will be required in the South West Interconnected System (SWIS) over the next decade to continue to deliver on the energy trilemma, of reliable, affordable and environmentally responsible electricity supply.

The Wholesale Electricity Market (WEM) must be able to deliver price signals that drive efficient investment. Providing better certainty for investors in new low emissions energy technologies will help meet emission reduction targets while maintaining reliability in the SWIS.

This will require the WEM to evolve and to provide sufficient and sustainable incentives that drive timely investment in low emissions generation capacity. These incentives are required to ensure that sufficient revenue will be available to make these investments viable.

As a result, the Coordinator of Energy (Coordinator) is considering a package of specific WEM reform initiatives aimed at enhancing investment certainty for renewable generation and new firming capacity. These initiatives are aimed at incentivising investment in new renewable generation capacity at the required scale and in the required timeframe to meet the energy industry decarbonisation targets.

The Coordinator is conducting the WEM Investment Certainty (WIC) Review, in consultation with the Market Advisory Committee (MAC), under clause 2.2D.1 of the WEM Rules. The MAC constituted the WEM Investment Certainty Review Working Group (WICRWG) to support the WIC Review's work.

The review is considering five specific reforms that were announced by the Minister for Energy on 9 May 2023:

1. reviewing the Reserve Capacity Price (RCP) curve to determine if it needs to be adjusted to send sharper signals for investment when demand for new capacity is stronger;
2. a 10-year RCP guarantee for new technologies, such as long-duration storage;
3. a wholesale energy price guarantee for renewable generators, to top up their energy revenues as WEM prices start to decline, in return for them firming up their capacity;
4. emission thresholds for existing and new high emission technologies in the WEM; and
5. a 10-year exemption from the emission thresholds for existing flexible gas plants that qualify to provide the new flexibility service.

This initial Consultation Paper sets out the findings and recommendations arising from analysis on Initiatives 1 and 2.

Finalising and implementing these recommendations is urgent, to enable the Australian Energy Market Operator (AEMO) to commence the implementation of the WEM Amending Rules introducing the new Flexible Capacity product. These WEM Amending Rules were made by the Minister for Energy in early December as part of the package of WEM Amending Rules implementing the outcomes of the Reserve Capacity Mechanism Review, which was completed by the Coordinator in 2023.

Call for Submissions

Stakeholder feedback is invited on the WIC Review proposals that are outlined in this paper. Submissions can be emailed to energymarkets@dmirs.wa.gov.au. Any submissions received before the consultation closing time will be published on www.energy.wa.gov.au, unless requested otherwise. The consultation period closes at **5:00pm WST on 15 August 2024**. Late submissions may not be considered.

Design Proposals and Rationale

Table 1 lists the proposals arising from Initiatives 1 and 2 of the WIC Review, along with a summary of the rationale for each proposal.

Table 1: WIC Review Proposals

Proposal	Rationale
Reserve Capacity Price curve	
Proposal 1 – RCP at RCT Set the Peak RCP to 100% of the Peak Benchmark Reserve Capacity Price (BRCP) if the number of Peak Capacity Credits issued equals the Peak Reserve Capacity Target (RCT).	The BRCP is set based on the gross cost of new entry (CONE) of the marginal new entrant technology. If the RCP is set higher than the BRCP at the RCT, the marginal new entrant will receive more revenue that it needs. Because the BRCP is based on gross CONE, the marginal new entrant capacity will receive more revenue in the energy and Essential System Services (ESS) markets than needed to cover its variable costs. This proposal would align the WEM with almost all other jurisdictions and set RCP to equal BRCP when the RCT is exactly met.
Proposal 2 – RCP deadband Set the Peak RCP to 100% of the Peak BRCP when the number of Peak Capacity Credits provided is between 95% and 105% of the Peak RCT.	The relatively small size of the SWIS means that the RCP can be changed significantly by a single retirement or a single new plant addition. A deadband will reduce RCP volatility. With a RCT around 5,000 MW, a deadband of around 500 MW would mean that a single build or retirement decision alone would not move the price, at least when the available capacity was near to the RCT.
Proposal 3 – RCP cap Set a maximum Peak RCP at 150% of the Peak BRCP, when the number of Peak Capacity Credits issued is 85% of the Peak RCT.	This increased RCP cap will provide a sharper signal for investment when there is a capacity shortage, and is in line with the low end of the range used for RCP caps internationally.

Proposal	Rationale
Proposal 4 – RCP floor Set a minimum Peak RCP at 50% of the Peak BRCP, when the number of Peak Capacity Credits provided is greater than or equal to 115% of the Peak RCT.	Some WICRWG and MAC members were concerned that having a RCP floor of zero meant less certainty for investors. WICRWG members considered that some investors look at the worst-case scenario (e.g. zero capacity payments) when choosing whether to invest. As a relatively small, isolated power system, it is appropriate that the WEM has a higher RCP floor than larger interconnected markets. The proposal sets a RCP floor at a level of oversupply above the RCT that is reciprocal to the level of undersupply that sets the RCP cap. This is expected to balance the interests of consumers and investors.
Proposal 5 – Flexible Capacity RCP curve **5.1** Allow any new facility that provides Flexible Capacity to receive (on request) a fixed RCP for ten years **5.2** Set a maximum Flexible RCP at 160% of the Flexible BRCP, when the number of Flexible Capacity Credits issued is 85% of the Flexible RCT. **5.3** Set the Flexible RCP to 100% of the Flexible Benchmark RCP where the number of Flexible Capacity Credits issued is 100% of the Flexible RCT. **5.4** Set the minimum Flexible RCP on the same basis as the Peak RCP.	The Flexible RCP curve needs to be differentiated from the Peak RCP curve to allow a shortage of Flexible Capacity to result in an investment signal, even when there is a shortage of Peak Capacity. The proposed RCP cap for Flexible Capacity is at the high end of the range used in international capacity mechanisms. Flexible Capacity payments are additional to the Peak Capacity payment, so it is less critical to mitigate volatility in the Flexible RCP, and no deadband is proposed.
Proposal 6 – Review of RCP curve parameters Include review of the RCP curves in the Coordinator's regular review of the BRCP reference technology.	The RCP curves must be considered in light of the BRCP arrangements, including whether the BRCP is set using gross CONE or net CONE.
Proposal 7 – Transitional pricing arrangements **7.1** Adjust existing transitional pricing arrangements to include a lookback adjustment for actual inflation. **7.2** There will be no new transitional arrangements for existing facilities not already subject to transitional pricing arrangements.	Some existing facilities operate under transitional pricing arrangements. These facilities have a cap and floor applied to their RCP. The transitional cap and floor are inflation adjusted each year, using forecasts made by the Reserve Bank of Australia. Forecasts must be used due to the timing of the price calculation, but there is no mechanism to reflect actual inflation, even when it differs

Proposal	Rationale
	significantly from the forecast, as it has in recent years. There is no need for transitional arrangements for facilities commissioned since 2019.
Ten-year Reserve Capacity Price guarantee for new technologies	
Proposal 8 – Eligibility for RCP guarantee **8.1** Allow any new facility that provides Flexible Capacity using a renewable fuel source to receive (on request) a fixed RCP for ten years. **8.2** Require renewable-fuelled facilities seeking the ten-year fixed RCP to provide in each Reserve Capacity Cycle evidence of 100% renewable fuel supply.	The desired outcome is to provide longer price certainty for these facilities, additional incentive for investment in these technologies, and allow more variable renewable generation to connect without compromising reliability. A period of fixed pricing provides investors with certainty of capacity revenue for a longer period than under the existing WEM Rules. Requiring a facility to be of a technology type not already present in the SWIS would be inconsistent with the goal of facilitating increased renewable build. Similarly, allowing new fossil-fuel-fired facilities would be inconsistent with the desired outcome of decarbonising the SWIS.
Proposal 9 – Duration requirement Require a facility requesting the ten-year fixed RCP to provide evidence that it can provide firm output for at least 120% of the prevailing ESR Duration Requirement.	Currently, ESR facilities are assigned Capacity Credits based on their ability to deliver firm output for a four-hour period. An ESR facility that can provide firm capacity over longer duration will support the replacement of fossil-fuel-fired generation by renewables. Facilities that only exceed the prevailing requirement by a very short time do not provide significant additional flexibility. EPWA considers that a 20% buffer is a reasonable representation of a duration that exceeds the standard requirement.
Proposal 10 - Implementation The WICRWG proposed longer duration ESR facilities requesting a ten-year fixed RCP together with proposed floating price facilities for Network Access Quantities (NAQ) purposes.	In the current RCM, Facilities can request a 5-year fixed RCP, but only receive NAQ (and hence Capacity Credits) if there would otherwise be a capacity shortfall. Treating longer-duration firming facilities seeking a 10-year fixed RCP in the same way as inflexible floating RCP facilities would defeat the purpose of the policy.

1. Introduction

1.1 Background

1.1.1 Context

Electricity markets around the world are undergoing a major transition in the move to net zero emissions energy sectors. The South West Interconnected System (SWIS) continues to experience a significant uptake of distributed photovoltaic (PV) and large scale wind generation, as well as firming technologies such as Electric Storage Resources (ESR).

As indicated in the SWIS Demand Assessment that was released by the Minister for Energy (Minister) on 9 May 2023,[1] a number of factors are likely to influence demand growth in the SWIS in the coming decade, including the electrification of major industrial processes.

The electricity supply mix in the SWIS is rapidly changing with:

- the planned exit of baseload coal generators, followed by the expected progressive exit of the rest of the fossil-fuelled fleet;
- the current and continued entry of renewable intermittent generation (wind and solar); and
- the uptake of ESR.

Significant network, renewable generation and ESR investment will be required in the SWIS over the next decade and beyond to continue to deliver on the energy trilemma of reliable, affordable and environmentally responsible electricity supply.

The Coordinator of Energy (Coordinator) has carried out a number of electricity market reviews since the start of 2022 to address issues associated with this transformation, including:

- the Reserve Capacity Mechanism (RCM) Review[2];
- the Cost Allocation Review[3];
- the Market Power Mitigation Strategy review[4];
- the Supplementary Reserve Capacity (SRC) Review[5];
- the Demand Side Response (DSR) Review[6]; and

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1 https://www.wa.gov.au/system/files/2023-05/swisda_report.pdf

2 Information on the RCM Review is available at Reserve Capacity Mechanism Review (www.wa.gov.au).

The MAC established an RCM Review Working Group (RCMRWG) to assist with this review. Information on the CARWG is available at Reserve Capacity Mechanism Review Working Group (www.wa.gov.au).

3 Information on the Cost Allocation Review is available at Cost Allocation Review (www.wa.gov.au).The MAC established a Cost Allocation Review Working Group (CARWG) to assist with this review. Information on the CARWG is available at Cost Allocation Review Working Group (www.wa.gov.au).

4 Information on the Market Power Mitigation Strategy is available at Market Power Mitigation Strategy (www.wa.gov.au).

5 Information on the SRC Review is available at Supplementary Reserve Capacity Review (www.wa.gov.au).

- The Review of the Benchmark Reserve Capacity Price (BRCP) Reference Technologies.[7]

These reviews address a number of issues associated with the transformation of the SWIS, but have also highlighted the need for further Wholesale Electricity Market (WEM) reforms to enhance the incentives for investment in new low emissions facilities and to help the energy industry achieve its decarbonisation targets, while maintaining system security and reliability and without unduly increasing costs to consumers.

1.1.2 The Need for Review

The WEM must be able to deliver price signals that drive efficient investment in low emissions capacity. Providing better certainty for investors in new flexible energy technologies will help the decarbonisation of the sector while maintaining reliability in the SWIS.

This will require the WEM to evolve and to provide sufficient and sustainable incentives that drive timely investment in renewable generation and low emissions firming capacity. These incentives are required to ensure that sufficient revenue will be available to make these investments viable.

Addressing this will incentivise investment in new renewable generation and firming capacity at the required scale and in the required timeframe to meet the energy industry decarbonisation targets.

As a result, EPWA is considering a package of specific WEM reform initiatives aimed at enhancing investment certainty for renewable generation and low emissions firming capacity proponents. These initiatives were announced by the Minister on 9 May 2023. Better certainty for investors in new flexible energy technologies will help meet the decarbonisation targets while maintaining reliability in the SWIS.

1.1.3 Scope of the Review

The Coordinator is conducting the WEM Investment Certainty (WIC) Review, in consultation with the Market Advisory Committee (MAC), under clause 2.2D.1 of the WEM Rules.

The WIC Review aims to ensure that the WEM will provide incentives for sufficient new renewable generation and firming capacity, while maintaining system security and reliability and without unduly increasing the cost to consumers. The WIC Review will address the need for enhanced investment incentives that was recognised in the RCM Review.

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6 Information on the DSR Review is available at Demand Side Response Review (www.wa.gov.au). The MAC established a Demand Side Response Review Working Group (DSRRWG) to assist with this review. Information on the DSRRWG is available at Demand Side Response Review Working Group (www.wa.gov.au).

7 See section 9 of the *Reserve Capacity Mechanism Review Information Paper (Stage 1)* and *Consultation Paper (Stage 2*), which is available at epwa_reserve_capacity_mechanism_review_information_and_consultation_paper.pdf (www.wa.gov.au). The economic modelling under the RCM Review was deliberately conservative on the participation of renewables in non-energy services, so the revenue adequacy for renewables would likely improve with more realistic assumptions.

The review[8] is considering five specific reforms that were announced by the Minister on 9 May 2023:

1. reviewing the Reserve Capacity Price (RCP) curve to determine if it needs to be adjusted to send sharper signals for investment when demand for new capacity is stronger;
2. a 10-year RCP guarantee for new technologies, such as long-duration storage;
3. a wholesale energy price guarantee for renewable generators, to top up their energy revenues as WEM prices start to decline, in return for them firming up their capacity;
4. emission thresholds for existing and new high emission technologies in the WEM; and
5. a 10-year exemption from the emission thresholds for existing flexible gas plants that qualify to provide the new flexibility service.

The MAC has constituted the WIC Review Working Group (WICRWG) to support the WIC Review's work. More information on the WIC Review is available from the EPWA website,[9] including the Scope of Works for the review, the Terms of Reference for the WICRWG, meeting papers for WICRWG and MAC meetings, and detailed minutes for each meeting.

1.2 Purpose and Structure of this Paper

This Consultation Paper sets out the findings and recommendations for two of the five WIC Review initiatives. It presents proposals to:

- reform the RCP curve to send sharper signals for investment when demand for new capacity is stronger and introduce a price curve for the new Flexible Capacity Product; and
- provide a ten-year RCP guarantee for new technologies.

Finalising and implementing these recommendations is urgent, to enable the Australian Energy Market Operator (AEMO) to commence the implementation of the WEM Amending Rules introducing the new Flexible Capacity product. These WEM Amending Rules were made by the Minister for Energy in early December as part of the package of WEM Amending Rules implementing the outcomes of the Reserve Capacity Mechanism Review, which was completed by the Coordinator in 2023.

This Consultation Paper is structured as follows:

- chapter 1 covers the improvements to the RCP Curves; and
- chapter 2 covers the price guarantee for new technologies.

8 Wholesale Electricity Market Investment Certainty Review (www.wa.gov.au).

9 https://www.wa.gov.au/government/document-collections/wholesale-electricity-market-investment-certainty-wic-review-working-group

2. The Reserve Capacity Price Curve

The RCP curve, together with the BRCP and the RCT, determines the RCP paid to Market Participants for each MW of capacity.

Ideally, the RCP should provide:

- a price signal for investment when there is insufficient capacity;
- appropriate allocation of risk for capacity suppliers and the consumers who pay for it; and
- signal for capacity withdrawal or retirement when there is significant surplus capacity.

During the RCM Review, stakeholders identified issues with the existing RCP curve, and the WIC Review included an initiative to review the RCP curve to determine if it needs to be steeper if capacity is short but flatter if capacity is oversupplied. These adjustments are intended to provide stronger incentives for investment in capacity by increasing the RCP faster when AEMO projects a capacity “shortfall".

2.1 The Current Reserve Capacity Price Curve

The current approach to setting the RCP curve has applied since the 2019 Reserve Capacity Cycle and was established in the WEM Rules when there was significant excess of reserve capacity in the WEM.

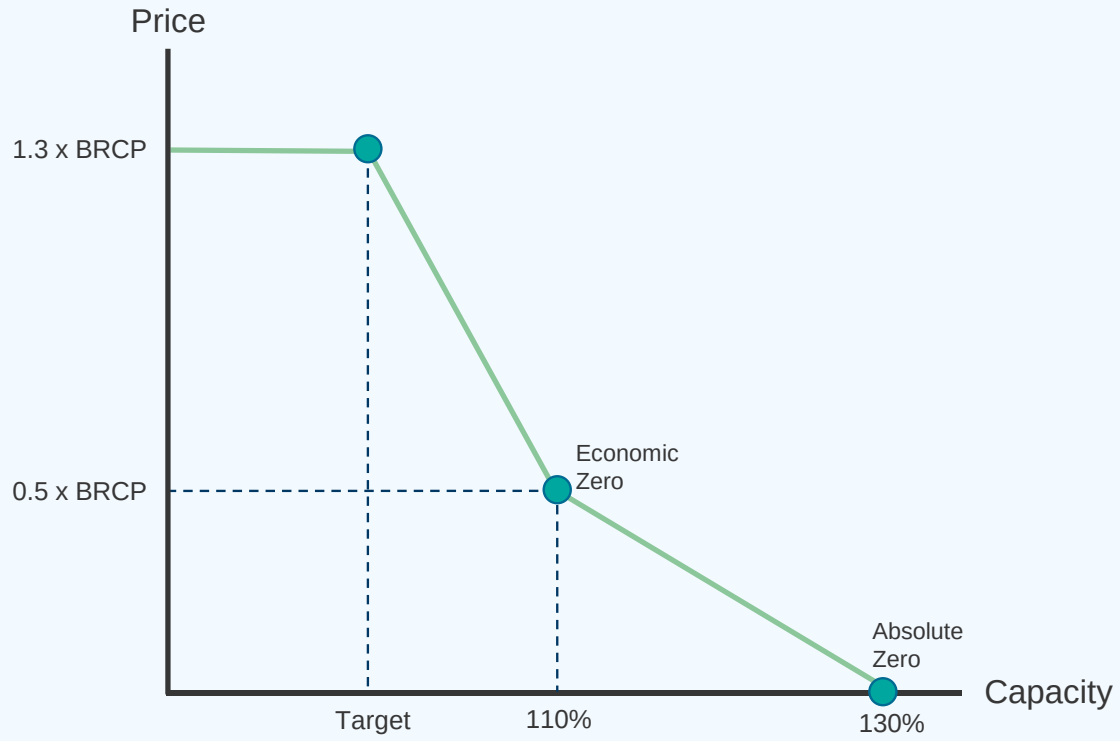
Before 2019, the RCP curve was set based on a calculation that effectively divided a fixed amount of capacity payments among all eligible capacity. This approach provided only muted investment signals, either in favour of investment in times of shortfall or against it when there was significant excess capacity.

A 2018 review of the RCP curve by the then Public Utilities Office decided to continue the administered pricing approach with an amended RCP curve, rather than replacing it with a capacity auction or a reliability obligation.

The current RCP curve is defined using three points:

- *the price cap*. At the RCT or below, the capacity price will be 1.3 times the BRCP;
- *the economic zero point*. A “level of capacity surplus and price at which no additional resources will enter the system under a very wide variety of market conditions”. This is set at 50% of the BRCP and a 10% surplus above the RCT; and
- *the absolute zero point*. The “point where the amount of excess capacity is deemed to be sufficiently high for the capacity price to be zero”. This is set at a 30% surplus above the RCT.

Existing RCP curve



Price Curve: based on lines joining the following price points:

Price cap equal to 1.3 times BRCP at the RCT

Absolute Zero point at 30% excess capacity

Economic Zero point at Price of 50% of BRCP and Capacity of 10% excess capacity.

Formula is given as: $Max(Segment\ 1,\ Segment\ 2,0) * BRCP$

$Segment\ 1 = \left(\frac{EZ\ BRCP\ Factor - BRCP\ Cap\ Factor}{EZ} \times Excess\ Capacity + BRCP\ Cap\ Factor\right)$

$Segment\ 2 = \left(\frac{EZ\ BRCP\ Factor}{EZ - AZ}\right) \times (Excess\ Capacity - AZ)$

Reference Price: CONE

Price at Capacity Target: Price Cap

Maximum Price: $1.3 \times \mathrm{BRCP}$ at zero excess capacity

Minimum Price: 0 at 30% of excess capacity.

The RCM Review:

1. identified that the Absolute Zero Point used is relatively high compared to other jurisdictions;
2. noted that, because the price is set at the RCP cap at the RCT, the investment signal does not change when there is a shortfall; and
3. proposed to use the same parameters to set the RCP curves for both Peak and Flexible Capacity

The Benchmark Capacity Providers (BRCP Reference Technology) Review[10] identified that, if there is no difference between the reference technology for Peak Capacity and Flexible Capacity, then a Peak Capacity shortfall will mean a zero price uplift for Flexible Capacity, even if there is also a shortfall of Flexible Capacity.

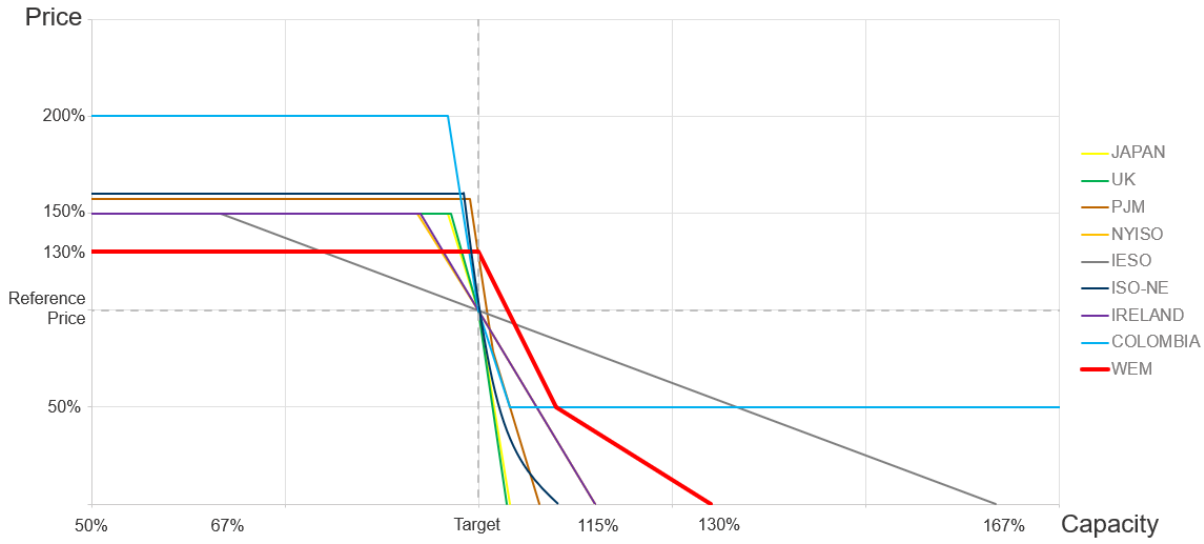
2.2 International scan

EPWA has revisited the analysis of international RCP curves conducted during the RCM Review. Some of the jurisdictions covered in that review do not have a RCP curve, as they do not use central procurement, so these were supplemented with additional jurisdictions which do.

The jurisdictions with capacity mechanisms considered were: Colombia, Ireland, ISO-NE, Japan, NYISO, Ontario, PJM, and UK. Figure 1 presents the RCP curves, and a fuller description for the arrangements in each jurisdiction is included in Appendix A.

While these RCP curves are used in capacity auctions, they provide the same function as in the WEM, defining the maximum and minimum prices paid for capacity, and their relation to the RCT.

Figure 1: International Reserve Capacity Price curves



The international comparison highlights several points:

- most of the other jurisdictions use net CONE, while the WEM uses gross CONE;
- the WEM RCP (1.3 x the benchmark price) is lower as a percentage of the reference price than in other jurisdictions, which range between 1.5x and 1.6x the benchmark price, except Colombia at 2x;
- all other markets except PJM set the capacity price at the reference price when capacity procured exactly equals the target, while the WEM sets the RCP at the cap at the RCT;

[10] Further information on the Coordinator's review of the Benchmark Capacity Providers for setting the BRCP is available here and the Coordinator's Determination of the Benchmark Capacity Providers is available here

- the WEM has a four-part curve. Most other markets have a three-part curve, with a straight line from the cap to the floor;
- Colombia and ISO-NE have convex curves (like the WEM) that send a sharper signal when in shortage than when in surplus; and
- Ontario has a higher Absolute Zero Point than the WEM, and Colombia has no Absolute Zero Point, rather a price floor at 50% of the benchmark price.

2.3 Proposed Reserve Capacity Price curve

The RCM will continue to use an administered RCP curve to set the RCP in each Reserve Capacity Cycle.

EPWA explored a variety of options with the WICRWG, including:

- adjustments to the existing four segment curve;
- addition of a deadband around the RCT point;
- a smooth curve with no Absolute Zero Point, like the pre-2019 curve.
- This section discusses the parameters and inflection points that make up the proposed curve:
- the price at the RCT;
- a “deadband” zone around the RCT in which the RCP does not change;
- the RCP cap as a proportion of the benchmark price, and the proportion of the RCT at which the RCP cap is reached;
- the RCP floor (which may be zero), and the proportion of the RCT at which the price falls to the floor; and
- differences between the Peak RCP curve and the Flexible RCP curve.

2.3.1 Peak Reserve Capacity Price at Target

In the current RCP curve, the price is set at 130% of the BRCP at the RCT. This means that there is no additional investment signal in times of shortfall, as the price is already at the RCP cap.

Other jurisdictions studied match the RCT with the benchmark price, as did the pre-2019 RCP curve. This aligns with the nature of the two parameters:

- the RCT is the level of capacity required to meet the Planning Criterion. It includes allowance for ESS requirements and contingencies.
- the BRCP represents the capital and fixed cost of the marginal new entrant capacity provider, enabling that provider to break even (including a return on investment) even if it receives no profit in the energy and ESS markets.
- WICRWG members representing generators expressed concern that reducing the RCP at the RCT would weaken the signal for new capacity at a time when new capacity is needed.
- EPWA notes that the various price parameters all need to work together. The review of the Benchmark Capacity Providers has determined that:
- the reference technology will change from a diesel-fired OCGT to a 4-hour lithium ion battery ESR;

- for a number of years ESR facilities are likely to receive infra-marginal rents in the energy market; and
- it is still appropriate to use gross CONE to set the BRCP.

This dynamic means that the marginal new entrant technology is likely to receive more revenue from the energy and ESS markets than is required to cover its variable costs, and the WEM can reasonably align with almost all other jurisdictions and set the RCP to equal BRCP when the RCT is exactly met.

WICRWG members representing consumers were concerned that projected significant increases in RCP's would result in large increases in cost for supply of electricity to end users. EPWA considers that increases in the RCP reflect changes in the expected capacity providers, and that costs to consumers would be even higher if emergency capacity procurement mechanisms such as Supplementary Reserve Capacity and Non- Cooptimised Essential Systems Services were used continually due to a lack of participation in the main capacity mechanism, the RCM.

Proposal 1:

Set the Peak RCP to 100% of the Peak BRCP if the number of Peak Capacity Credits issued equals the Peak RCT.

Consultation Questions:

(1) Do stakeholders support setting the price to the BRCP at the RCT? If you have any concerns, please outline your reasons.

2.3.2 Deadband

Some WICRWG members were concerned that the relatively small size of the SWIS means that a few tens of MW can make a material difference to the RCP, meaning that the RCP can be changed significantly by a single retirement or the addition of a single new build. For example, if the largest generator on the SWIS were to retire, the capacity margin would change by around 5% compared to it not retiring.

If the available capacity is:

- at the RCT, the RCP will be 130% of the BRCP;
- 105% of the RCT, the RCP will be 90% of the BRCP; and
- 110% of the RCT, the RCP will be 50% of the BRCP.

WICRWG members also noted that there are other factors that affect the RCP. For example, the RCT for the 2025-26 Capacity Year is 20% higher than for the 2024-25 Capacity Year. This means that there can be significant change in the RCP from year to year.

Both the WICRWG and the MAC generally supported having a flat priced region (a deadband) around the RCT to reduce year-to-year volatility, and assist investment certainty.

WICRWG members considered that if there were to be a deadband, it should be symmetrical both above and below the RCT, to balance the costs to consumers with the interests of investors.

The deadband needs to be sufficiently large to cope with volatility in the RCT. With a RCT around 5,000 MW, a deadband of around 500 MW would mean that a single build or retirement decision alone would not move the price, at least when the available capacity was near to the RCT.

Proposal 2:

Set the Peak RCP to 100% of the Peak BRCP when the number of Peak Capacity Credits provided is between 95% and 105% of the Peak RCT.

Consultation Questions:

(2)(a) Do stakeholders support including a deadband in the Peak RCP curve?

(2)(b) Do stakeholders support the proposed settings for the deadband?

2.3.3 Peak Reserve Capacity Price Cap

In the current RCP curve, the RCP cap is set at 130% of the BRCP. In the 2022 and 2023 Reserve Capacity Cycles, the RCP was above the BRCP, but no significant new facilities entered the RCM. The WICRWG considered that other factors, particularly network access issues, are likely to have contributed more to the lack of investment certainty in recent years.

However, while most other jurisdictions use net CONE to set their reference price, all but Colombia have a price cap between 150% and 160% of the reference price.

EPWA considers that it is appropriate to provide a sharper signal for investment when there is a capacity shortage, and proposes to adjust the RCP cap to the low end of the international range.

Almost all international jurisdictions reviewed have their RCP cap at between 92% and 98% of the RCT. With a WEM deadband starting at 95% of the RCT, the RCP cap needs to apply at a lower percentage of the RCT to avoid an extremely steep slope, and the potential volatility that entails, while still signalling an increased need for new capacity.

Setting the RCP cap to apply at 85% of the RCT would mean the same slope as the portion between 105% and 115% of RCT (see section 2.3.4). With the current RCT, the Peak Capacity RCP would change from 100% of BRCP to 150% of BRCP over a capacity reduction of around 500 MW.

Proposal 3:

Set a maximum Peak RCP at 150% of the Peak BRCP, when the number of Peak Capacity Credits issued is 85% of the Peak RCT.

Consultation Questions:

(3) Do stakeholders have any concerns about the proposed parameters for the Peak RCP cap?

2.3.4 Reserve Capacity Price Floor

In the current RCP curve, the price will be zero at 130% of the RCT. This means that if there is a capacity surplus of 30% above the RCT, the RCP will be zero.

Almost all international comparators have an Absolute Zero Point between 105 and 115%. Ontario's Absolute Zero Point is 167% of the RCT and Colombia has a price floor at 50% of the reference price rather than an Absolute Zero Point.

Some WICRWG and MAC members were concerned that having a RCP floor of zero meant less certainty for investors. Members considered that some investors look at the worst-case scenario (e.g. zero capacity payments) when choosing whether to invest. While the option to apply for a five-year fixed RCP does provide some certainty, no proponent has yet sought this option.

Some WICRWG members representing generators preferred the pre-2019 approach under which the RCP fell away much more gradually (noting that this reduces the signal for retirement during oversupply).

Some WICRWG and MAC members suggested a RCP floor based on debt-servicing costs – that is, payments of interest and principal for the portion of capital costs funded by debt. This value would change depending on the level of gearing, prevailing interest rates, and the expected term of the loan all of which are considered in the ERA's WEM Procedure: Benchmark Reserve Capacity Price. With the currently projected BRCP, this would translate to a RCP floor of:

- around 30% of the BRCP to cover both interest and principal payments; and
- around 10% of the BRCP to cover interest payments only.

The RCP floor could be determined each year as an absolute value, like the BRCP, or set at a fixed proportion of the BRCP.

EPWA considers that:

- for a relatively small, isolated power system, it is appropriate that the WEM has a higher Absolute Zero Point than larger, interconnected markets;
- there is a case for a non-zero RCP floor, for example if proponents are unable to obtain a fixed RCP;
- it is important to have some protection for consumers in the case of oversupply;
- oversupply is unlikely to occur in the near future as new generation is likely to primarily be intermittent renewables and ESR. Under the Relevant Level Method, intermittent facilities will receive Capacity Credits to a relatively low proportion of nameplate capacity, especially where output is highly correlated with existing facilities; and
- changing the RCP floor each year may not provide the certainty investors are looking for.

EPWA proposes to set the RCP floor at a level of oversupply above the RCT that is reciprocal to the level of undersupply that sets the RCP cap. This is expected to balance the interests of consumers and investors where available capacity is less than 200% of the RCT.[11]

[11] With a peak capacity requirement of 5,000 MW, and a price floor of 50% of the BRCP, consumers would pay the same amount in capacity payments when AEMO issues 5,000 MW of Peak Capacity Credits or 10,000 MW of Peak Capacity Credits. Between 100% and 200% of the capacity requirement, consumers would pay less, and above 200% of the capacity requirement, consumers would pay more.

WICRWG members representing consumer groups expressed concern that a non-zero RCP floor could result in a lack of signals for exit in case of surplus, and ongoing payment by consumers for capacity that is not needed. EPWA considers that this risk is mitigated by including the RCP floor in the Coordinator's regular review of the Benchmark Capacity Providers and the RCP curves.

Proposal 4:

Set a minimum Peak RCP at 50% of the Peak BRCP, when the number of Peak Capacity Credits provided is greater than or equal to 115% of the Peak RCT.

Consultation Questions:

(4)(a) Do stakeholders support a non-zero RCP floor?

(4)(b) Do stakeholders consider that a non-zero RCP floor should be recalculated each year or set based on a fixed proportion of the BRCP?

(4)(c) Do stakeholders consider that a non-zero RCP floor should allow for principal repayments, interest payments, or be symmetrical with the RCP cap?

2.3.5 Flexible Capacity Reserve Capacity Price Curve

The Coordinator has determined the same Benchmark Capacity Provider for both Peak Capacity and Flexible Capacity. This means that the BRCP for each will be the same.

In the RCM Reform Rules (commencement date yet to be confirmed), providers of Flexible Capacity will be paid a supplement reflecting the value of Flexible Capacity over and above the value of Peak Capacity. However, if the new Flexible Capacity product has the same RCP curve parameters as the existing Peak Capacity product, and there is a shortage of Peak Capacity, there will be no price premium for Flexible Capacity, and thus no investment signal, even if there is also a shortfall of Flexible Capacity.

As shortfalls in Peak Capacity are currently projected for the SWIS, to strengthen the investment signal for Flexible Capacity in the short to medium term, EPWA proposes to allow any new facility that provides Flexible Capacity to receive (on request) a fixed RCP for ten years.

The two Peak and Flexible RCP curves need to be differentiated to allow potential for a shortage of Flexible Capacity to result in an investment signal, even when there is a shortage of Peak Capacity.

EPWA proposes to set a higher RCP cap for Flexible Capacity than Peak Capacity, at the high end of the range used in international capacity mechanisms.

The Flexible RCT is expected to be significantly smaller than the Peak RCT – in the order of 2,000 MW rather than above 5,000 MW for Peak Capacity. This means that a deadband would have to be at least 25% of the RCT to perform the same function as the deadband in the Peak Capacity RCP curve.

EPWA considers that it is less critical to mitigate volatility in the Flexible Capacity RCP because Flexible Capacity payments are additional to the Peak Capacity payment. Therefore, a deadband in the Flexible Capacity RCP curve is not necessary.

It is proposed to set the minimum Flexible RCP on the same basis as the Peak RCP, i.e. at a level of oversupply above the RCT that is reciprocal to the level of undersupply that sets the Flexible RCP cap.

Proposal 5:

5.1 Allow any new facility that provides Flexible Capacity to receive (on request) a fixed RCP for ten years

5.2 Set a maximum Flexible RCP at 160% of the Flexible BRCP, when the number of Flexible Capacity Credits issued is 85% of the Flexible RCT.

5.3 Set the Flexible RCP to 100% of the Flexible BRCP where the number of Flexible Capacity Credits issued is 100% of the Flexible RCT .

5.4 Set the minimum Flexible RCP on the same basis as the Peak RCP.

Consultation Questions:

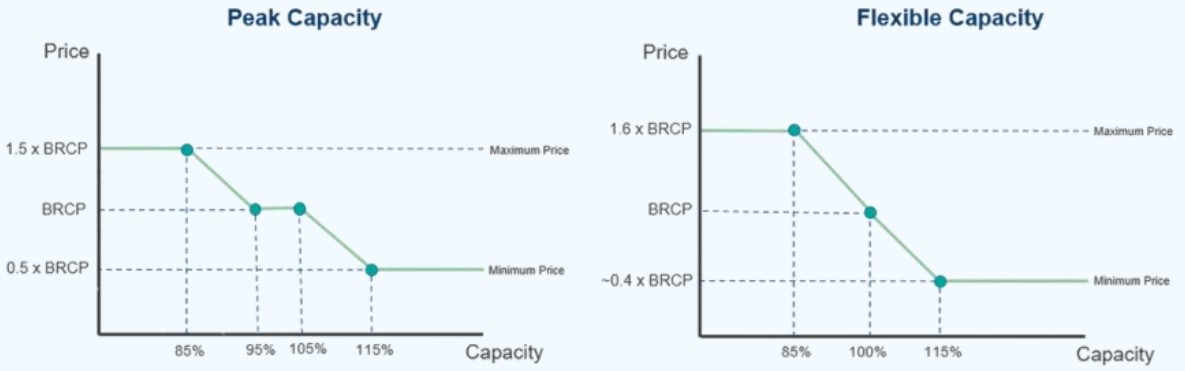
(5)(a) Do stakeholders support a higher RCP cap for Flexible Capacity than Peak Capacity?

(5)(b) Do stakeholders consider that the Flexible RCP curve should have a deadband?

(5)(c) Do stakeholders consider that Flexible Capacity should have a non-zero RCP floor?

Proposed Reserve Capacity Price Curves

(excluding existing transitional pricing arrangements)



Peak Capacity

Maximum Price: 1.5 × BRCP at 85% of Target Capacity

Price at Capacity Target: BRCP (CONE)

Deadband: BRCP at 95% - 105% of Target Capacity

Minimum Price: 0.5 × BRCP at 115% of Target Capacity

Flexible Capacity

Maximum Price: 1.6 × BRCP at 85% of Target Capacity

Price at Capacity Target: BRCP (CONE)

Deadband: None

Minimum Price: 0.4 × BRCP at 115% of Target Capacity

2.4 Impact of Reserve Capacity Price curve changes

The RCP has increased significantly in recent years, as shown in Table 2. This increase has been driven by an increase in underlying costs, a decreasing quantity of installed capacity, and in the most recent Reserve Capacity Cycle, a step-change in the RCT.

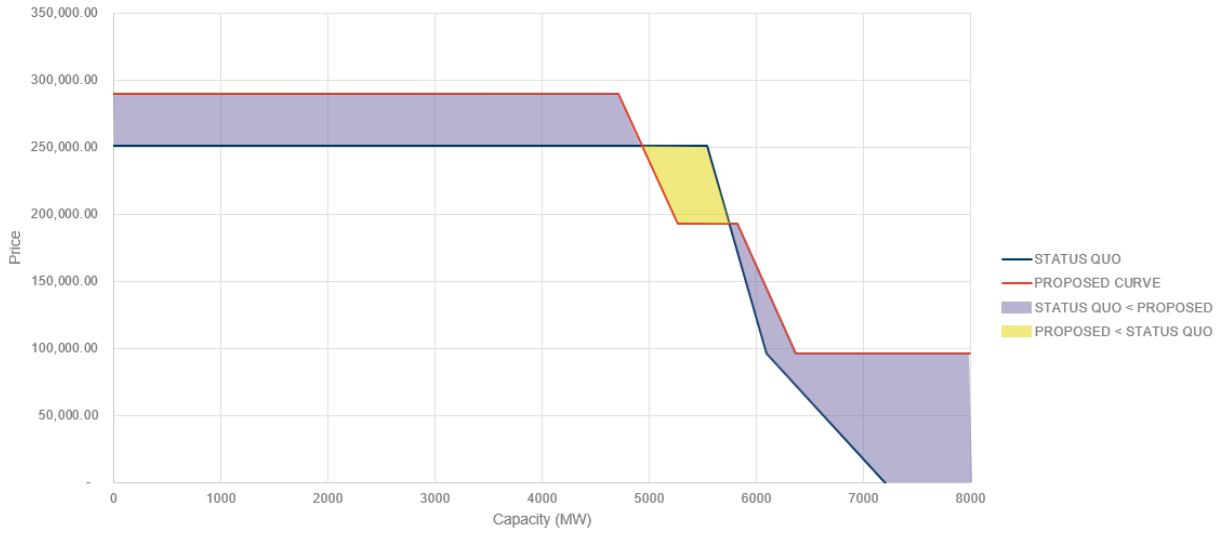
Table 2: Historical Reserve Capacity Prices

Capacity Year	Reserve Capacity Target (MW)	Capacity Credits Issued (MW)	Reserve Capacity Price ($/MW)
2021	4,482	4,925	78,573
2022	4,421	4,807	85,294
2023	4,396	4,727	105,949

Capacity Year	Reserve Capacity Target (MW)	Capacity Credits Issued (MW)	Reserve Capacity Price ($/MW)
2024	4,526	4,596	194,783
2025	5,543	4,717	251,420

The proposed changes to the RCP curve are likely to see a significant increase in the RCP in the short term. Changes compared to the current RCP curve are illustrated in Figure 2, with shaded areas representing relative ranges of higher or lower prices given the same BRCP and RCT.

Figure 2: Current and proposed Reserve Capacity Price curves



Other factors are also likely to see continuation of a high RCP including:

- announced retirement of existing coal plant affecting the capacity margin;
- a new benchmark technology used to set the BRCP (changing from OCGT to lithium battery storage);
- the continued use of gross CONE to set the BRCP;
- continuing demand growth rates;
- the step-change in reserve margin in the RCT; and
- lack of investment driven by uncertainty around the timing and design of National greenhouse gas emission initiatives.

Recent increases in the RCP have not yet driven significant new investment in the SWIS. The WICRWG considered that the RCP is only one factor in project developers' decision to invest. In recent years, development decisions have also been influenced by:

- access to the Western Power network and its interaction with the RCM certification mechanism;

- energy transition outcomes, including the New WEM Commencement Day on 1 October 2023 and the RCM Review outcomes; and
- Commonwealth energy transition policies, including the future of the RET, and the CIS.

As such, it is not clear that the proposed changes in the RCP curve would be sufficient – on their own – to drive the necessary investment in the SWIS. The changes must be considered in context of the wider investment landscape. Consumer representatives on the WICRWG expressed concern that increased RCP prices could see a rise in consumer bills over the medium term.

2.5 Adjustments and reviews

2.5.1 Review of Reserve Capacity Price curve parameters

As noted in section 22.3.1, the RCP curve must be considered in light of the BRCP arrangements, including whether it is set using gross CONE or net CONE.

In the current WEM Rules:

- Clause 2.26.3 requires the ERA to review the BRCP method every five years;
- Clause 2.26.3A extends this to the RCP curve parameters (including the cap, the Economic Zero Point and the Absolute Zero Point); and
- Clause 4.16.9 requires the ERA to review its BRCP WEM Procedure at least every five years.

The WEM Amending Rules implementing the outcomes of the RCM Review will consolidate the ERA's BRCP WEM Procedure Review activities into section 4.16 of the WEM Rules, including triggering an ERA review of the BRCP method if the benchmark technology changes.

EPWA proposes to add a review of the RCP curve to the Coordinator's regular review of the BRCP reference technology. As a result, the ERA review of the BRCP method would not include the RCP curve parameters.

Proposal 6:

Include a review of the RCP curves in the Coordinator's regular review of the BRCP reference technology.

Consultation Questions:

(6) Do stakeholders agree that the RCP curves should be considered in conjunction with the BRCP reference technology? If you have any concerns, please outline your reasons.

2.5.2 Transitional pricing arrangements

In the 2019 RCP reform, transitional pricing arrangements were implemented for existing facilities, which had operated under the previous pricing arrangements.

These facilities have a cap and floor applied to their RCP. The transitional cap and floor are inflation adjusted each year, using forecasts made by the Reserve Bank of Australia. Forecasts must be used due to the timing of the price calculation, and there is no mechanism to reflect actual inflation, even when it differs significantly from the forecast, as it has in recent years.

EPWA proposes to add a lookback adjustment in future RCP calculations to reflect differences between forecasts and actuals, as follows:

$$\text{Trans\_Ceiling} = \text{Trans\_Ceiling}_{[\text{previous}]} \times \max\left(1,\ (1 + \text{ForecastCPI} + \text{ActualCPI}_{[\text{previous}]} - \text{ForecastCPI}_{[\text{previous}]})\right)$$

The first year would adjust for the period since 2019, with subsequent years adjusting for the previous year only. Prices already published for previous Reserve Capacity Cycles would not be adjusted.

Facilities commissioned since 2019 have operated under a regime with a zero price floor. The proposed new RCP curve decreases the downside risk and increases the upside risk compared to the RCP curve at the time these facilities invested.

Consumer representatives on the working group raised the option of having a RCP cap for these facilities to avoid windfall gains. As shown in Figure 2, these facilities could receive higher or lower prices due to the new RCP curve, so EPWA considers there is no need for transitional arrangements for these facilities.

Proposal 7:

7.1 Adjust existing transitional pricing arrangements to include a lookback adjustment for actual inflation.

7.2 There will be no new transitional arrangements for existing facilities not already subject to transitional pricing arrangements.

Consultation Questions:

(7)(a) Do stakeholders agree that existing transitional pricing arrangements should consider actual outcomes in addition to forecasts?

(7)(b) Do stakeholders agree that new transitional pricing arrangements are not necessary?

3. Ten-year Reserve Capacity Price guarantee for new technologies

As announced by the Minister on 9 May 2023, initiative 2 of the WIC Review included developing a policy that provides a ten-year period of fixed reserve capacity pricing for "proponents of new flexible technologies, such as long-duration storage".

This would provide additional incentive for investment in these technologies, and allow more renewable generation to connect. A period of fixed pricing provides investors with certainty of capacity revenue for a longer period than under the existing WEM Rules.

The WIC Review considered:

- which "new" technologies should be eligible for a 10-year RCP guarantee; and
- what does "long duration" storage mean in the application of this initiative and should the definition of this change over time.

3.1 Eligibility

One interpretation of "new" is a type of technology that does not currently exist in the SWIS, such as pumped-storage hydro, compressed air energy storage, concentrated solar power, or supercritical coal. This reading would have the policy apply to the first instance of a particular technology receiving Capacity Credits.

Requiring a facility to be of a technology type not already present in the SWIS would be inconsistent with the goal of facilitating increased renewable build. Similarly, allowing new fossil-fuelled facilities would be inconsistent with the desired outcome of decarbonising the SWIS.

EPWA therefore proposes to allow any new facility that provides flexible firming services (as evidenced by holding Flexible Capacity Credits) using renewable energy sources (including wind and solar facilities holding Flexible Capacity Credits) to be eligible for a RCP fixed for ten years.

A facility capable of running on fossil fuels, but in fact only producing energy only from renewable sources (for example biogas, biodiesel, green hydrogen, or biomass) would be eligible. Applicants would need to provide evidence of eligibility when applying for capacity certification. At first application, this could be in the form of fuel supply contracts for future periods, while for subsequent applications, it could relate to fuel actually used.

Proposal 8:

8.1 Allow any new facility that provides Flexible Capacity using a renewable energy source to receive (on request) a fixed RCP for ten years.

8.2 Require facilities capable of running on fossil fuels and seeking the ten-year fixed price to provide in each Reserve Capacity Cycle evidence of 100% renewable fuel supply.

Consultation Questions:

(8) Do stakeholders support the proposed new fixed price option? If you have any concerns, please outline your reasons.

3.2 Duration requirement

Currently, ESR facilities are assigned Capacity Credits based on their ability to deliver firm output for a four-hour period. One outcome of the RCM Review is that this required duration of storage facilities will be extended over time, as a result of a growing Availability Duration Gap.

Given this Availability Duration Requirement, it was considered reasonable to allow the ten-year price guarantee for ESR facilities that can provide firm output over a period longer than the prevailing ESR Duration Requirement. An ESR facility that can provide firm capacity over longer duration will support the replacement of fossil-fuelled generation by renewables.

Facilities that only exceed the prevailing requirement by a few minutes do not provide significant additional flexibility. EPWA considers that a 20% buffer is a reasonable representation of a duration that exceeds the standard requirement. That would mean that if the prevailing ESR Duration Requirement is 4 hours, facilities with an output duration of 5 hours and above would be eligible for the ten-year fixed RCP.

Similarly, the assessment would be based on the design capability of a facility. For a storage facility, it would be determined as the maximum stored MWh that can be discharged to the grid, divided by nameplate injection capacity, regardless of whether the Market Participant chooses to seek certification of its facility at a level lower than its nameplate capacity.

Proposal 9:

Require a facility requesting the ten-year fixed RCP to provide evidence that it can provide firm output for at least 120% of the prevailing ESR Duration Requirement.

Consultation Questions:

(9)(a) Do stakeholders support the proposed duration requirement for the new fixed RCP option? If you have any concerns, please outline your reasons.

3.3 Implementation

In the current RCM, Facilities can request a 5-year fixed RCP. If successful, they fix the prevailing RCP as their Facility RCP for the current and subsequent four Reserve Capacity Cycles.

However, such a facility will only receive Network Access Quantities (NAQ) (and hence Capacity Credits) if there would be a capacity shortfall without the facility. That is, if existing and proposed Facilities prepared to receive the floating RCP (which can change from year to year) will meet the RCT, no new fixed price Facilities will be eligible for capacity payments.

Under this new ten-year guarantee, eligible proposed Facilities requesting a fixed price would be considered along with non-fixed price proposed facilities for NAQ purposes, and be eligible for NAQ if there were sufficient existing and committed facilities to meet the RCT.

If successful, the prevailing RCP for the current Reserve Capacity Cycle would be fixed as the Facility RCP for the current and subsequent nine Reserve Capacity Cycles.

Where a new facility has a longer development process than the standard Reserve Capacity Cycle, it would still have the opportunity to seek early certification.

Proposal 10:

WICRWG proposed longer duration ESR facilities requesting a ten-year fixed RCP together with proposed floating RCP facilities for NAQ purposes.

Consultation Questions:

(10) Do stakeholders support the proposed treatment of Facilities with the new fixed RCP option? If you have any concerns, please outline your reasons.

Appendix A. International Reserve Capacity Price curves

This appendix describes the RCP curves used in the UK, Ireland, Ontario, New York, PJM, ISO-NE, Colombia and Japan.

A.1 UK[12]

The Secretary of State sets the methodology for calculating the demand curve used for capacity auctions. There are two key parameters for this curve – the target capacity level and the net CONE. The target capacity is the estimated optimal level of capacity needed to meet the reliability standard, taking into account the capacity expected to be available outside the Capacity Market. Net CONE is calculated by taking the cost of a newly built combine cycle gas turbine (CCGT) plant less the contribution to profit from expected electricity market and ancillary market services revenue.

The UK's main capacity auctions are held four years ahead of the delivery year and the demand curve is published by the government four and a half years ahead. Another auction is done one year ahead of delivery year to enable the participation of Demand Side Response and to provide the opportunity to refine the level of capacity previously issued in capacity agreements. The demand curve for this auction is published one and a half years prior to the delivery year.

Price Curve: Consists of a horizontal line at price cap, and a negatively sloping line from minimum to maximum capacity. The slope crosses through the point where the Target Capacity meets Net CONE

Reference Price: Net CONE

Price at Capacity Target: Net CONE

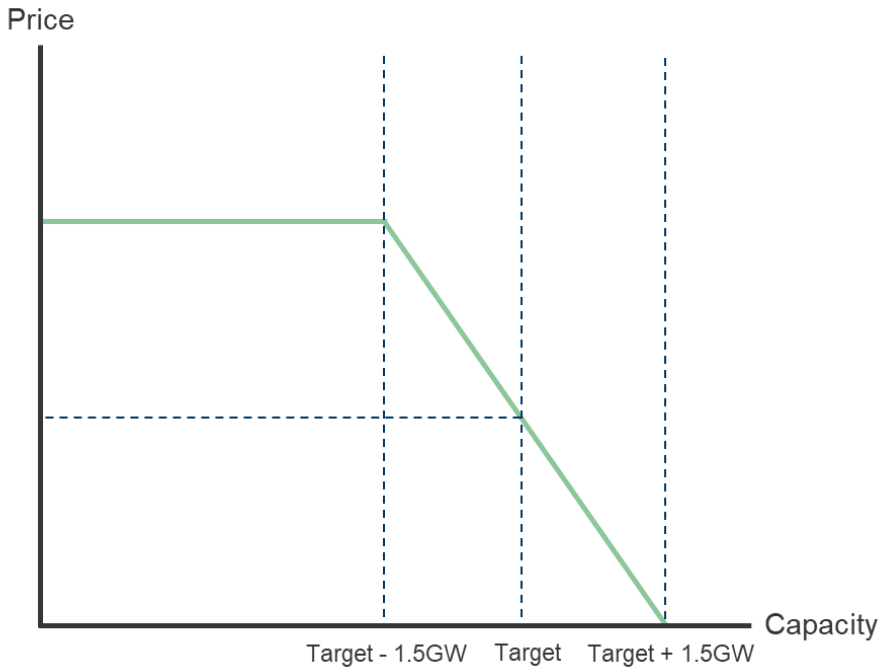
Maximum Price: $1.5 \times \text{Net CONE}$ from 0 to minimum capacity (Target Capacity less 1.5GW)

Minimum Price: 0 at maximum capacity (Target Capacity plus 1.5GW)[13]

[12] Implementing Electricity Market Reform (EMR) – Finalised policy positions for implementation of EMR; Capacity Market Parameters.

[13] 1.5GW is approximately 3.54% of UK's current Target Capacity. Thus, minimum capacity is 96.46% of Target Capacity while maximum capacity is about 103.54% of Target Capacity.

Figure 3: UK Reserve Capacity Demand Curve



A.2 Ireland

The parameters for capacity market auctions, including the demand curve methodology and values, are published by the Single Electricity Market (SEM) in the Initial Auction Information Pack. Participants can, then, submit their responses to these proposed parameters. All final parameters in the auction are set and approved by the Regulatory Authorities (Irish Commission for Regulation of Utilities and the Northern Ireland Authority for Utilities Regulator) consistent with the Capacity Market Code.

The Capacity Year 2026/27's Net CONE value was initially set to reflect the lowest cost CCGT in Ireland. After feedback from participants that that the estimate was too low to encourage investment, the SEM Committee revised the assumptions to set Net CONE based on an OCGT plant.[14]

The latest capacity auction (2027/28 T-4) follows the following parameters[15]:

Price Curve: Consists of a horizontal portion at Auction Price Cap from 0MW to 92.5% of adjusted Capacity Requirement, and a negatively sloping straight line to 115% of adjusted Capacity Requirement. The line should pass through the point where Target Capacity is priced at Net CONE.

Reference Point: Net CONE

Price at Capacity Target: Net CONE

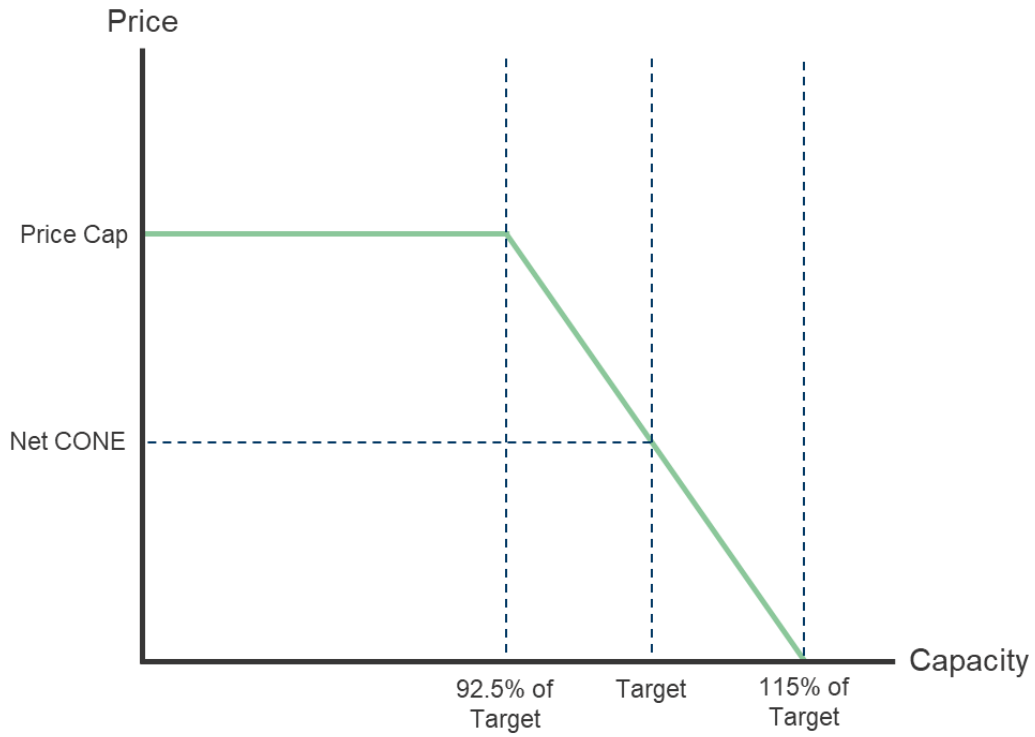
Maximum Price: $1.5 \times \text{Net CONE}$ from 0 to 92.5% of Target Capacity

Minimum Price: 0 at 115% of Target Capacity

[14] CRM Best New Entrant New Cost of New Entrant, 2026/27 Decision Paper

[15] CRM 2027/28 T-4 Capacity Auction Parameters Decision Paper

Figure 4: Ireland Reserve Capacity Demand Curve



A.3 Ontario Independent Electricity System Operator[16]

IESO has recently updated the Reference Price and the Maximum Auction Clearing Price (MACP) of their demand curve for the 2023 Capacity Auction. This was done to ensure that the demand curve reflects the current economic conditions while taking into account the need to procure sufficient capacity for Resource Adequacy needs, provide a stable and appropriate price signal, and drive competition and ratepayer value.

The previous demand curve was established in 2015. Its reference price was based on the 2019 Brattle calculation using Installed Capacity. The 2023 Reference Price enhancement was estimated to account for inflation and the transition to using unforced capacity rather than installed capacity.

The MACP of the previous curve was equal to 1.25 times the Reference Price. The new MACP is set at 1.5 times the Reference Price. The Maximum Auction Limit at the MACP was also changed from 80% of target capacity to 66.7%, while the maximum auction capacity limit decreased from 180% to 167.7% of Target Capacity.

Price Curve: Consists of a horizontal portion at maximum auction clearing price up to the minimum capacity, and a downward sloping straight line from the maximum auction clearing

[16] Capacity Auction Design Memo 7.1

price at minimum capacity to maximum capacity at minimum auction clearing price. The line passes through the point where Target Capacity is priced at Reference Price.

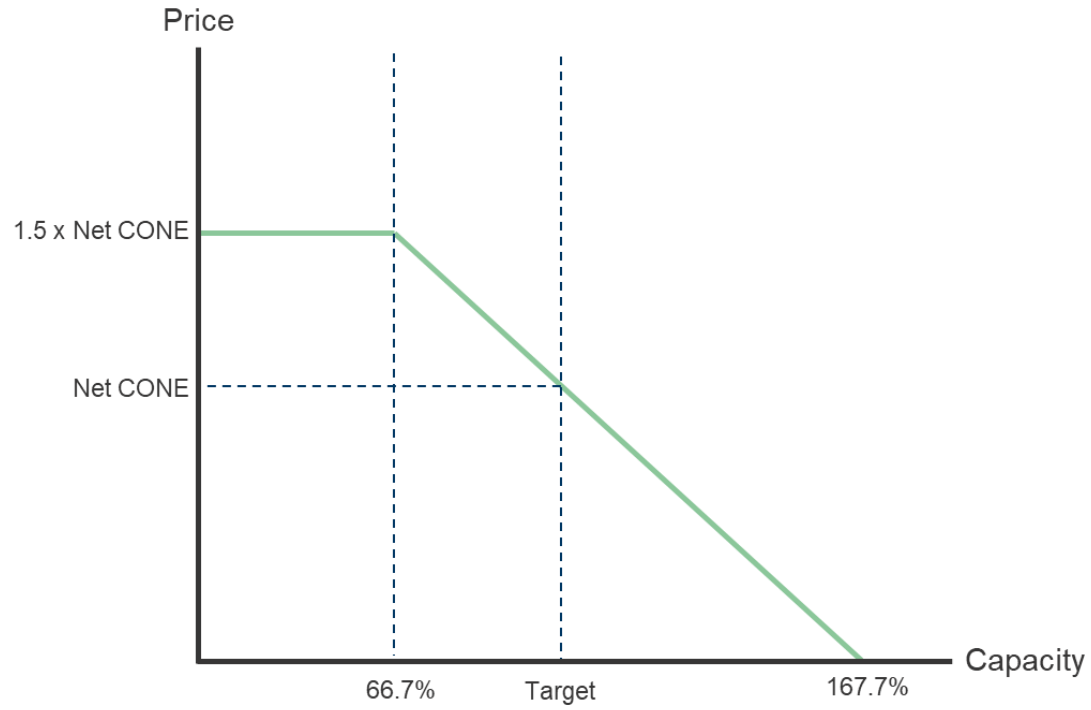
Reference Price: Net CONE

Price at Capacity Target: Net CONE

Maximum Price: $1.5 \times \text{Reference Price}$ from 0 to Minimum Capacity Limit (66.7% of Target Capacity)

Minimum Price: 0 at Maximum Capacity Limit (167.7% of Target Capacity)

Figure 5: IESO Reserve Capacity Demand Curve



A.4 New York ISO[17]

The NYISO accounts for location in establishing its Installed Capacity (ICAP) Demand Curves:

- Separate installed capacity demand curves are set to determine the unforced capacity obligation for each locality and the total unforced capacity obligations for all load serving entities in the New York Control Area.
- The New York State Reliability Council sets the capacity auction's installed reserve margin. This is used by the NYISO to determine the minimum installed capacity requirement (ICR) for the capacity auction and the locational minimum installed capacity requirement (LICR) based on the region or locality.

[17] Manual 4: Installed Capacity Manual

The reference price is based on the estimated cost for a peaking plant for the rest-of-state region or locality, called the annual reference value, less an estimate of energy and ancillary services annual net revenue.

Price Curve: ICAP Price curve consists of three segments:

1. Horizontal segment where price is 1.5 times estimated localized levelized cost to develop a new peaking plant or CONE
2. Negative sloped segment that passes through a point where minimum installed capacity requirement or locational minimum installed capacity requirement meets the reference price and on to the zero crossing point.
3. Horizontal segment for all quantities above the zero crossing point, at which the price is zero.

Reference Price: Gross CONE

Price at Capacity Target: Gross CONE

Maximum Price: $1.5 \times \text{Gross CONE}$

Minimum Price: 0 at Zero Crossing Point (112-118% of ICR/LCR depending on location)

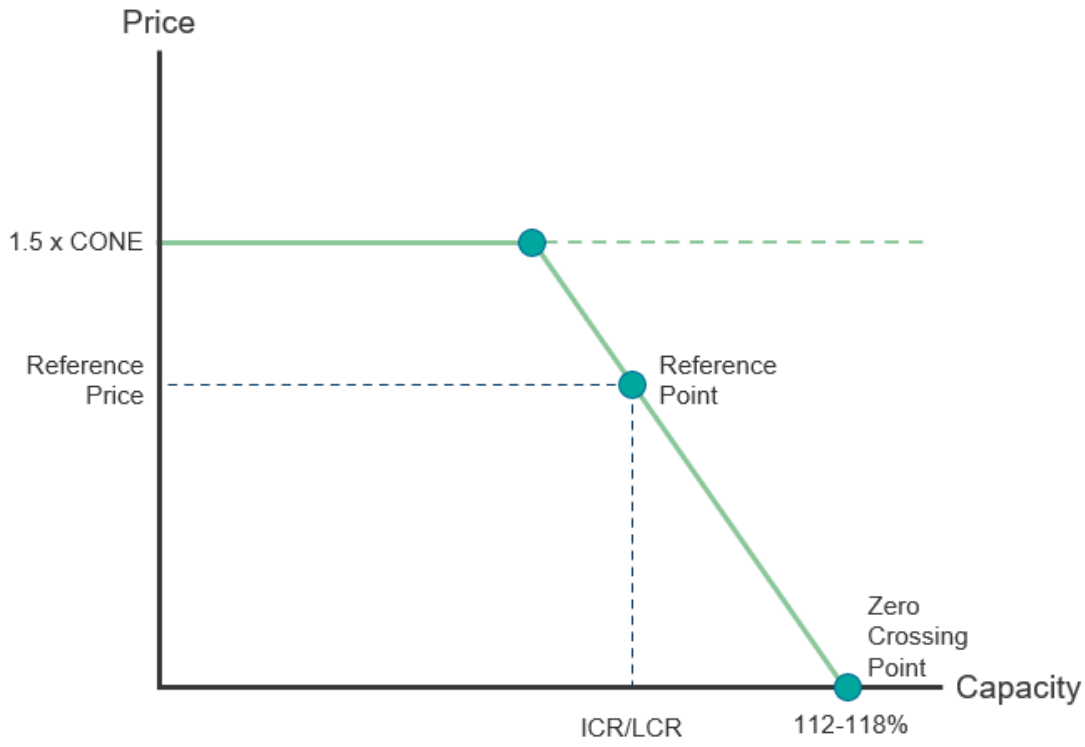


Figure 6: NYISO Reserve Capacity Demand Curve

A.5 PJM[18]

[18] PJM Manual 18: PJM Capacity Market

The PJM Capacity Market is a forward mechanism with a base residual auction (held three years prior to the beginning of the delivery year) and three incremental auctions. It is based on the reliability pricing model with the following key elements:

- Locational capacity pricing
- Variable resource requirement mechanism (VRR).
- Forward commitment of supply by generation, demand resources, energy efficiency resources, and qualified transmission upgrades
- Reliability backstop mechanism

The base residual auction demand curve is downward sloping and based on the VRR. The VRR is a family of price/quantity points that provide price to a corresponding level of resource procured relative to the installed reserve margin. A VRR curve is expected to reflect that additional capacity has value even above the target installed reserve margin.

One of the parameters of the VRR curve is the value of CONE. The reference resource for CONE from delivery year 2025/2026 to subsequent delivery years is a combined cycle generating station. The gross CONE is the average of the gross CONE for the four CONE areas.

Price Curve: The variable resource requirement curve is plotted by combining a horizontal line from y-axis to point (a) and using a straight line to connect points (a), (b), and (c). The points are computed as follows:

Point	Price	Quantity
a	$\frac{Greater\ of\ [CONE,\ 1.5 \times NetCONE]}{1 - PoolWide\ EFORd}$	$ReliabilityReq \frac{(100\% + IRM - 1.2\%)}{(100\% + IRM)}$
b	$\frac{(0.75 \times NetCONE)}{1 - PoolWide\ EFORd}$	$ReliabilityReq \frac{(100\% + IRM + 1.9\%)}{(100\% + IRM)}$
c	0	$ReliabilityReq \frac{(100\% + IRM + 7.8\%)}{(100\% + IRM)}$

- The Reliability Requirement $(\mathrm{ReliabilityReq})$ used in calculating the unforced capacity quantities excludes any adjustment for price responsive demand (PRD) and energy efficiency (EE) resources. The resulting curve will be adjusted leftward based on the PRD impact, and rightward based on the impact of EE.
- The Current IRM is 14.7%; and
- The Current EFORd is 4.81%.

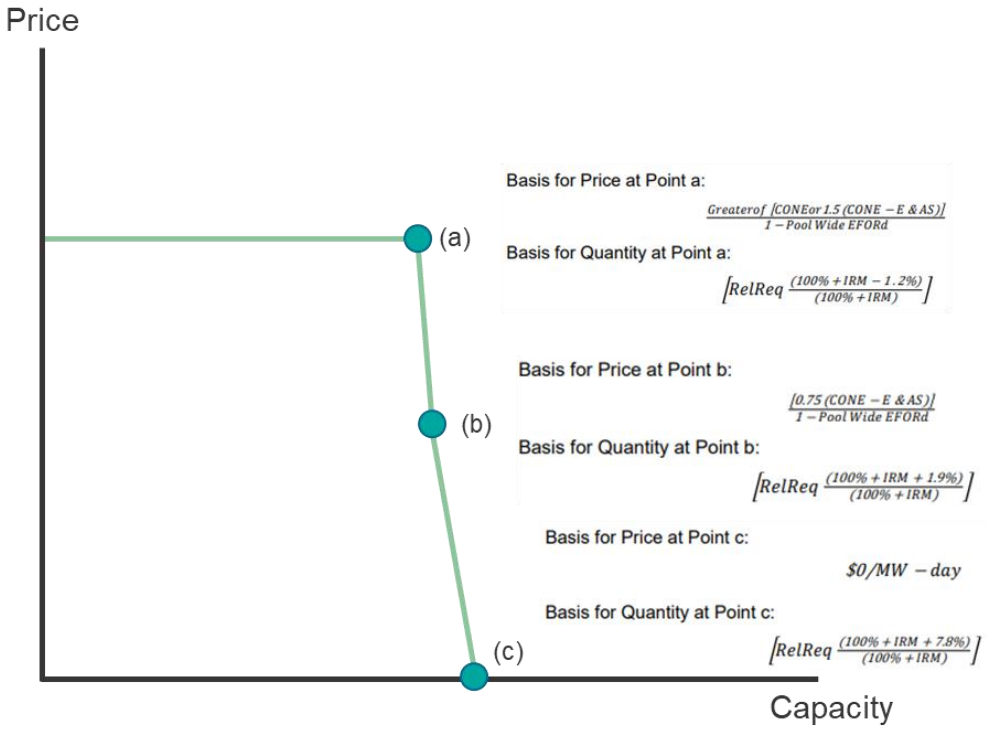
Reference Price: Net CONE

Price at Capacity Target: Net CONE

Maximum Price: $\frac{\mathrm{Greater\ of\ [CONE,\ 1.5 \times NetCONE]}}{\mathrm{1 - PoolWide\ EFORd}}$

Minimum Price: 0 at point (c)

Figure 7: PJM Reserve Capacity Demand Curve



A.6 ISO New England[19]

In 2016, ISO-NE amended its curve to better reflect the locational reliability impact of capacity. Each zone now has different prices proportional to the marginal reliability impact values at each capacity level. This design addressed price volatility and market power concerns raised by the regulator in relation to the previous vertical curves.

The System-Wide Capacity Demand Curve is based on the reliability impact of adding incremental capacity that is cost-efficient across all zones.

Price Curve: Marginal Reliability Impact as a function of capacity with a scaling factor that produces a price of Net CONE equal to the Net Installed Capacity Requirement (ICR) level.

Reference Point: Net CONE

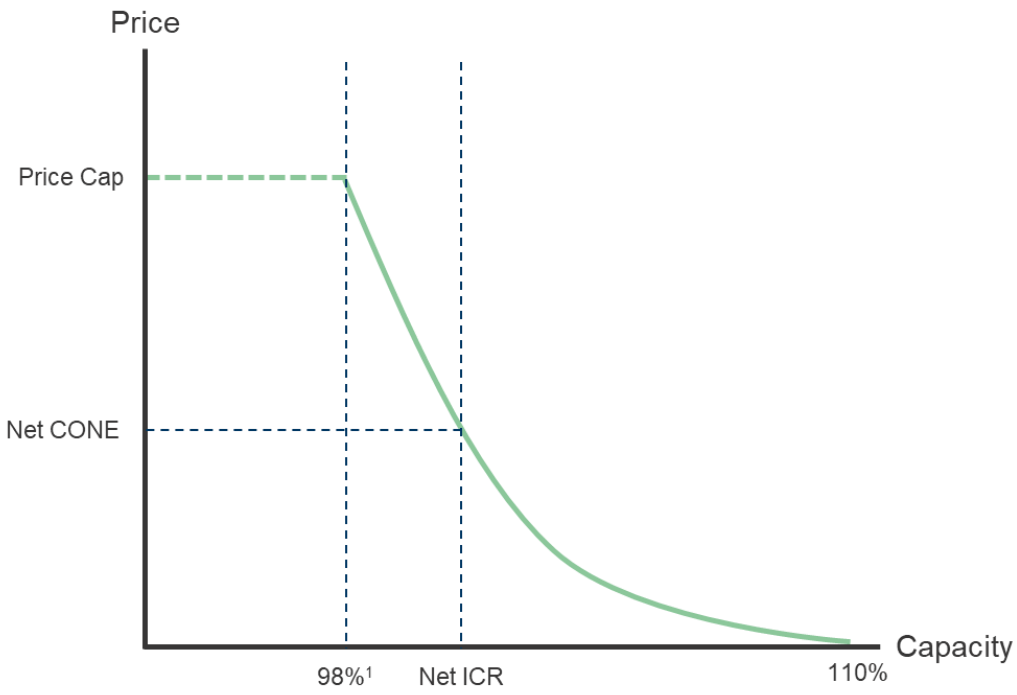
Price at Capacity Target: Net CONE

Maximum Price: $\mathrm{Max}[1.6 \times \mathrm{Net\ CONE}, \mathrm{CONE}]$ at 98% of ICR

Minimum Price: 0 at Capacity greater than 110% of ICR

Figure 8: ISO-NE Reserve Capacity Demand Curve

[19] Demand Curve Design Improvements



A.7 Colombia[20]

80% of Colombia's energy and about two-thirds of its capacity is from hydro generation. Thus, there is a need to ensure sufficient capacity to meet the demand, especially in dry periods. The firm energy auction is a forward market conducted three to four years prior to the commitment period.

The Colombian capacity market follows a descending clock auction where the price starts at the cap and generators offer as much capacity as they are prepared to supply at that price. If there is excess supply, the price will be reduced, and the participants can resubmit their offers. This continues until the supply quantity and the clearing price are determined.

Secondary Markets – reconfiguration auctions and monthly auctions – are sealed-bid clearing-price auctions. Reconfiguration auctions are held annually for buyers and sellers to balance their position for the coming commitment year. A monthly auction is also held during the commitment year to further balance positions.

Price Curve: At CONE, load purchases its firm energy target (100% of estimated firm energy demand). At higher prices, load purchases slightly less than the target quantity; at lower prices load purchases slightly more than the target quantity

Reference Point: CONE

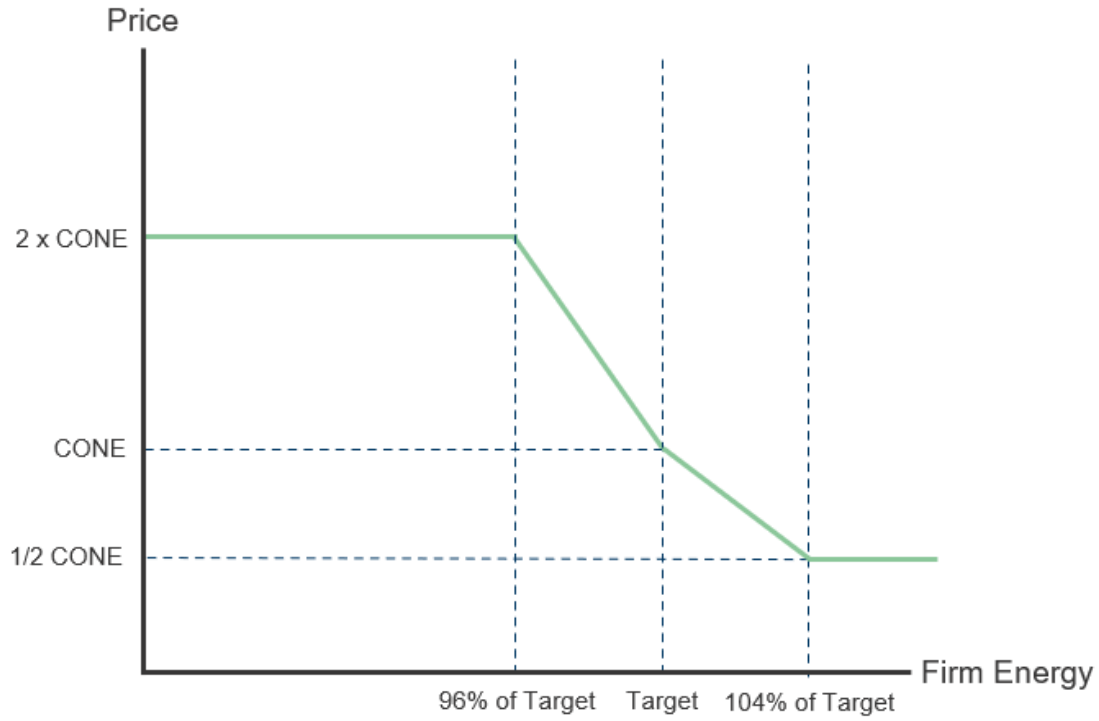
Price at Capacity Target: CONE

Maximum Price: $2 \times \mathrm{CONE}$ from 0 to 96% of Target Capacity

Minimum Price: ${}^{1}/_{2} \times \mathrm{CONE}$ at 104% of Target Capacity

[20] Colombia Firm Energy Market

Figure 9: Colombia Reserve Capacity Demand Curve



A.8 Japan[21]

The main auction is held 4 years prior to the delivery year. An additional 1-year ahead auction is also done to adjust the forecast demand and supply capacity decrease due to generator outage.

The demand curve is set to be "convex" where price rises steeply for capacity offers smaller than the target. The price at the target is valued by the CONE of combined cycle gas turbine thermal power plant selected based on economic efficiency.

The price when there is a capacity surplus is a linearization of a theoretical convex "trade-off curve" which plots the value of additional capacity compared to avoided outage costs.

Price Curve: A horizontal segment at the price cap from the y-axis to the maximum capacity at price upper limit. A negatively sloping line connecting maximum capacity at price upper limit to the target capacity. Another straight line from target capacity to capacity at zero-price linearizes the convex trade-off curve such that the area below (a) is equal to the area above (b).

Reference Point: Net CONE

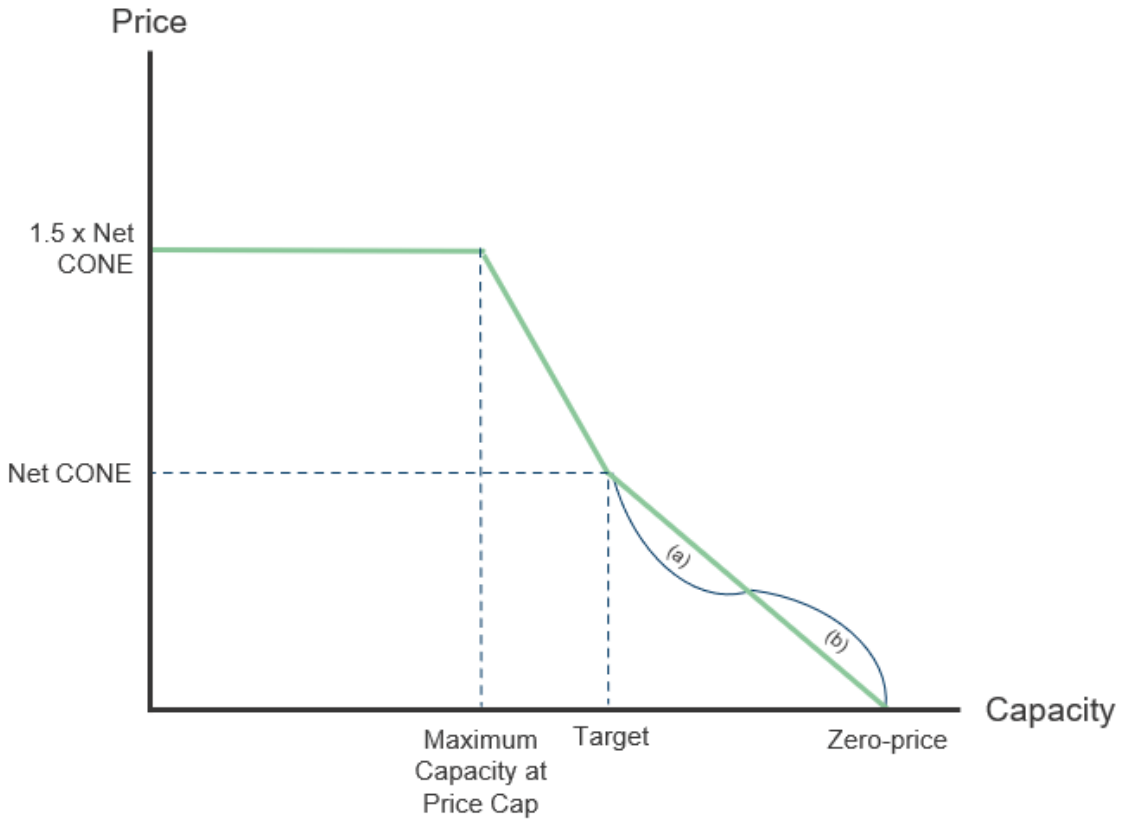
Price at Capacity Target: Net CONE

Maximum Price: $1.5 \times \text{Net CONE}$ from 0 to 96% of Target Capacity

Minimum Price: 0 at 104% of Target Capacity

[21] Toward Deregulated, Smart and Resilient Power Systems with Massive Integration of Renewable Energy in Japan

Figure 10: Japan Reserve Capacity Demand Curve



Appendix B. Example Reserve Capacity Price curves

This appendix shows how RCP curves and RCP's would have looked for recent years using actual input parameters. Figure 11, Figure 12 and Figure 13 show the curves, while Table 3, Table 4, Table 5 show the curve parameters and results.

Figure 11: Reserve Capacity Price curves for historical years (current rules)

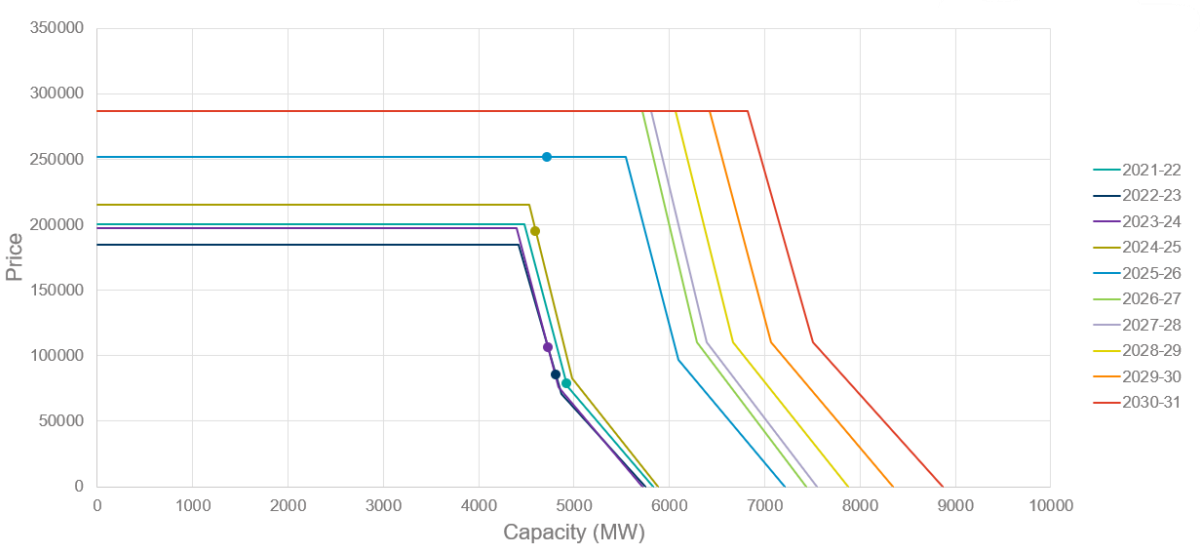


Figure 12: Peak Reserve Capacity Price curves for historical years (proposed rules)

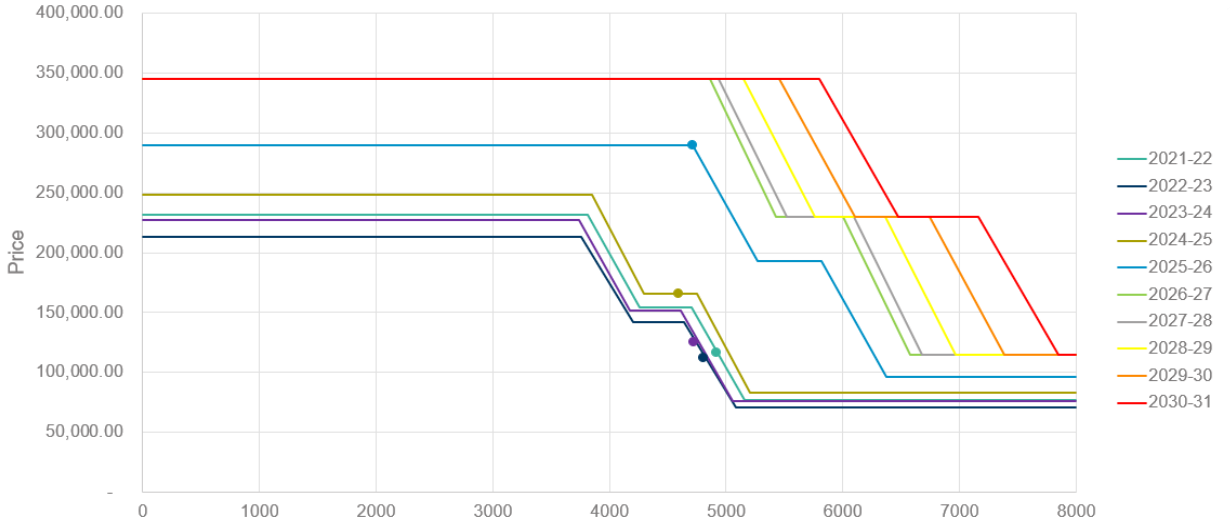


Figure 13: Flexible Reserve Capacity Price curves for historical years (proposed rules)

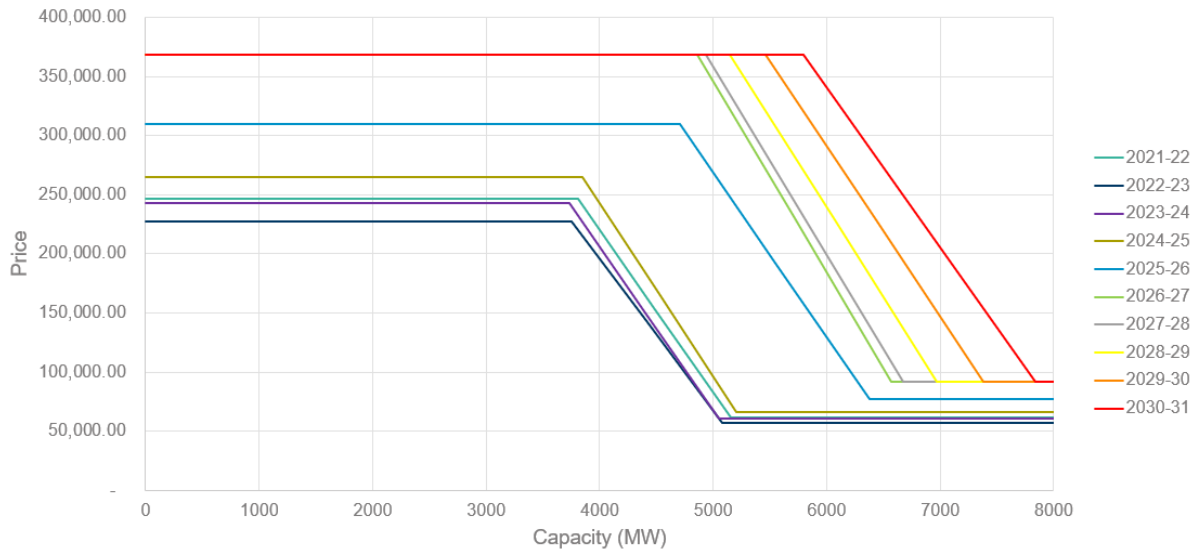


Table 3: Peak Reserve Capacity Price curve parameters and results (current rules)

Capacity Year	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31
Price Cap ($)	200,460.00	184,470.00	197,210.00	215,410.00	251,420.00	299,000.00	299,000.00	299,000.00	299,000.00	299,000.00
Target (MW)	4,482.00	4,421.00	4,396.00	4,526.00	5,543.00	5,716.00	5,806.00	6,061.00	6,422.00	6,821.00
Economic Zero ($)	77,100.00	70,950.00	75,850.00	82,850.00	96,700.00	115,000.00	115,000.00	115,000.00	115,000.00	115,000.00
110% of Target (MW)	4,930.20	4,863.10	4,835.60	4,978.60	6,097.30	6,287.60	6,386.60	6,667.10	7,064.20	7,503.10
Absolute Zero ($)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
130% of Target (MW)	5,826.60	5,747.30	5,714.80	5,883.80	7,205.90	7,430.80	7,547.80	7,879.30	8,348.60	8,867.30
Reserve Capacity Price ($)	**78,573**	**85,294**	**105,949**	**194,783**	**251,420**	**-**	**-**	**-**	**-**	**-**
Capacity Credits Assigned (MW)	**4,925**	**4,807**	**4,727**	**4,596**	**4,717**	**-**	**-**	**-**	**-**	**-**

Table 4: Peak Reserve Capacity Price curve parameters and results (proposed rules)

Capacity Year	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31
Price Cap	231,300.00	212,850.00	227,550.00	248,550.00	290,100.00	345,000.00	345,000.00	345,000.00	345,000.00	345,000.00
85% of Target	3,809.70	3,757.85	3,736.60	3,847.10	4,711.55	4,858.60	4,935.10	5,151.85	5,458.70	5,797.85
BRCP	154,200.00	141,900.00	151,700.00	165,700.00	193,400.00	230,000.00	230,000.00	230,000.00	230,000.00	230,000.00
95% of Target	4,257.90	4,199.95	4,176.20	4,299.70	5,265.85	5,430.20	5,515.70	5,757.95	6,100.90	6,479.95
BRCP	154,200.00	141,900.00	151,700.00	165,700.00	193,400.00	230,000.00	230,000.00	230,000.00	230,000.00	230,000.00
105% of Target	4,706.10	4,642.05	4,615.80	4,752.30	5,820.15	6,001.80	6,096.30	6,364.05	6,743.10	7,162.05
Price Floor ($)	77,100.00	70,950.00	75,850.00	82,850.00	96,700.00	115,000.00	115,000.00	115,000.00	115,000.00	115,000.00
115% of Target	5,154.30	5,084.15	5,055.40	5,204.90	6,374.45	6,573.40	6,676.90	6,970.15	7,385.30	7,844.15
Reserve Capacity Price ($)	**124,097**	**120,692**	**136,410**	**165,700**	**290,100**	**-**	**-**	**-**	**-**	**-**
Capacity Credits Assigned (MW)	**4,925**	**4,807**	**4,727**	**4,596**	**4,717**	**-**	**-**	**-**	**-**	**-**

Table 5: Flexible Reserve Capacity Price curve parameters and results (proposed rules)

Capacity Year	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31
Price Cap	246,720.00	227,040.00	242,720.00	265,120.00	309,440.00	368,000.00	368,000.00	368,000.00	368,000.00	368,000.00
85% of Target	3,809.70	3,757.85	3,736.60	3,847.10	4,711.55	4,858.60	4,935.10	5,151.85	5,458.70	5,797.85
BRCP	154,200.00	141,900.00	151,700.00	165,700.00	193,400.00	230,000.00	230,000.00	230,000.00	230,000.00	230,000.00
100% of Target	4,482.00	4,421.00	4,396.00	4,526.00	5,543.00	5,716.00	5,806.00	6,061.00	6,422.00	6,821.00
Price Floor ($)	61,680.00	56,760.00	60,680.00	66,280.00	77,360.00	92,000.00	92,000.00	92,000.00	92,000.00	92,000.00
115% of Target	5,154.30	5,084.15	5,055.40	5,204.90	6,374.45	6,573.40	6,676.90	6,970.15	7,385.30	7,844.15
Capacity Credits Assigned (MW)	**4,925**	**4,807**	**4,727**	**4,596**	**4,717**	**-**	**-**	**-**	**-**	**-**
Reserve Capacity Price ($)	**124,097**	**120,692**	**136,410**	**165,700**	**290,100**	**-**	**-**	**-**	**-**	**-**

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