



Capability Class 2 Technologies (CC2T) Review Working Group (CC2TRWG) - Minutes

Date:	4 December 2025
Time:	9:30 AM – 11:23 AM
Location:	Microsoft Teams online

Attendees	Representing in the Working Group	Comment
Dora Guzeleva	Chair, Energy Policy WA (EPWA)	
Natalia Kostecki	Australian Energy Market Operator (AEMO)	
Rebecca Pedlow-Collins	AEMO	
Oscar Carlberg	Alinta Energy	
Francis Ip	BLT Energy	
Jake Flynn	Collgar Renewables	
Alister Alford	Enel X	
Richard Cheng	Economic Regulation Authority (ERA)	
Noel Schubert	Expert Consumer Panel	
Max Collins	Neoen	
Bobby Ditric	NewGen Power Kwinana	
Patrick Peake	Perth Energy	
Rhiannon Bedola	Synergy	
Kaavya Jha	Tesla Motors	
Paul Jones	Western Power	
Other attendees	From	Comment
Richard Bowmaker	Robinson Bowmaker Paul (RBP)	
Sue Paul	RBP	
Eija Samson	RBP	
Catlianna Evans	RBP	
Shelley Worthington	EPWA	Secretariat
Sean McAvoy	EPWA	Secretariat
Luke Commins	EPWA	Secretariat



Apologies	
Warren King	Frontier Energy
Dale Waterson	Merredin Energy
Darren Gladman	SMA
Sumeet Kaur	Shell Energy
Clement Ng	IGO

1. WELCOME

The Chair opened the meeting with an Acknowledgement of Country.

2. MEETING APOLOGIES AND ATTENDANCE

The Chair noted the attendance as listed above.

3. MINUTES OF MEETING 2025_10_23

The Chair noted that the minutes had been approved out of session and published online.

4. ELECTRIC STORAGE RESOURCE (ESR) OPERATIONAL CONSTRAINTS

The Chair noted that the 23 October 2025 meeting focused on ESR operational constraints and advised that this topic will resume in 2026 following further modelling and analysis.

5. ESR DERATING EVALUATION AND AVAILABILITY INCENTIVES

The Chair presented slide 2 and then handed over to Ms Paul to deliver the remainder of the presentation.

ESR Derating Methods

Ms Paul presented slides 4 and 5.

Ms Paul explained that Last-in Effective Firm Capacity (EFC) and Last-in Effective Load Carrying Capability (ELCC) belong to the same family of approaches. Both simulate Unserved Energy under different fleet and demand assumptions using probabilistic algorithms by asking:

- How many Megawatts (MWs) of non-firm capacity is equivalent to 1 MW of firm capacity; or
- What contribution does non-firm capacity make in achieving the reliability standard.

Ms Paul noted that these two options are the common approaches used in most other capacity markets, but that there have been various issues with these methods due to their complexity.

Ms Paul referred to the Reserve Capacity Mechanism (RCM) Review, which highlighted an issue with the last-in ELCC method. When new intermittent generators or storage resources are added later rather than earlier, their capacity contribution can be underestimated when it is positively correlated with the existing fleet. So far, attempts to address this issue have been unsuccessful and sometimes lead to an adverse effect.

Ms Paul presented slides 6 and 7.

Ms Paul noted that the to-be-commenced method for Capability Class 3 in the Wholesale Electricity Market (WEM), calculates the ELCC at a fleet level while other jurisdictions



calculate the ELCC or the EFC for individual facilities, adding one facility at a time then calculating the marginal contribution. The individual method results in volatile allocations of lower capacity contribution for intermittent generation.

Ms Paul referenced an ongoing litigation case against the PJM market in the United States and noted that some of the case is based on concerns that the method used:

- under allocates capacity for intermittent generation, causing financial losses; and
- is volatile resulting in capacity shortfalls, which cannot currently be addressed by non-firm capacity resources, creating system stress.

Ms Paul noted that the WEM's fleet method helps reduce volatility and provides a more accurate estimate of a new resource's fleet contribution. While it may not be the most economically efficient approach, the associated benefits justify its use.

Ms Paul stated that one alternative approach analysed uses multiple demand forecasts instead of relying solely on the 10% probability of exceedance (POE).

Ms Paul presented slides 9 and 10.

Ms Paul clarified that based on information provided by AEMO, the minimum charge level issue is not currently causing a problem due to most registered ESR being oversized.

- Mr Peake referenced a 2024 GHD report that suggested that minimum charge level capability was greater than 3-5%, so this may cause a significant issue.

In response to Mr Peak, the Chair clarified that report referred to the degradation of the facility over time and that this should not be included in the Benchmark Reserve Capacity Price, since the ERA has advised that it can be recovered through efficient variable cost. The Chair added that the figures represent actual experience from AEMO.

- Ms Pedlow-Collins agreed with the Chair, noting that AEMO is witnessing 3 to 5% minimum charge levels with the growing ESR capacity in the WEM, although this was dependent on the manufacturer.
- Mr Cheng supported the Chair's response, advising that degradation is allowed in efficient variable cost as per the Offer Construction Guideline. He noted that the ERA is looking into the minimum charge issue and welcomed its identification by the CC2TWG.

The Chair stated that whatever the minimum charge level capability is, that it needs to be accurately reflected in the certification process for the various technologies.

- Mrs Bedola asked if this was required to be in the certification application and whether it was getting missed, or whether it is a value that Market Participants were unaware of.
- Ms Pedlow-Collins responded that applicants were providing zero as the minimum charge level, and this is the information that AEMO is operating off. She noted that the application process could be enhanced to reflect the importance of usable capacity to create an accurate method.

The Chair clarified that the relevant certification requirements are already in the Electricity System and Market (ESM) Rules, but it could be clarified in the relevant WEM Procedures. She noted that it was important for applicants to provide accurate information on this, otherwise, they may fail the testing requirements.

Ms Paul presented slide 11.

- Mrs Bedola sought to clarify how much energy is used and the time associated with it in the ESR ramping triangles.



Ms Paul noted that, while ramping up can occur quickly, that large ESR may not be allowed to do so because of ramping restrictions in place to protect Power System Security.

- Ms Pedlow-Collins explained that:
 - during testing, the WEM Dispatch Engine (WEMDE) uses ESR ramping rates to maintain Power System Security and that, based on current observations, ESR can ramp up at a rate of 10% per minute. She noted that WEMDE will continue to adjust as the system evolves and as ESR capacity increases and, therefore, the current observed rate may change over time; and
 - the rates are based on a combination of WEMDE and the ESR Facility's constraints, as capabilities vary by manufacturer. Therefore, the 10% figure is only a guideline, not a universal rule.
- Mr Collins noted that:
 - when the number of Capacity Credits received equals the Declared Sent Out Capacity (DSOC), the average is slightly under capacity (by a couple tenths of a MW) as DSOC cannot be exceeded. He suggested that, if this could be reflected in the ESM Rules, testing requirements would likely improve; and
 - the control system is designed to never exceed the DSOC. If the limit were set differently, ESR would fluctuate above and below the target every five seconds. However, because DSOC acts as a hard ceiling, ESR cannot go above it, which results in the actual value staying below DSOC.
- In response to the Chair, Mr Collins provided two potential options to address the DSOC ceiling limit:
 - allowing the ramps and measure MW hour (MWh) instead of time at a certain MW; or
 - allowing a 3% deviation at both ends because metering is accurate within a 3% margin,

noting that measuring the whole area under the curve would fix the issue.

The Chair noted that the 3% metering error relates to all Facilities and that this issue has previously been raised. She considered that what Mr Collins has proposed could help resolve the concern.

Ms Paul presented Slide 12.

- Mr Schubert asked whether the ESR obligations might exceed actual system requirements because they are calculated as an aggregate rectangular block rather than being aligned with the shape of the demand curve.

In response to Mr Schubert, the Chair explained that, due to the 2025 Availability Duration Gap changes, this no longer applies as the new calculation of the duration obligations introduced creates several rectangles which will mimic the demand curve. For example, the peak of the curve is covered by a four-hour block, followed by a six-hour block below it, and so on.

In response to a question from Mr Collins, the Chair clarified that the new duration requirement method does not consider demand response from large loads as it only considers the top of the demand curve.

Ms Paul presented slides 13 to 16.



Ms Paul stated that the status quo derating method performs the best in comparison to the alternative methods. However, Ms Paul sought additional input from the CC2TRWG on whether:

- there is any merit to move towards option 1 - a fleet ELCC, due to it performing moderately well and may well offer other benefits; and
- whether Demand Side Programmes (DSP) should be included in the fleet ELCC calculation if option 1 is preferred.
- Mr Carlberg responded that:
 - there was no benefit in examining option 1 further as an ELCC approach is appropriate for resources with uncertain output, whereas ESR have more predictable availability. He further noted that ELCC is complex, likely increasing implementation costs, and would make scheduled generators an outlier by not being subject to an ELCC approach; and
 - it was not worth incorporating DSPs into the fleet ELCC. He noted that significant implementation costs have already gone into the DSP accreditation method, and that DSP availability is generally predictable.
- Mrs Bedola advised her preference for keeping the status quo, noting that ESR's dispatchable nature can skew historical data. Past performance may have been influenced by external factors, such as AEMO directions to maintain Power System Security outside the ESR Obligation Duration (ESROD) intervals.

The CC2TWG supported the statements and agreed that the status quo was preferred.

The Chair advised that if any members had other views, they could approach EPWA.

Reserve Capacity refunds for ESR Facilities

Ms Paul presented slides 21–22 and explained how an ESR with insufficient charge to fully meet its Reserve Capacity Obligation Quantity (RCOQ) can adjust its charging strategy to reduce the refund amount. This is because a charge shortfall only occurs once the ESR is completely depleted.

Ms Paul presented slides 23-24 and explained that other options to incentivise prudent charging behaviours are subject to ongoing technical analysis.

- Mr Ditric asked how ESR spare capacity is factored into the spare capacity calculation. He assumed that it would only be included when there is an RCOQ and it forms part of the ESROD and suggested that this approach may overstate spare capacity.

The Chair noted that Mr Ditric's question would be actioned for further consideration.

<i>Action: AEMO to clarify how ESR capacity is considered in the spare capacity calculation.</i>

- Mr Peake considered that it is unreasonable that an ESR can enter the ESROD not fully charged and avoid refunds, this was comparable to a scenario when a fossil-fuel facility enters the peak period with insufficient fuel, which was unacceptable. Mr Peake noted that this leaves customers exposed to potential power outages, even though the ESR continues to receive capacity payments funded by those customers.
- Mrs Bedola noted that a requirement to be fully charged ignores Frequency Co-optimised Essential System Services (FCESS) noting that, from the example provided, during the charging period the ESR could provide Contingency Reserve Lower services.



Mr Jones supported Mr Peake's comment, while Mr Carlberg, Mr Collins and Ms Pedlow-Collins agreed that FCESS should be considered.

The Chair clarified that the requirements to be charged applies only when ESR is required and agreed that FCESS should be considered.

Ms Paul clarified that this sufficient charge level issue is not addressed through changing the refund calculation as, in theory, the ESR already has the incentive to enter the ESROD with sufficient charge. The ongoing technical analysis is trying to determine when sufficient charge level constraints should apply.

The Chair noted that ESRs might attempt to avoid dispatch by bidding near the energy price cap during the period. However, if the system requires them, they will still be dispatched, and a refund will apply if they lack sufficient charge. The Chair added that bidding behaviour is a matter for the ERA.

The Chair stated that, under the current arrangements, only the charge in the next five minutes is considered. While the ESM Rules could be amended to require full charge, it is uncertain whether this would improve WEM efficiency. Based on the analysis, changing the refund calculation to achieve this is not practical, so an alternative mechanism will be investigated.

- Mr Peake advised that he would be supportive of changing the ESM Rules considering that, if ESR is required to operate for the entire ESROD, it should have sufficient charge.
- Mr Carlberg noted that, as every day is different, there should be flexibility for ESR to be available when the system needs it most, not reserve capacity unnecessarily for all times. He considered that intervention or full charging should be limited to lack of reserve (LOR) periods.
- Mrs Bedola agreed that ESR should be charged when they are required but noted that WEMDE currently prefers ESR over other Facilities for FCESS due to having a minimum generation of zero. Consequently, this may need to change if minimum charge constraints are introduced. Otherwise, ESR may struggle to comply with charge constraints.
- Mr Collins noted that requiring ESR to be fully charged for ESROD would discourage daytime dispatch and likely increase prices before the ESROD, as ESR would avoid discharging during those periods. Therefore, any changes must consider broader market impacts.

The Chair explained that refunds are sculpted to purposefully focus on the reserve margins. However, while ESR are paid for services like FCESS, those that receive Capacity Credits are paid to be available to meet system stress events. During very high demand days or very low margins it is expected that the Reserve Margins may be breached and, therefore, ESR must be there during these stress events.

The Chair noted that, in her view, the market should not move towards a greater number of manual interventions to maintain ESR charge levels, as frequent interventions harm the effectiveness of the market. Therefore, the CC2TWG should develop triggers in the ESM Rules for ESR to know when and under what circumstances they need to be fully charged.

- Mr Cheng noted that, if ESR is being paid for a Reserve Capacity, then it is expected that it discharges for the entire obligation period. He agreed that FCESS must be considered but queried how a non-accredited FCESS ESR would be treated.



- Ms Pedlow-Collins responded that AEMO is currently seeing most ESRs apply for flexible capacity, and that obtaining flexible capacity carries an obligation to apply for FCESS accreditation.

The Chair emphasised that the RCM ensures that Facilities with Capacity Credits are available during their Reserve Capacity obligation periods, and this principle must be preserved.

- Mr Schubert stated that ESR dispatch is dependent on energy availability to charge them and this may not always be available, referring to the events on 25 August 2025.
- Mrs Bedola added that on that day there were several issues, like significant changes to AEMO's rooftop solar forecasts across the day causing gas nominations to be lower and therefore needing ESR to fill the void. Changing the ESM Rules for this day may not offer benefit. However, she noted the need to future-proof for stress events.
- Ms Kostecki advised that AEMO will be publishing a detailed report about the events on 25 August but agreed that it should not solely inform all future thinking. AEMO is using this and other learnings to understand what the system requirements are and how to handle them.

The Chair noted that the events of 25 August 2025 will be addressed at a later stage following further analysis. However, early learnings from that day, along with other findings, indicate that additional future-proofing is required. She noted that energy availability was not the sole cause of the issues experienced as several contributing factors were involved. However, ongoing initiatives, such as the Operational Forecasting Review, may help mitigate similar challenges in the future.

- Ms Kostecki noted that:
 - regardless of the size of the dynamic refund factor or whether conditions involve low spare capacity or other scenarios, AEMO will generally intervene even when the risk to power system security is low;
 - intervention avoids relying solely on the refunds regime to deter aggressive commercial behaviour that trades off compliance costs against risk and helps prevent situations from escalating to a tipping point where directed load shedding becomes necessary;
 - AEMO monitor conditions in real time and will intervene if risks are escalating faster than available mitigation mechanisms, to ensure Power System Security and Power System Reliability.

Ms Paul noted that interventions are mechanisms for perfect storm events where everything goes wrong. If interventions are used frequently this indicates a problem with the WEM itself.

- Ms Kostecki agreed that intervention is not a preferable strategy and would welcome any effort to mitigate them through changes to the ESM Rules or other requirements. She added that there will always be a degree of uncertainty which will require interventions.

The Chair noted that while interventions may need to happen, the ESM Rules should be designed to minimise interventions.

- Mr Ditic noted that refunds are likely to be high during stress events and suggested that changing the allocation of refunds back to generators and linking charge levels with availability could incentivise appropriate behaviour.



- Mrs Bedola noted that consumers are paying for the significantly increased capacity prices and would be concerned if the refund allocation changed.

The Chair noted that the refund allocation method had already been discussed in previous work and that consumers bore the cost associated with any reliability issues. Therefore, any discussion about changing the refund allocation should be discussed in a forum with greater consumer representation, such as the Market Advisory Committee.

- Mr Schubert suggested that ESR should have a greater incentive to charge as much as possible with low emissions energy to better achieve the environmental limb of the State Electricity Objective.
- Ms Pedlow-Collins advised that there are some additional incentives incoming with the 10-year fixed price option for ESRs that are charged by renewable sources.
- Mr Carlberg responded that this will likely happen without further reform as the market signals will adjust to provide the incentive.

Mrs Bedola and Mr Collins supported Mr Carlberg's comment.

The Chair thanked the members for their comments and asked Ms Paul to continue.

Ms Paul presented slides 26 – 31 and noted the existing refund scheme seems fit-for-purpose. However, she sought input from the CC2TRWG on whether:

- refund options should consider incentivising availability across the board; and
- there were any additional comments on the alternative options.
- Mr Carlberg noted that he:
 - supported the status quo as the options presented are not materially better. Further increasing the refund exposure will likely not incentivise availability but cause ESRs to raise prices to avoid refund exposure; and
 - considered that the availability during low reserves should be the focus as the RCM is concerned with reliability.
- Mrs Bedola supported the status quo, considering that changing the refunds will likely lead to high prices outcomes.
- Mr Peake supported the status quo, considering that the current refund already provides a strong incentive. He noted that the proposed options may not provide any additional benefit and, since total refunds are capped, the incentive may not last the entire year.

Members supported the comments and agreed that the status quo was preferred.

- Mr Schubert suggested that distinguishing between capacity-critical days and non-critical days could provide flexibility and ensure that ESR are charged when required.

The Chair replied that distinguishing between capacity critical days is part of future work to determine the triggers for ESR minimum charge levels.

Ms Paul summarised that the status quo for the refund allocation is the preferred option and that other methods will be investigated to ensure sufficient ESR charge levels when required.

SWIS Generation Mix

Ms Paul presented slide 33 and asked if the members had any further comments.



- Mrs Bedola sought clarity on a recent ESM Rule change that allowed AEMO to state if an amount of Capability Class 1 and Capability Class 3 Facilities were required.
- Ms Pedlow-Collins responded that this was included in the Tranche 8 Amending Rules and allowed these Capability Classes to be given priority in the Network Access Quantities (NAQ) process.

The Chair clarified that the changes are concerned with determining if there is shortfall, i.e. not a certain amount, and that when a shortfall is determined by AEMO it allows new facilities in these Capability Classes to be treated in a prior step in the NAQ process.

- Mr Peake expressed concern that, to maintain reliability, the existing gas and diesel Facilities could be required to operate continuously at maximum capacity, leading to higher costs. He noted that, in this scenario, bringing additional renewable generation online may be more cost-effective than relying on ESR. However, current market signals may not support this outcome.

The Chair noted that much work had been completed to incentivise certain classes but perhaps it is worth considering if restrictions on some classes is required.

- Mr Ditric suggested that moving away from yearly targets could support a better generation mix, as annual targets tend to favour facilities like ESR that can connect quickly, thereby limiting the development of other facilities.
- Mr Cheng noted that network availability will affect the generation mix and should always be considered.
- Mr Schubert noted that the current RCM arrangements provide generous returns to ESR, which may explain the significant ESR capacity in the WEM, but that incentives could be implemented to attract other facilities.

The Chair clarified that attracting generation investment was outside the scope of the CC2TWG. Any methods to incentivise investment would instead be considered by the WEM Investment Certainty Working Group.

- Mr Cheng asked whether a RCOQ for ESR state of charge had been considered.

The Chair responded that a sufficient state of charge is not required every day and, therefore, it is not beneficial implement a RCOQ obligation, and that ongoing work of this group will determine triggers to implement charging obligations.

- In response to a question from Mrs Bedola, Ms Pedlow-Collins advised that AEMO would return with a date of when the technical analysis would be completed.

Action: AEMO to advise the CC2TWG the date that the technical analysis is expected to be completed.

The Chair and Ms Paul thanked the CC2TRWG for their contributions.

6. GENERAL BUSINESS

The Chair stated that another meeting of the CC2TRWG would be scheduled for February 2026.

The meeting closed at 11:23am.