Government of Western Australia
Energy Policy WA

Meeting Agenda

Meeting Title:	Reserve Capacity Mechanism Review Working Group (**RCMRWG**)
Meeting Number:	2022_06_02
Date:	Thursday 2 June 2022
Time:	9:30 AM to 11:25 AM
Location:	Online, via TEAMS.

Item	Item	Responsibility	Type	Duration
1	Welcome and Agenda	Chair	Noting	5 min
2	Meeting Apologies/Attendance	Chair	Noting	2 min
3	Minutes of Meeting 2022_05_05	Chair	Decision	3 min
4	Actions Items	Chair	Noting	5 min
5	Project Timeline	RBP	Discussion	5 min
6	CRC: Contribution to Resource Adequacy	RBP	Discussion	30 min
7	CRC: Outages	RBP	Discussion	15 min
8	CC: Preference for Resource Flexibility	RBP	Discussion	40 min
9	Next Steps	Chair/RBP	Discussion	5 min
10	General Business	Chair	Discussion	5 min
	Next Meeting: 16 June 2022			

Please note this meeting will be recorded.

Government of Western Australia
Energy Policy WA

Minutes

Meeting Title:	Reserve Capacity Mechanism Review Working Group (**RCMRWG**)
Date:	5 May 2022
Time:	9:30am – 11:30am
Location:	Microsoft TEAMS

Attendees	Company	Comment
Laura Koziol	Chair	Proxy for Dora Guzeleva
Paul Arias	Bluewaters Power	
Rhiannon Bedola	Synergy	
Manus Higgins	AEMO	
Peter Huxtable	Water Corporation	
Mark McKinnon	Western Power	From 9:45 AM
Wendy Ng	Shell Energy	
Patrick Peake	Perth Energy	
Jacinda Papps	Alinta Energy	
Toby Price	AEMO	Subject matter expert
Matt Shahnazari	Economic Regulation Authority	
Noel Schubert	Small-Use Consumer representative	Observer
Dev Tayal	Tesla Energy	
Rebecca White	Collgar Wind Farm	
Andrew Stevens	Clear Energy	
Richard Bowmaker	Robinson Bowmaker Paul (**RBP**)	
Ajith Sreenivasan	RBP	
Tim Robinson	RBP	
Stephen Eliot	Energy Policy WA (**EPWA**)	
Shelley Worthington	EPWA	

Apologies	From	Comment
Dora Guzeleva	Chair	
Dale Waterson	Merredin Energy	
Andrew Walker	South32 (Worsley Alumina)	

Item	Subject	Action
1	**Welcome** The Chair opened the meeting at 9:30am.	
2	**Meeting Apologies/Attendance** The Chair noted the attendance as listed above.	
3	**Minutes of RCMRWG meeting 2022_03_17** Draft minutes of the RCMRWG meeting held on 17 March 2022 were distributed in the meeting papers on 29 April 2022. The RCMRWG noted the tracked changes in the draft minutes and accepted the minutes as a true and accurate record of the meeting. **Action: RCMRWG Secretariat to publish the minutes of the 17 March 2021 RCMRWG meeting on the RCMRWG web page as final.**	**RCMRWG Secretariat**
4	**Action Items** The paper was taken as read. All action items were closed.	
	The slides for agenda items 5 to 10 are available on the webpage for the RCM Review (https://www.wa.gov.au/government/document-collections/reserve-capacity-mechanism-review-working-group).	
5	**Project Timeline** Mr Robinson presented the timeline in slides 4 to 6 and noted the following about the status of the project: • considerable progress has been made on the project – the international literature review is complete, data has been gathered, and the system stress modelling has commenced (initial results are discussed under agenda item 6); • indicative directions have been identified for defining the capacity service and the planning criterion based on the system stress modelling; • further modelling and analysis are to be completed; and • a draft consultation paper is to be completed in August 2022.	

Item	Subject	Action

6	**System Stress Modelling Outputs**
	Mr Bowmaker presented the initial results of the system stress modelling in slides 7 to 17. The discussion was as follows:
	• Mr Bowmaker noted that
	  ○ the system stress modelling looked at:
	  ▪ the causes of system stress in 2022, 2030 and 2050;
	  ▪ how the current generation mix and other capacity sources will operate and how they will support the identified types of current and future system stress;
	  ▪ whether the current Planning Criterion is adequate to meet the capacity requirements in the South West Interconnected System (**SWIS**);
	  ○ the modelling methodology was to:
	  ▪ generate future load and variable renewable energy traces;
	  ▪ insert the traces into a system adequacy model;
	  ▪ determine whether the system has sufficient capacity to meet demand on an hour by hour basis, at the points of system stress; and
	  ○ this quantifies how often system stress events occur, the extent to which system stress occurs, what times of the day stress occurs, etc., which allows conclusions to be drawn on whether the current Planning Criterion is adequate and the types of products that will be needed in the future.
	• Mr Bowmaker reviewed the scenarios that had previously been agreed by the RCMRWG for 2022, 2030 and 2050.
	  ○ Ms Bedola asked whether additional wind and solar capacity is assumed to generate the hydrogen for scenario 3 and whether higher load was assumed for the creation of the hydrogen. Mr Bowmaker indicated that no specific technology assumptions were made – specific wind or solar capacity to generate hydrogen was not part of the results, nor was load for hydrogen generation.
	  ○ In response to questions from Mr Price, Mr Bowmaker indicated that:
	  ▪ behind the meter generation goes into the operational load forecast; and
	  ▪ no assumptions have been made around virtual power plants and how they are used.
	• Mr Bowmaker presented the initial modelling results (slide 10) and the key findings in terms of capacity additions (slide 11).
	• Mr Bowmaker presented the key finding in terms of minimum demand (slide 12).	

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- In response to a question from Mrs Bedola, Mr Bowmaker indicated that the negative load results indicate load before accounting for demand flexibility and storage.
- Mr Schubert noted that the SWIS has had peak demand greater than 4,000 MW in several years and asked why this does not seem to occur in the results. Mr Bowmaker indicated that high peaks do not appear because the results are an average load profile, and the final modelling will use a Monte Carlo simulaion approach with a number of different demand shapes to address extreme peak demand. Mr Schubert pointed out that these peak events would show what capacity is required.
- In response to a question from Mr Higgins, Mr Bowmaker acknowledged that the system stress modelling only considers what generation capacity is required and that economic modelling will be done in the next stage.
- In response to a question from Mr McKinnon, Mr Bowmaker indicated that negative operational load indicates periods where the market operator will need to find ways to absorb the additional energy in terms of bringing in batteries or demand side management.

- Mr Bowmaker presented the key finding in terms of demand shape, (slide 13).
  - Mr Schubert suggested that the demand profile will be flatter if retail tariffs are structured properly, and incentives are put in place for electric vehicles (**EV**s). Mr Bowmaker indicated that the modelling accounted for EV charging, which tends to be in the evening – this pushes the peak later in the day and leads to a broader peak, but the duck curve shape does not disappear.
- Mr Bowmaker presented the key finding in terms of timing of firming resources (slide 14).
  - Ms White pointed out that the modelling shows that unserved energy still occurs in the traditional peak periods, which is usually due to insufficient capacity, and indicated that she had expected that unserved energy in the future would be caused by low load and instability leading to system black or partial system black events. Ms White asked whether the modelling indicates that there are no low load issues that would lead to unserved energy?
    - Mr Bowmaker indicated that the model identifies unserved energy that is caused by a shortage of capacity, not things happening as a result of system stability issues.
    - Ms White asked whether this definition is appropriate going forward and raised the question of whether flexibility should be considered in the RCM.

        - Mr Robinson indicated that issues associated with low load are addressed later in the agenda and suggested to return to the issue at that time.
    - Mr Bowmaker pointed out that the broader peak that is expected by 2050 suggests that unserved energy could occur as late as 10:00pm, so the hours over which capacity services are defined may need to be extended. Mr Robinson suggested that, alternatively, it may need to be ensured that the capacity is available in all of the peak hours.
    - Mrs Papps asked how this relates to 14-hour fuel requirement for Scheduled Generators and whether fuel requirements are only needed in the five hours in the back half of the day. Mr Robinson acknowledged that it could be argued that the critical period is shorter than 14 hours. The Chair suggested that fuel requirements will be considered when assessing the methods to assign Certified Reserve Capacity. Mr Robinson suggested that fuel requirements should be discussed later when discussing ramping and flexibility.
    - Mr Price asked whether the fleet assumptions will drive the types of unserved energy experienced – for example because reliance on storage pushes unserved energy to later in the day. Mr Price indicated that he had envisaged that a base case for the characteristic of demand would be developed and used to assess what types of fleet capabilities achieve certain levels of unserved energy. Mr Robinson clarified that this was why different scenarios were modelled.
- Mr Bowmaker presented the key finding in terms of timing of demand ramping (slide 15).
    - Mr Bowmaker indicated that:
        - the modelling showed that much higher demand ramping rates are required as the demand shape changes in the later years – about 2,000 MW/h by 2050 (about three times the current rate); and
        - the ramping is well within the capabilities of current technologies like open cycle gas turbines (**OCGT**s) and batteries, but options to address ramping will be more limited with the zero carbon emissions policy, which will rule out OCGTs.
    - Ms Bedola asked whether the ramping issues are driven by renewables or load? Mr Bowmaker indicated that it is a combination of what is going on behind the meter and the volatility of wind and solar.
- Mr Bowmaker presented the key finding on the methods of measuring unserved energy (slide 17).

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	○ Mr Bowmaker pointed out the different ways to measure unserved energy: ▪ unserved energy as a percentage of total load (**EUE%**); ▪ loss of load hours (**LOLH**); and ▪ loss of load events (**LOLEv**). ○ Mr Bowmaker pointed out that the different scenarios resulted in different types of unserved energy in terms of EUE%, LOLH and LOLEv, which will be important when it comes to discussions on the Planning Criterion. ○ Mr Tayal asked whether the modelling showed any events with a continuous number of hours of unserved energy that would match the expected MWh profile of batteries or other storage technology that is required in 2030 or 2050? Mr Bowmaker indicated that RBP can present this information. ○ Mr Price asked if the modelling accounts for extreme scenarios, such as multiple days with a lack of wind or low irradiance. Mr Bowmaker clarified that the initial results presented are based on hour-by-hour modeling of averaged demand but that the final results will be based on a Monte Carlo simulation approach, modelling all actual traces available and considering many different scenarios, including extreme weather events. Mr Higgins asked if the modelling had assessed whether sufficient Scheduled Generation will be available in 2030. Mr Robinson clarified that this was the case, based on the current plan for generator retirements.	
	ACTION: RBP is to provide information to the RCMRWG on how the number of continuous LOLH matches against battery profiles.	**RBP**
7	**Capacity Services** Mr Bowmaker and Mr Robinson presented the initial assessment of the capacity services needed in the SWIS in slides 19 to 23. The discussion was as follows: • Mr Bowmaker presented the initial key findings of the assessment of the characteristics of the capacity needed in the SWIS (slide 19). ○ Mr Bowmaker confirmed that, at this point, the model has not identified any ramp rates that cannot be addressed by the available essential system services (**ESS**). ○ Ms White questioned how capacity characteristics beyond a simple MW requirement can be incentivised, considering that the Reserve Capacity Price is out of scope for the review. Ms White considered that, without changing the Reserve Capacity Price it will be difficult to incentivise different capacity products, such as capacity from different technology types and in different locations.	

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Ms White emphasised that incentives for having capacity in different locations on the network is important to increase the resilience of the system.

Mr Robinson clarified that the capacity needed in future will not be solely defined by peak demand but also by other characteristics, such as ramping capabilities. Mr Robinson noted that the option to address the ramping needs through the RCM are discussed later in the presentation. Mr Robinson noted that there are different ways to address the needed characteristics that are in scope of the RCM Review, such as different capacity classes or methods for assigning Certified Reserve Capacity (**CRC**).

Mr Robinson noted that the results indicate that there will be a need in the future for capacity to be more flexible and available over a wider range of hours than currently needed. Currently, different requirements for availability apply to different technology types with Scheduled Generators being the only facilities that must be able to respond at any time. In the future, it will be important that all facilities can respond in a wide range of hours.

Mr Price considered that it may be beneficial if the RCM takes system resilience into account by setting appropriate minimum standards in the allocation of CRCs.

- Ms White noted that Electrical Storage Resources only have to be available for four hours.
- Mr Robinson noted that the objective is to find a technology neutral approach by defining the system need and the product to address it. Mr Robinson noted that the RCM Review is aiming to identify a common approach for certifying different technologies.

  Mrs Papps supported simplifying/rationalising the methods for assigning CRC and noted that the current regime is extremely complex, which has the potential to discourage investment.

- Mr Robinson presented the initial assessment on whether flexibility should be addressed through the RCM (slide 20).
  - Mr Robinson noted that the initial results show that, by 2050, the demand ramp rates exceed 2 GW / hour and that the resulting need for load shaping will dominate the need for firming capacity. Mr Robinson noted that this need for fast ramping capacity can be addressed in different ways:
    - as a specific capacity product with a specified target;
    - as a specific class for capacity that is more capable and therefore gets capacity allocated before the other classes; and/or

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- address flexibility through the ESS market rather than the RCM.

Mr Robinson noted that demand side management could help addressing the issue, but in order to do so, the regime for DSPs will need to be changed.

- Mr Shahnazari considered that, if ramping capability is considered as a separate product or 'class', its pricing and demand curve might be separate to the system adequacy product and based on its supply cost and benefit to the system. Therefore, this becomes a separate service itself.
  Mr Shahnazari considered that combining the services without separation of prices should be considered with caution. If not designed carefully, it is likely to distort price signals for system adequacy and ramping flexibility services. If, in the future, the system requires a system adequacy product but not ramping flexibility, or vice versa, a single price for both services may distort the signal for each service to enter the market.
- Mr Peake suggested that system adequacy and fast ramping should be sought separately. However, if ramping is driving the capacity need then both system adequacy and ramping should be sought in a combined process so that the overall cost can be optimised.
- Mrs Bedola considered that the market as a whole needs to encourage the right generation mix., Therefore, the RCM and the energy and ESS market together must provide the revenue that encourages investment in the services needed.
- Mr Shahnazari noted that the rules already allow procurement of fast ramping services through the ESS market.

  Mr Robinson agreed that fast ramping can be included as a distinct service in the ESS market and noted that the question is whether inclusion in the ESS market is sufficient to ensure the required investment in fast ramping capacity.
- Mr Robinson confirmed that the rules allow for a fast-ramping service to be procured through the Supplementary Essential System Service Mechanism (**SESSM**) if a need for this service is identified for the short term.
- Ms White cautioned against the building of additional administrative mechanisms to avoid impeding competition.
  Ms White considered that the market should be designed to incentivise the needed services and administrative mechanisms such as the SESSM should only be a backstop solution.
  Mrs Papps, Mrs Bedola, Ms Ng, and Mr Peake supported Ms White's comment.

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- Mr Shahnazari suggested that fast ramping capacity could be procured through its own mechanism, similar to the RCM, instead of including the procurement in the RCM.
- Mrs Bedola noted that the setting of the Electric Storage Resource Obligation Intervals limits how to operate batteries in the time before those intervals.
- Mr Price noted that AEMO is developing options to incorporate ramping (Operating Reserve) in the NEM and suggested to consider how this is proposed to be designed and integrated into any capacity mechanism that is introduced in the NEM.

  Mrs Papps noted that the Australian Energy Market Commission's (**AEMC**) rule change about ramp rates in the NEM has been deferred until June 2023 to wait for the outcome of Energy Security Board's (**ESB**) work on the capacity mechanism.
- Mr Robinson clarified that the modelling suggests that the fast-ramping needs in the WEM can be addressed by existing technology but the question is how to encourage a sufficient amount of the required capabilities. Mr Robinson noted that the next steps of the RCM Review will include a more detailed assessment of whether the existing market mechanisms encourage sufficient fast-ramping capacity or if additional incentives are needed.
- Mr Robinson indicated that, based on the RCMRWG's discussion, it will be worth investigating whether capacity classes can be used to address the need for fast-ramping capacity. Mr Higgins supported this approach.

- Mr Robinson presented the initial assessment of whether the low load issue should be addressed through the RCM (slides 22 and 23).
  - Mr Robinson noted that, to address the low load through the RCM:
    - a 'reverse capacity' product would be needed, assigning credits for the capability of increasing load or decreasing generation; and
    - an additional planning criterion would be needed for such a service.

    Mr Robinson noted that the initial results indicate that such a service may be needed around 25% of the Trading Intervals by 2050 which is significantly more than the Trading Intervals where a capacity service is needed.
  - There was discussion about whether consumers should have the right to spill energy into the system at any time.
    - Mr Stevens considered that allowing distributed energy resources (**DER**) to spill energy into the system at any time

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and potentially paying them for not spilling at times poses a risk to investors in larger scale generation. Mr Stevens considered that DER generation should have to register to obtain the right to spill into the system. Ms White supported Mr Stevens' comments.

- Mrs Bedola noted that restricting consumers from spilling energy into the system may result in consumers disconnecting from the network.
- The Chair noted that whether generation from DER should be restricted was considered by the DER Roadmap and is not in scope of the RCM Review.

- Mr Huxtable considered that investment in large scale capability to increase load requires multiple years of lead time and significant capital expenditure.
- Mr Peake considered that a lot of money is spent on enabling the absorption of DER and cautioned that increasing prices for consumers by too much could threaten the energy transformation and lead to support coal fired generation.
- Mr Shahnazari considered that there should be a framework for deciding which services should be part of the RCM and which should not. For example, what makes us to consider ramping flexibility can be included in the RCM, but not other ESS services?

8 Planning Criterion

Mr Robinson presented the conclusions about the assessment of the Planning Criterion based on the initial results and the international review (slides 25 to 27). The discussion was as follows:

- Mr Robinson noted that:
  - The international review suggests keeping the two-limbed Planning Criterion.
  - The system stress modelling indicates that EUE% should be retained as one of the limbs of the Planning Criterion.
  - The initial results indicate that there is no benefit in using both LOLH and LOLEv as system stress measurements for the Planning Criterion.
  - The initial results showing a small number of short and small outages indicate that it will be more appropriate to use peak load or LOLEv and not LOLH as the second limb of the Planning Criterion.
  - Further modelling should inform whether peak load or LOLEv are more appropriate measures for the second limb of the Planning Criterion.

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- Ms White asked whether there is any policy direction for the reliability target.

  Mr Robinson clarified that the assessment of the Planning Criterion includes a cost-benefit analysis to assess the trade-off between higher reliability requirements and costs, noting the requirement that the current reliability standard should not be eroded.
- Mr Schubert asked if the modelling differentiates between long- and short-duration storage.

  Mr Bowmaker clarified that the modelling assumes that the Electrical Storage Obligation Intervals would span four hours. Mr Bowmaker noted that the modelling to date was an hour-by-hour assessment and therefore not assessing when electrical storage resources (**ESR**) are charging over time, but that this will be assessed in the next round of modelling.
- Mr Peake considered that the public would be most upset by deep outages and that regular but small outages can be spread around so no one customer is greatly affected.
- Mrs Papps noted that Alinta Energy broadly supports the retention of a two-limbed Planning Criterion and asked how this will affect the fuel requirement for Scheduled Generators.

  Mr Peake noted that the fuel requirement for Scheduled Generators will become a big issue if there is an increase in reliance on DSPs and the question is what availability DSPs will have to provide.

  The Chair noted that the fuel requirement will be considered when assessing the methods for assigning CRC.
- Mr Robinson noted that even if the Planning Criterion is to be retained, the following aspects need to be addressed:
  - the reserve margin will need to be assessed to account for the largest contingency, which also sets the need for Spinning Reserve, and the largest contingency is now a network outage combined with the loss of generation from DER, not failure of the largest generator; and
  - whether CRC should be assigned based on the installed capacity (**ICAP**) or the unforced capacity (**UCAP**).
- Mr Shahnazari referred the RCMRWG to the ERA's discussions in relation to the reserve margin in the following two publications:
  - Rule Change Proposal for the review of the Relevant Level Methodology, page 42;[1] and

[1] The Rule Change Proposal is published on the Coordinator's website: Rule Change RC_2019_03 (www.wa.gov.au)

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	○ 2020 Review of two market rules intended to incentivise the availability of generators, p. 16-17,65.[2] • Mr Shahnazari noted that keeping a two-limbed Planning Criterion has implications on the capacity value because Facilities may contribute differently to the two limbs. • Mr Higgins asked whether schedulable and non-schedulable generation should be separated into different availability classes. Mr Robinson noted that this will be considered when assessing the methods for assigning CRC.	
9	**Support for Preliminary Directions** The RCMRWG supported the preliminary directions.	
10	**Next Steps** Mr Robinson noted that the next step is modelling the alternative planning criteria and assessing the effect on the capacity target and system reliability. The next RCMRWG meeting in June 2022 to discuss: • final results for the assessment of capacity services and the Planning Criterion; and • CRC allocation approaches. The Chair invited RCMRWG members to provide out of session comments on the system stress modelling and the preliminary directions for the planning criterion by 13 May 2022. Ms White suggested that any out of session comments on the presented material should be consolidated and included in the papers for the next RCMRWG meeting. The Chair noted that how out of session feedback will be reported back to the RCMRWG will depend on the nature of the feedback.	
	ACTION: RCMRWG members are to provide any further feedback and comments on the system stress modelling and the preliminary directions on the planning criterion to the RCMRWG secretariate.	**RCMRWG members (13/05/2022)**
11	**General Business** No general business was discussed.	

The meeting closed at 11:30am.

[2] The report is published on the ERA's website: 2020 Review of Incentives to Improve Availability of Generators - Economic Regulation Authority Western Australia (erawa.com.au)

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Agenda Item 4: RCMRWG Action Items

Reserve Capacity Mechanism Review Working Group (**RCMRWG**) Meeting 2022_06_02

Shaded	Shaded action items are actions that have been completed since the last MAC meeting.
Unshaded	Unshaded action items are still being progressed.
Missing	Action items missing in sequence have been completed from previous meetings and subsequently removed from log.

Item	Action	Responsibility	Meeting Arising	Status
5	RCMRWG Secretariat to publish the minutes of the 17 March 2022 RCMRWG meeting on the RCMRWG web page as final.	MAC Secretariat	2022_05_05	**Closed** Minutes published on 9 May 2022
6	RBP is to provide information to the RCMRWG on how the number of continuous LOLH matches against battery profiles	RBP	2022_05_05	**Open** To be presented at the 16 June 2022 meeting.
7	RCMRWG members are to provide any further feedback and comments on the system stress modelling and the preliminary directions on the planning criterion to the RCMRWG secretariate.	RCMRWG members (13/05/2022)	2022_05_05	**Closed** four members provided feedback

Government of **Western Australia**
Energy Policy WA

Reserve Capacity Mechanism Review Working Group

Meeting 2022_06_02

2 June 2022

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

Meeting Protocols

- Please place your microphone on mute, unless you are asking a question or making a comment
- Please keep questions relevant to the agenda item being discussed
- If there is not a break in discussion and you would like to say something, you can ‘raise your hand’ by typing ‘question’ or ‘comment’ in the meeting chat
- Questions and comments can also be emailed to energymarkets@energy.wa.gov.au after the meeting
- The meeting will be recorded and minutes will be taken (actions and recommendations only)
- Please state your name and organisation when you ask a question
- If you are having connection/bandwidth issues, you may want to disable the incoming and/or outgoing video

Agenda

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9	Next Steps	Chair	Discussion	5 min
10	General Business	Chair	Discussion	5 min
	Next meeting: 16 June 2022			

5. Timeline

Project Timeline

30/05

Stage	Step	Short description	Analysis	21/01	28/01	4/02	11/02	18/02	25/02	4/03	11/03	18/03	25/03	1/04	8/04	15/04	22/04	29/04	6/05	13/05	20/05	27/05	3/06	10/06	17/06	24/06	1/07	8/07	15/07	22/07	29/07	5/08	12/08	19/08	26/08	2/09	9/09	16/09	23/09
1	Working group meetings		RCM Working Group meetings	WG				WG				WG							WG				WG		WG					WG									
1	MAC meetings		MAC meetings							MAC					MAC						MAC						MAC							MAC					
1	Step 1	Requirements analysis	(a)International Literature review																																				
1	Step 1		Gather assumptions and set up models																																				
1	Step 1		(b)Model system stress																																				
1	Step 1		(c)Analyse the required capacity services																																				
1	Step 2	Review Planning Criterion	(d)Assess the Planning Criterion																																				
1	Step 2		(e)Assess the ICAP and UCAP Concepts																																				
1	Step 3	Review CRC allocation	(f)Assess CRC Allocation and identify options																																				
1	Step 5	Model CRC allocation	(h)Scenario Analysis - Model CRC allocation options																																				
1	Step 4	Review BRCP	(g)Analysis of the BRCP																																				
1	Consultation paper		Consultation paper																																				

Purpose of this Session

- In this session we will discuss options for CRC allocation and capacity credit allocation
- We will present a set of draft options for assessment in the next stage of modelling, where we seek to quantify the effects of the various options on the economics of different technologies and evolution of the generation fleet
- We seek input and guidance from the working group on the options selected for further consideration

Three key topics:

1. How to determine the contribution to resource adequacy for different facility capabilities?
2. How to account for outages?
3. How to recognise the contribution to other aspects of reliability (particularly flexibility)?

Relevant comments from previous meetings to be considered in the review – general

This slide will be taken as read and not presented.

comment/feedback	Response
Need to be realistic about the duration of interruptions demand side providers will offer, especially if relying heavily on demand side reductions.	To be considered in design of demand response certification method.
Applying overly onerous penalties and creating missing money for intermittent generation needs to be avoided to meet the net-zero emissions target. Mr Carlberg suggested that one way to achieve this could be having different capacity buckets, potentially with different periods where they have guaranteed capacity payments.	Will be assessed through the design and modelling.
Reliance of generation from a single location can also be an issue e.g. in case of outages or network congestion.	Will be assessed through the design and modelling.
The certification requirement for Scheduled Generators to demonstrate sufficient fuel contracts and transport arrangements to maintain 14 hours of continuous operation imposes unnecessary high costs on Market Generators	Will be considered in design of CRC allocation.

Relevant comments from previous meetings to be considered in the review – ELCC

This slide will be taken as read and not presented.

comment/feedback	Response/action
If using an ELCC approach to set CRC, a facility may have different contributions under each limb of the planning criterion.	To be considered in design of CRC allocations.
If there are only few system stress events the ELCC method may deliver very volatile outcomes and therefore may not send clear signals as to when intermittent generators should be available.	To be considered in further assessment of options for ELCC method.
The ELCC method is complex and difficult to explain to investors.	To be considered in further assessment of options for ELCC method.
About ELCC: Less complexity and less volatility would be an advantage.	To be considered in further assessment of options for ELCC method.
About ELCC: Correlation can be overstated and the impact be overestimated if only a few events of system stress are considered	To be considered in further assessment of options for ELCC method.

Note that the RCM Review is considering ELCC fresh and does not build on the ERA's RLM Review and the associated Rule Change Proposal. However, analysis from that review and rule change process will be considered.

Relevant comments from previous meetings to be considered in the review – ICAP vs UCAP

This slide will be taken as read and not presented.

comment/feedback	Response/action
• Forced Outages should not be considered when allocating Certified Reserve Capacity (CRC) to generators and that this would increase risk to generators without improving reliability. • There are adequate incentives for generators to be available. • Forecasting outages is unlikely to be more accurate than applying a reserve margin. • Historic outages do not predict future performance and derating capacity for past outages will disadvantage generators that run more often because they have the greatest outage risk while also have the highest incentive to be available.	To be considered when modelling ICAP vs UCAP
concern about the risk to the reliability of the system from generators not delivering capacity when needed, including scheduled generators and renewable generators	To be considered when modelling ICAP vs UCAP To be considered in the design of CRC allocations.
It is important to review the purpose of the reserve margin and whether it is the best way to manage the effect of outages as it creates a free riding problem	To be considered when modelling ICAP vs UCAP.

6. CRC: Contribution to Resource Adequacy

Current WEM Arrangements (1)

Overview

Facility class	Component	Certification Method	Description
Scheduled and semi scheduled facility	Non-intermittent generating system	Capability at 41℃	Energy they can send out at 41℃.
Scheduled and semi scheduled facility	Intermittent generating system (IR)	Relevant Level Methodology (RLM)	Historical Intermittent Generating System output during Trading Intervals when surplus capacity (after intermittent generation) is the lowest, and therefore the system is under greatest stress.
Scheduled and semi scheduled facility	Electric Storage Resource (ESR)	Linear Derating Capacity	Ability to sustain output during The Electric Storage Resource Obligations Intervals during a Trading Day, given their storage (MWh) capability and capacity (MW).
Non-scheduled facility	Non-intermittent, IR, ESR	RLM	Historical output during Trading Intervals when surplus capacity (after intermittent generation) is the lowest, and therefore the system is under greatest stress.
Non-scheduled facility – only ESR	ESR	Linear Derating Capacity	Same as scheduled ESR facility.
Demand Side Participation		Relevant Demand	Based on the DSP's ability to curtail load relative to its Relevant Demand, which is indicative of the historical consumption of its Associated Loads during peak Trading Intervals.

Current WEM Arrangements (2)

Relevant Level Methodology

$$RLM\ (MW) = average\ output\ - \left(K + \frac{U}{average\ output} \right) \times variance\ of\ the\ output$$

- Output calculated during 5 historic years during periods where demand net of the sum of the output of all intermittent generators are the highest: **when output from scheduled generators is the highest. (**Load for Scheduled Generation or LSG)
- **The value of K depends on the probability distribution of demand and available capacity of existing resources and their correlation.** For instance, the outage rate of scheduled generators affects the value of parameter K. Outage rates determine the probability distribution of the available capacity of scheduled generators.
- **The value of parameter U** (added to address a lack of data about the performance of intermittent generators during extremely high demand periods) **is the ratio of**:
  - change in LSG, on days with peak LSG when air temperature was above 38 degrees Celsius to:
  - the mean output of the fleet of intermittent generators during peak LSG trading intervals

Note: The WEM Rules do not provide guidance on determination of K and U, but these are the definitions used by the ERA in its most recent review.

International Review

Overview

Market	Non-intermittent generation system	Intermittent system	ESR	DSP
Ireland	Derated based on historic outage	Class of resource derated based on historic outage	Derated based on historic outage	Based on historic performance
UK	All capacity facilities are derated to account for unplanned plant closure or maintenance **seasonally**	Based on **Equivalent Firm Capacity (EFC)**	Based on historic performance	Based on historic performance
ISO NE	Median of the existing generating capacity resource's summer or winter seasonal claimed capability rating for the previous five years	Seasonal median output during reliability hours, currently investigating **Marginal Reliability Index MRI**	Historic performance	Reliability measured during historical peak demand or system stress periods
PJM	Nameplate capacity around the year subject to EFORd	**Effective Load Carrying Capability (ELCC)**	Nameplate capacity subject to EFORd from the availability of the component equipment	Resource's estimated demand reduction value as submitted and reviewed

Effective Load Carrying Capacity (1)

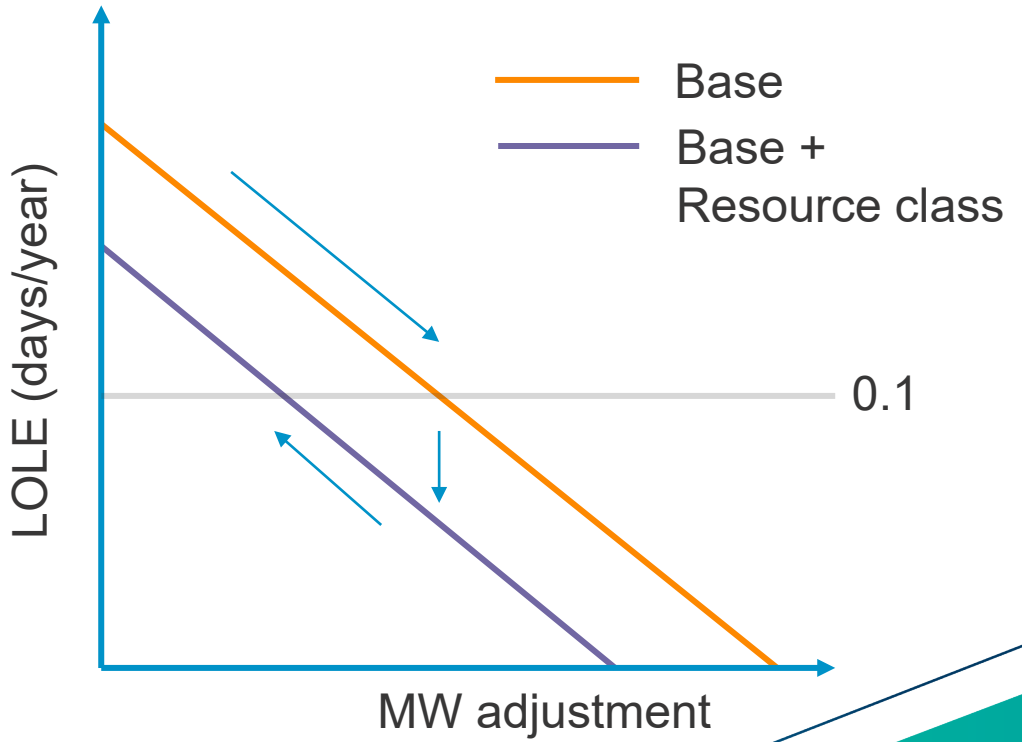
A resource's ELCC value measures the equivalent amount of additional load the system could serve ("carry") with the resource (versus without it), while meeting the same LOLE

- Determining LOLE in base case
- Adding resource to base case
- Adjusting load until LOLE is back to same level

$$ELCC = \frac{Load\ added\ (MW)}{Resource\ nameplate\ added\ (MW)}$$

Marginal ELCC: the incremental capacity value of a resource measured relative to an existing portfolio – individual resources or resources of same type are attributed an ELCC based on their marginal contribution to resource adequacy (e.g. wind class, solar class)

Portfolio ELCC: the combined capacity contribution of a combination of intermittent and energy-limited resources. This method inherently captures all interactive effects (e.g. wind + battery, solar + battery)



Effective Load Carrying Capacity (2)

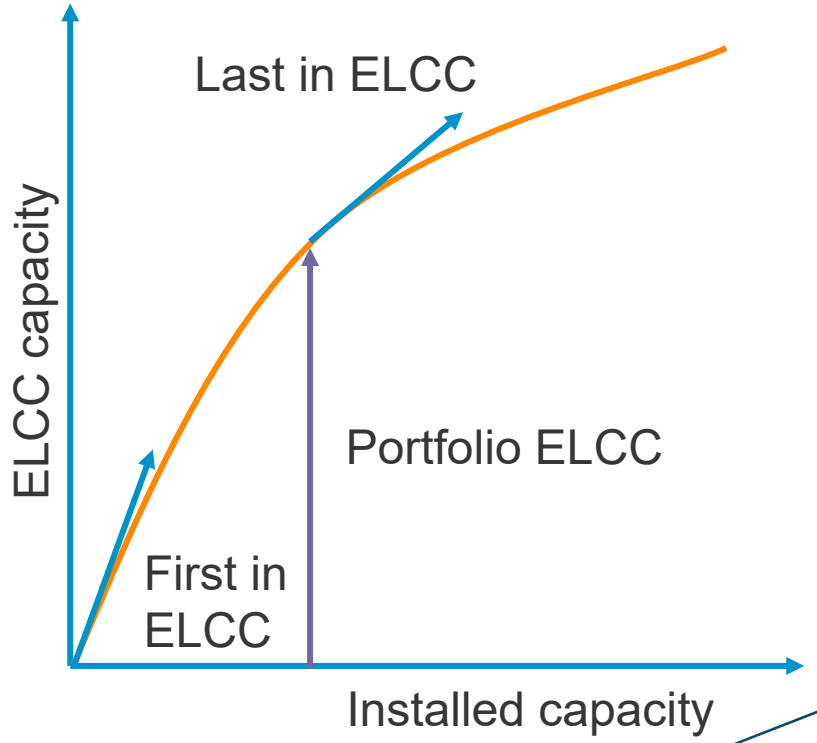
Delta method

Portfolio ELCC (P): Portfolio ELCC is the total ELCC provided by a combination of intermittent and energy-limited resources.

The First-In ELCC (FI_i): The marginal ELCC of each individual resource in a portfolio with no other intermittent or energy-limited resources.

The Last-In ELCC (LI_i): The marginal ELCC of each individual resource when taken in context of the full portfolio.

$$ELCC_i\ (each\ resource) = LI_i + (P - \sum_{j=1}^{n} LI_j)(\frac{LI_i - FI_i}{\sum_{j=1}^{n} LI_j - FI_i})$$

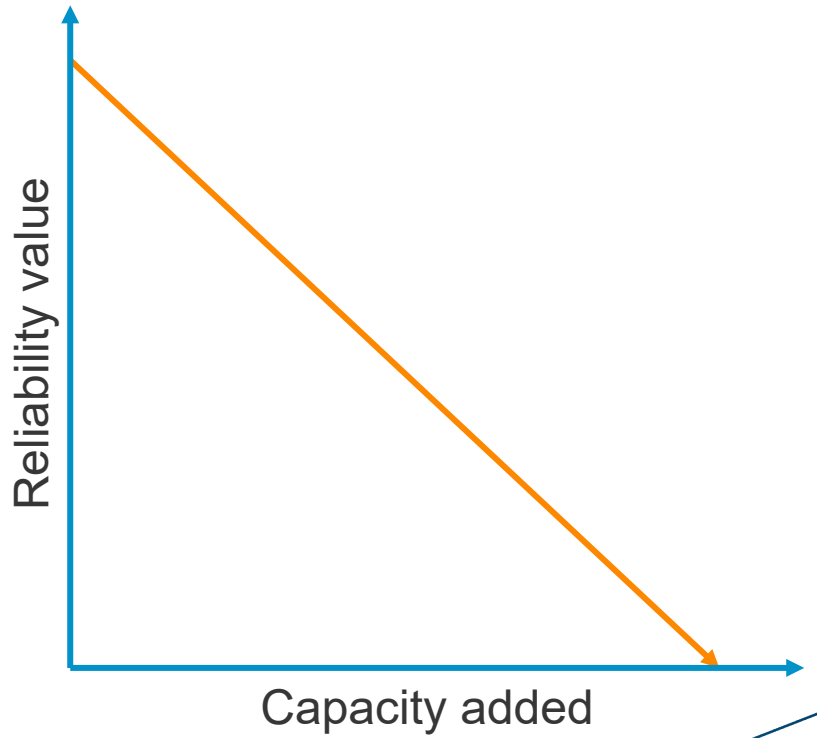


Marginal Reliability Index

A resource's MRI value measures the incremental impact of its 'last' MW on system LOLE, relative to the incremental impact of 'perfect capacity'

- First with base case reflecting the expected system resource mix, including the nameplate capability of the resource class being examined and increase load so $LOLE_1$ is 0.1 days/year.
- Add to the base case an incremental amount of nameplate capability for the resource class being examined $\{\text{x MW}, LOLE_2\}$.
- Add to the base case the same incremental amount of 'perfect capacity' $\{\text{x MW}, LOLE_3\}$ but here $LOLE_3 < LOLE_2$

$$\boldsymbol{MRI = \frac{(0.1 - LOLE_2)}{(0.1 - LOLE_3)}}$$



Equivalent Firm Capacity

An EFC is defined as the precise amount of perfectly reliable firm capacity a resource can displace while maintaining the exact same level of risk on the system

- First the LOLE is noted with base case reflecting the expected system resource mix, including the nameplate capability of the resource class being examined.
- A certain amount of perfect capacity is added in the place of resource class being examined until LOLE is back to previous amount.

$$\boldsymbol{LOLE(R \cup \{i\}) = LOLE(R \cup efr_R(i))}$$

Similarities

- MRI and EFC are similar. Both measure the reliability by replacing intermittent facility class with firm generation capacity (perfect capacity):
  - In **MRI**, the **difference in LOLE** is calculated when **x MW** of intermittent is replaced with **x MW** of perfect capacity
  - In **EFC**, the **LOLE is kept the same** by replacing **x MW** of intermittent with **y MW** of perfect capacity
- ELCC and EFC are also similar. Both measure the capability of the resource by keeping the LOLE constant:
  - In **EFC**, the **LOLE is kept the same** when **x MW** of intermittent is replaced with **y MW** of perfect capacity
  - In **ELCC**, the **LOLE is kept the same** by adding **y MW** of load for the addition of **x MW** of intermittent

Proposed Options for Assessment

1. Amend (but retain) distinct methods for different capacity types:
    - Non-intermittent: nameplate*
    - Intermittent: ELCC
    - Storage: linear derating
    - DSP: ELCC
2. Probabilistic assessment for all capacity types, using ELCC (focus on 2030/2050)

Does the group concur with these options?

Should other options be considered?

* Outage treatment discussed in next section

ELCC assessment – further detail

- ELCC will be calculated for individual facilities, not facility classes
- The delta method will be used to account for and distribute fleet effects
- We will use *forecast* demand traces (consistent with other modelling)
- Assume storage and demand side resources are used to maximise peak shaving.
- Modelling will not include differential treatment for existing and proposed facilities. In practice we could adopt a similar approach to the NAQ assessment, where AEMO first calculates ELCC for the existing/committed fleet, and then for new facilities, to avoid having ELCC reduced by new facilities.

ELCC methodology – dealing with volatility

Because the modelling is mostly forward looking, it is geared towards informing long term average outcomes. Parked for now are volatility issues relating to intermittent facilities:

- Volatility of outcomes unrelated to performance or external changes (e.g. underlying load)
- Correlation between weather and load and renewable generation
- Small sample of historical system stress events (meaning new system stress events potentially having a large effect on the outcome from year to year).

Options for mitigating volatility include:

- Excluding events outside the planning criterion from the input dataset
- Adjusting intermittent facility performance for outliers (either at participant request or AEMO discretion)
- Adjusting demand based on other criteria to simulate additional system stress events.

7. CRC: Treatment of Outages

Capacity Valuation

Installed capacity (ICAP)

- Physical generating capacity adjusted to ambient weather conditions
- Using ICAP rather than UCAP has the risk of rewarding poorer performing resources
- 1 MW of ICAP across resources does not provide same reliability

  E.g., $\boldsymbol{Coal \neq Gas \neq Wind\ (MW\ ICAP)}$
- $\boldsymbol{UCAP = ICAP}$ for variable resources given their intermittent nature

Unforced Capacity (UCAP)

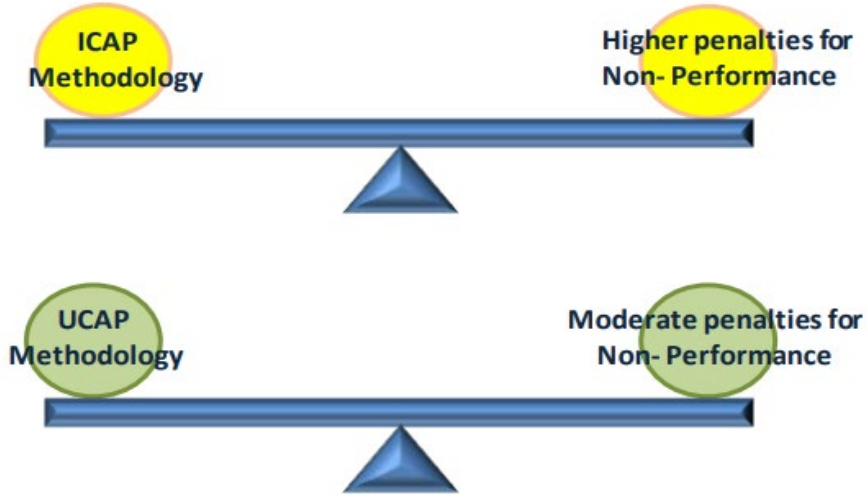
- Generating capacity available after forced outage rate (EFORd) taken into account

  $$\boldsymbol{UCAP = ICAP * (1 - unit's\ EFORd)}$$
- UCAP creates stronger alignment between the product procured and the product expected to be delivered
- 1 MW of UCAP is a comparable product/service across all capacity providers

  E.g., $\boldsymbol{Coal = Gas = Wind\ (MW\ UCAP)}$
- For Intermittent, UCAP is evaluated based on the generator's historical generation during peak hours

ICAP v UCAP: issues

- Since ICAP does not account for failure probabilities for individual generators – penalties for non-performance need to be stronger to ensure in the same level of system reliability.
- UCAP bases capacity allocation based on historic performance and will not necessarily reflect future performance.



- Participants would need to be able to submit that certain outages are one off and should not be incorporated into historic outage rate
- Need to consider method to determine EFORd for facilities which are seldom dispatched.

Proposed Options for Assessment

We will calculate the effect on CRC allocation *for non-intermittent generators* of:

- ICAP
  - Probabilistic method assumes facilities are fully available
  - Peak limb of planning criterion accounts for expected outage rate or single largest contingency
  - Refunds paid for planned outages above a threshold, and forced outages (as now)
- UCAP
  - Probabilistic method assumes stochastic outages with EFORd based on historic facility outage rates (or class average for new facilities), but facilities are otherwise fully available.
  - Peak limb of planning criterion only accounts for single largest contingency.
  - Refunds paid only when actual (planned + forced) rate exceeds expected rate

Note: Refunds not relevant for modelling, as modelled outage rates will equal expected rates.

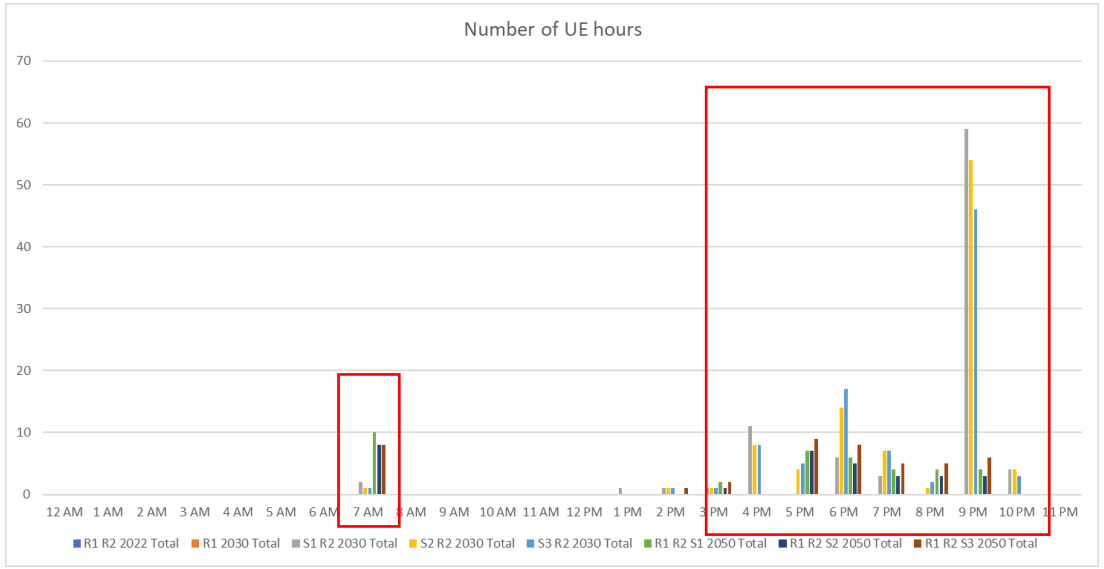
8. CC Allocation: Preference for Flexibility

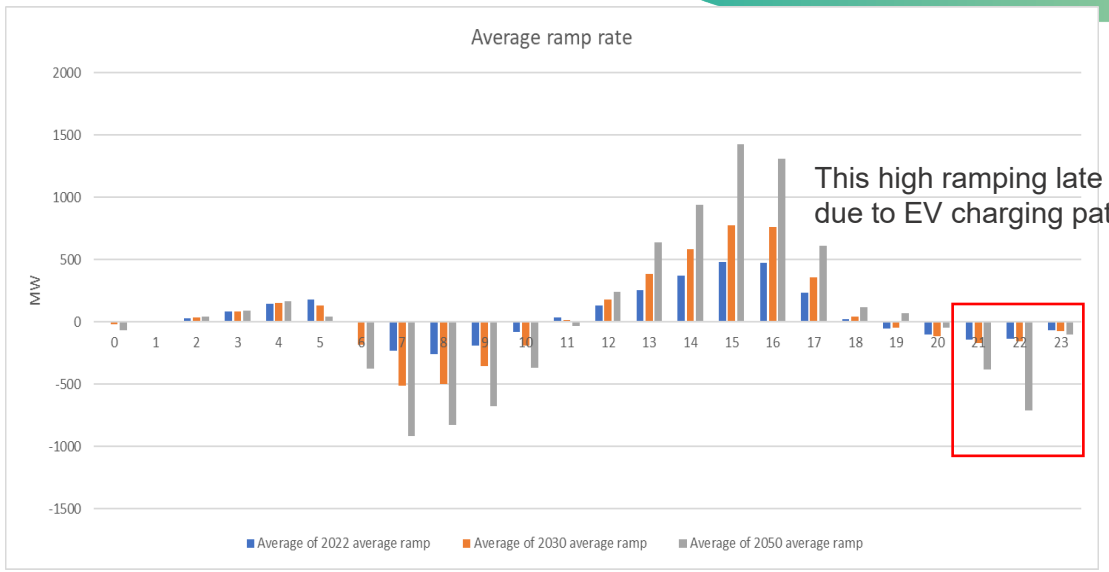
What is the purpose of the RCM

"***The purpose of the RCM is to ensure acceptable reliability of electricity supply at the most efficient cost***"

- Historically, 'acceptable reliability' could be achieved by procuring sufficient MW to avoid unserved energy at during peak demand throughout a hot day.
- In future, the peak demand will not last all day, and having sufficient MW to meet the peak may not be sufficient to maintain acceptable reliability (avoid unserved energy).
- ELCC is an important factor in the reliability contribution of a facility, but it is not the only factor. Also affecting facility contributions are:
    a. How firm the capacity is
    b. Whether it has any fuel restrictions
    c. Whether it has any availability restrictions (e.g. cannot be called at certain times).
    d. Whether it can change output quickly
    e. Whether it has a minimum generation level

Classification of Facilities





This high ramping late night is due to EV charging pattern

- The SWIS will have even higher solar penetration in 2050
- We need to make sure the fleet includes facilities which provide capacity in the evening when solar output is low
- Firm generation will also be needed in the morning (before BTM solar ramps up)

- It will be important to have facilities that can ramp up fast in the evening, and facilities that can ramp down fast in the morning.
- In future intermittent generators may be well placed to provide fast ramping service in both directions as they increasingly pre-curtail.

Proposed Options for Assessment

Capacity products

Options to be considered:

1. No differentiation, all CRC is awarded CC. (modelling may show we get sufficient flexible capacity without specific preferences).
2. Separate capacity products with their own quantity requirements and price curves:
    - A peak capacity product that is largely similar to what we have today
    - A flexibility capacity product for which the quantity is set by modeled ramping needs (and ideally dispatched through a defined ramping FCESS)

Does the group concur with these options?

Should other options be considered?

Capacity Products – Further Detail

- AEMO procures peak capacity first, then assesses whether fleet meets the flexibility requirement. If fleet does not meet the flexibility requirement, then AEMO procures flexibility product. Both existing and new facilities would be compensated for providing flexibility, and Facilities providing flexibility have a fixed price option (similar to that for peak capacity facilities).
- Facilities are not required to be available at all times. AEMO determines availability obligation hours for:
  - Peak product based on likelihood of unserved energy
  - Flexibility product based on likelihood of inability to meet ramp
- AEMO will set initial obligation hours at procurement time but can amend if circumstances change (similar to current approach to ESR obligation hours).
- Participants nominate their own fuel storage duration, which is used in ELCC calculations and Capability Class allocation.
- Other issues:
  - Only firm capacity with low minimum generation eligible to provide flexible capacity product
  - BRCP for the flexible capacity product would need to account for payments for the peak capacity product.

Proposed Options for Assessment

Acknowledging other dimensions of capability

Options to be considered:

1. Availability classes (per current):
    - Class 1: Intermittent and non-intermittent
    - Class 2: Storage and DSPs
2. Capability classes:
    - Class 1: Unrestricted firm capacity (no fuel/availability limitations)
    - Class 2: Restricted firm capacity (fuel/availability limitations)
    - Class 3: Non-firm capacity

Proposing to *not* consider including flexibility as another dimension of the capability classes, instead dealing with it as a separate capacity product.

Does the group concur with these options?

Should other options be considered?

Capability Classes – Further Detail

- AEMO procures capacity up to the RC target from the facilities in order of capability class. If there is more CRC than the RCT, facilities in later capability classes may not be allocated capacity credits.
- Any technology can nominate for any capability class. This includes DSPs and pure intermittent generators. Facilities will need to provide evidence to support their nominated class (particularly their ability to meet availability obligations), and can be placed in another class if performance does not match certification.
- Unrestricted firm capacity would have availability obligations in all obligation hours.
- Restricted firm capacity would have availability obligations in all obligation hours
- Non-firm capacity would have no availability obligations (but would expect to receive proportionally fewer capacity credits than other classes)

9. Next Steps

Next steps

- **Assess CRC allocation options and conduct economic modelling**
- **Next Working Group meeting mid July 2022**
  - Discussion: BRCP approach
- **Questions or feedback can be emailed to energymarkets@energy.wa.gov.au**

We're working for Western Australia.