Government of Western Australia
Energy Policy WA

Meeting Agenda

Meeting Title:	Reserve Capacity Mechanism Review Working Group (**RCMRWG**)
Meeting Number:	2022_05_05
Date:	Thursday 5 May 2022
Time:	9:30 PM to 11:30 PM
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_03_17	Chair	Decision	3 min
4	Actions Items	Chair	Noting	5 min
5	Project Timeline	RBP	Discussion	10 min
6	System Stress Modelling Outputs	RBP	Discussion	40 min
7	Capacity Services	RBP	Discussion	20 min
8	Planning Criterion	RBP	Discussion	20 min
9	Support for Preliminary Directions	RBP	Discussion	5 min
10	Next Steps	Chair/RBP	Discussion	5 min
11	General Business	Chair	Discussion	5 min
	Next Meeting: 9 June 2022 (TBC)			

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:	17 March 2022
Time:	9:35am – 11:50am
Location:	Microsoft TEAMS

Attendees	Company	Comment
Dora Guzeleva	Chair	
Paul Aires	Bluewaters Power	
Rhiannon Bedola	Synergy	
Oscar Carlberg	Alinta Energy	Subject matter expert (**SME**)
Manus Higgins	AEMO	
Peter Huxtable	Water Corporation	
Mark McKinnon	Western Power	
Wendy Ng	Shell Energy	
Patrick Peake	Perth Energy	
Jacinda Papps	Alinta Energy	
Toby Price	AEMO	SME
Matt Shahnazari	Economic Regulation Authority	
Noel Schubert	MAC Small-Use Consumer representative	Observer
Dev Tayal	Tesla Energy	
Andrew Walker	South32 (Worsley Alumina)	
Rebecca White	Collgar Wind Farm	
Richard Bowmaker	Robinson Bowmaker Paul (**RBP**)	
Ajith Sreenivasan	RBP	
Tim Robinson	RBP	
Stephen Eliot	Energy Policy WA (**EPWA**)	
Laura Koziol	EPWA	

Apologies	From	Comment
Andrew Stevens	Clear Energy	
Dale Waterson	Merredin Energy	

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_02_17** Draft minutes of the RCMRWG meeting held on 17 February 2022 were distributed in the meeting papers on 10 March 2022. The RCMRWG accepted the revised minutes as a true and accurate record of the meeting, subject to some minor corrections. **Action: RCMRWG Secretariat to publish the minutes of the 17 ~~March~~ February 2021 RCMRWG meeting on the RCMRWG web page as final.**	**RCMRWG Secretariat**
4	**Action Items** The paper was taken as read. **Action item 3**: The Chair noted that Mr McKinnon had provided the MAC Secretariat with Western Power's assumptions about the value of lost load (VOLL) on 10 March 2022. The RCMRWG closed action item 3.	
5	**International Review Scope** Mr Robinson presented an overview of the international review scope.	
6	**Market Summaries** Mr Sreenivasan presented a summary of the jurisdictions investigated. The following key points were raised: • Mr Dev Tayal asked if the international review had identified any markets that explicitly focused on fast ramping or flexible capacity. Mr Robinson answered that none of the markets investigated is addressing flexibility in the capacity mechanism. However, the issue that the capacity product from slow ramping facilities is less flexible than form fast ramping facilities has been raised and is being investigated in some markets, and a submission to the Federal Energy Regulatory Commission has been made that seeks to address the issue.	

Item	Subject	Action

Mr Tayal asked if Western Australia was also the first market having to address minimum operational load. Mr Robinson confirmed that this is the case.

- In regard to the capacity mechanism in PJM, Mr Carlberg considered that:
  - Locational pricing will be too complex for the Wholesale Electricity Market (**WEM**) given its size.
  - PJM's price curve would be too steep for the WEM as it would be too sensitive and therefore volatile. This would undermine certainty when it is needed the most due to the increase of intermittent generation.
  - An auction would also cause price volatility.

  Mr Tayal agreed with Mr Carlberg's comments.
- Mr Robinson confirmed that the methodology used to determine the Benchmark Reserve Capacity Price (**BRCP**) is similar to the concept of (gross) cost of new entry (**CONE**).

  Mr Carlberg considered that using the Net-Cone concept may be problematic in the WEM considering the ongoing increase of generation from intermittent generation. Mr Carlberg considered that the RCM should play a bigger role and account for all the costs a new entrant will face.

  Mr Shahnazari noted that considering Net-CONE will be more valuable if the benchmark technology for setting the BRCP changes. Currently the BRCP is based on a generator using liquid fuel that does not participate much in other markets. However, if the benchmark technology changes to renewable generators or batteries, the revenues from other markets should be considered to avoid excess capacity.

  Mr Robinson noted that the BRCP only sets the price cap and that the price curve will also influence the setting of the Reserve Capacity Price.
- Mr Carlberg supported PJM's approach to assess the reliability of intermittent generators based on their performance during defined time bands because of its simplicity.
- Mr Shahnazari clarified that the capacity value of scheduled generators in the PJM is estimated based on historical performance during system stress periods using the equivalent demand forced outage rate to derate the installed capacity of scheduled generators. This aligns with the concept underpinning the effective load carrying capability (**ELCC**).
- Mr Carlberg considered that a target loss of load expectation (**LOLE**) is still useful even though it does not account for the

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magnitude and duration of the loss of load event. For example, it could be used to set fuel requirements for Scheduled Generators.

- Mr Carlberg considered that a higher LOLE target (more hours of outage) will lower the Reserve Capacity Requirement and has the potential to lengthen the amount of fuel/storage availability required.
- Mr Robinson confirmed that PJM introduced the minimum offer price rule as a market power mitigation measure.
- Mr Robinson clarified that the UK introduced strict emission criteria for the determination of a facility's eligibility to participate in the capacity mechanism.
- Mr Walker asked which of the investigated jurisdictions is most similar to the WEM in regard to the load shape, considering the mix of industrial and residential load as well as anticipated electrification.

  Mr Robinson noted that the WEM had a flatter industrial load than all of the other jurisdictions investigated, and no other jurisdiction is experiencing the WEM's level of mid-day low load. However, Ireland is the most similar jurisdiction having the highest penetration of renewable generation and having to address the resulting volatility and variability. Additionally, Hawaii is currently addressing the issue of low load at midday but without a capacity mechanism.
- Mr Robinson clarified that, in jurisdictions with multi-year auctions, the capacity requirement is updated based on the latest forecast so that the participants can adjust their position close to the delivery period.

  The Chair noted that the WEM allows participants to declare bilateral trading, without checks and balances, which provides certainty while allowing the same position adjustment as an auction.
- Mr Shahnazari considered that the current RCM lacks a mechanism that accounts for the uncertainty of availability in the capacity evaluation, especially for renewable generators. Mr Shahnazari considered it is important to investigate performance mechanisms to ensure that the risk of renewable generators not delivering their capacity value is shifted form the customers to the generators.

  Mr Carlberg considered that:

  - 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.
  - Historic outages do not predict future performance and derating capacity for past outages will disadvantage generators that run

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more often because they have the greatest outage risk while also have the highest incentive to be available.

Ms Ng, Ms White and Mrs Bedola agreed with Mr Carlberg.

Mr Shahnazari noted that the ERA identified several areas of concern about the risk to the reliability of the system from generators not delivering capacity when needed, including scheduled generators and renewable generators. The ERA also found that a review of the Reserve Capacity Obligation Quantity is important.

- Ms Ng asked where the energy price caps are set in the jurisdictions investigated.

  Mr Robinson noted that the energy price caps in other jurisdictions are higher than in the WEM and offered to circulate this information to members, if desired.

7 Potential Applications for the WEM

Mr Robinson presented the potential lessons for the WEM. The following points were made:

- Mr Carlberg considered that, given the penetration of intermittent generation will decrease the traditional revenue streams of facilities, capacity payments will need to pay a larger role in incentivising and sustaining investment in generation~~in the WEM, it is important that capacity payments increase the life of facilities~~.
- Mr Carlberg considered that, in terms of sending locational signals and penalising or derating capacity in constraint areas, there seems to be consensus that the bigger issue is to ensure that sufficient transmission capacity is available. Mrs Bedola agreed with Mr Carlberg.
- Mr Carlberg considered that the problem Ireland encountered where Intermittent Generators did not participate in the capacity mechanism because of the penalty regime, is a good lesson for WA. Intermittent generation is already marginally economic, and this will get worse with lower energy prices, and CRC continuing to reduce under the current RCM. 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.

  The Chair noted that this issue will be assessed through the modelling.
- Ms Ng noted that, when considering excluding diesel generators form the RCM, the issue of fuel diversity and technology diversity

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should be considered. Ms Ng considered that the timing of any exclusion is important.

- Mr Peake noted that the limitation of focusing on a 1 in 10 year event that other jurisdictions are experiencing will become even more pronounced if surplus renewable generation is needed to minimise the need for storage capacity.

  Mr Carlberg agreed with Mr Peake and considered that this is why excess capacity should not influence the Reserve Capacity Price.

  The Chair noted that, in the absence of a reserve capacity auction, the only way to send appropriate price signals is by reflecting reserve capacity excess in the Reserve Capacity Price.

- Mr Carlberg cautioned not to be too confident in the ability to accurately forecast excess capacity.

- Mr Peake considered that the RCM should not only consider expected unserved energy but also defined energy shortage risk events.

- Mr Carlberg considered that the ELCC method has some merit for the assessment of intermittent generators because it assesses the contribution during system stress events, but cautioned that 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.

  Mr Carlberg further noted that the ELCC method is complex and difficult to explain to investors. Mr Carlberg noted that he would prefer a more approximate method that is less volatile so it sends a clearer signal and is easier understood by investors.

  Ms White agreed that less complexity and less volatility would be an advantage.

- Mr Robinson agreed that a facility's minimum generation affects its flexibility and will be considered in the assessment to the extent possible.

- Ms White and Mrs Bedola supported that the RCM should also consider the correlation of output from different resources, not only different technologies.

  Mr Price noted that, because of the output correlation, it is important to consider the impact on the Network Access Quantities if applying the ELCC method.

  Mr Carlberg considered that correlation can be overstated and the impact be overestimated if only a few events of system stress are considered.

  The Chair re-assured members that RBP is aware of the different views about how to account for output correlation under the ELCC

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method that were raised during the Rule Change Panel's consultation on the Rule Change Proposal: Method used for the assignment of Certified Reserve Capacity to Intermittent Generators (RC_2019_03).

- Mr Peake considered that, if gas plants will be only used to back up intermittent generation, they will be used to generate large quantities for short periods. This will result in expensive gas contracts and supply surges that may be difficult to handle.

  Mr Carlberg considered that coal plants are currently posing a higher risk because, while the WEM has a diversified amount of gas supply points, the supply points for coal are limited.

  Ms White considered that reliance of generation from a single location can also be an issue e.g. in case of outages or network congestion.

- Mr Carlberg reiterated his concern that high penalties and derating of capacity for non-performance may disproportionately impact the generators that run more often and currently have the greatest incentives to be available, as these generators are more exposed to outages. Mr Carlberg further considered that accounting for Forced Outages when assigning CRC may also result in double counting the impact of Forced Outages in the RCM, as the Planning Criterion already includes a margin for expected forced outages. This would result in unnecessary over-procurement.

  Mr Shahnazari considered that 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. Mr Shahnazari noted that other jurisdictions use the reserve margin for a different purpose.

- Mr Carlberg noted that the current WEM mechanism that allows a generator to secure a guaranteed capacity price for five years is only available under very limited circumstances.

  The Chair noted that the five-year price guarantee is available whenever AEMO cannot secure sufficient capacity to meet the Reserve Capacity Requirement under the annual Reserve Capacity Price.

  Mr Peake noted that any period for which a guaranteed capacity price may be available should enable the payback of investment and the required length will depend on the price level.

  Mr Carlberg agreed with Mr Peake and noted that different periods may be required for different technologies.

- Mr Carlberg considered that the Reserve Capacity price should not be based on excess capacity and provided the following reasons in writing via the chat function:

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- Given the size of our market excess is boom or bust, making price very volatile. A 10% excess in WA is only ~400-500MW.
- Volatile capacity pricing has not really changed investment decisions, a more crucial factor are power purchase agreements. Volatile capacity pricing will not incentivise capacity in a high renewable world.
- There is a significant level of capacity in the market that does not respond to economic signals and therefore capacity price.
- An alternative is to have different buckets of capacity we need to fill, and turning the tap off when we have enough, and limiting the length of time these capacity types are paid for, potentially to 10 years.
- The risk of a capacity shortage going forward will be a much bigger issue than excess capacity, particularly as the WEM is a small system.
- It is not possible to measure excess accurately. The POE10 forecast has been exceeded many times at the start of this year and it is very difficult to schedule outages. At the recent WA electricity consultation forum (WAECF) AEMO mentioned capacity was tight, yet the capacity price is below the floor.

Mrs Bedola noted that the curve for the Reserve Capacity Price should be shallower considering the high impact of a single facility in the WEM.

The Chair repeated that the Reserve Capacity Price is out of scope for the RCM Review, but these comments will be noted.

- The Chair reminded members that the price curves are out of scope for the RCM Review but that stakeholders can specify any related issues via email and EPWA will log them for noting and further assessment.
- Mr Tayal noted that the Energy Security Board (**ESB**) is currently consulting on the options for a reserve capacity mechanism for the National Electricity Market (**NEM**) beyond the three options presented in their recent paper. Mr Tayal suggested that EPWA consult with the ESB directly on that matter.

  Mr Robinson agreed that it would be beneficial to be aware on the development of the reserve capacity mechanism in the NEM beyond the consultation papers published.
- Mrs Bedola noted that the determination of the Individual Reserve Capacity Requirement is only considering consumption in the Hot Season.

Item	Subject	Action
8	**Modelling Assumptions** The slides were taken as read. The following points were made: • Mr Robinson clarified that the demand forecast will be undertaken for energy and capacity for each Trading Interval. • The Chair noted that the modelling will assume transmission capacity is upgraded where needed. • Mrs Bedola considered that assuming 5 kW of PV on every household for the demand forecast is too high. • Mr Robinson clarified that the system stress modelling will focus on the shape of the demand curve and that the actual level of the demand is less relevant.	
9	**Next Steps** The RCMRWG agreed that the report to the MAC should focus on the comments from the working group. The Chair noted that RCMRWG members could send any additional comments that they wished to be included in the report to the MAC until COB 18 March 2022. The RCMRWG agreed to hold the next meeting in early May 2022 to discuss the outcome of the initial findings of the system stress modelling.	
10	**General Business** No general business was discussed. The next RCMWG meeting is scheduled for 17 March 2022.	

The meeting closed at 11:50am.

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Agenda Item 4: RCMRWG Action Items

Reserve Capacity Mechanism Review Working Group (**RCMRWG**) Meeting 2022_05_05

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
3	Mark McKinnon to share Western Power's assumptions about VOLL from the recent access arrangements with the MAC Secretariat.	Mark McKinnon	2022_02_17	**Closed** Mr McKinnon provided the MAC Secretariat with the assumptions on 10 March 2022.
4	RCMRWG Secretariat to publish the minutes of the 17 March 2021 RCMRWG meeting on the RCMRWG web page as final.	MAC Secretariat	2022_03_17	**Closed** Minutes published on 21 March 2022

Government of **Western Australia**
Energy Policy WA

Reserve Capacity Mechanism Review Working Group

Meeting 2022_05_05

5 May 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

Item	Item	Responsibility	Type	Duration
1	Welcome and Agenda	Chair	Noting	5 min
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3	Minutes of RCMRWG meeting 2022_03_17	Chair	Decision	3 min
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8	Planning Criterion	RBP	Discussion	20 min
9	Support for Preliminary Directions	RBP	Discussion	5 min
10	Next Steps	Chair	Discussion	5 min
11	General business	Chair	Discussion	5 min
	Next meeting:	To be determined		

5. Timeline

Project timeline

29/04

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						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	(d)Assess the Planning Criterion																																				
1	Step 2	Criterion	(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 present initial results of the system stress modelling. This modelling is intended to inform the characteristics of the capacity service needed in the WEM.
- We will also discuss indicative directions for the defined capacity service and the planning criterion and seek input and guidance from the working group.
- As these issues are part of an overall design package, later stages may cause us to revisit these directions.

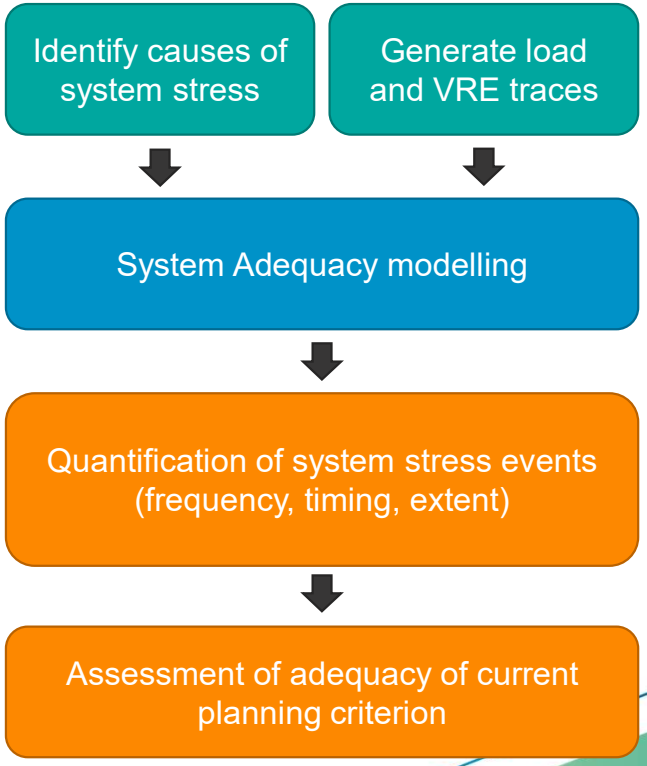
6. System Stress Modelling Outputs

Modelling Methodology – Recap

System Stress Modelling Objectives:

- Identify causes of system stress – current and future
- Quantify how the current generation mix (and other capacity sources) accommodate the identified types of system stress under credible demand scenarios (current, 2030 and 2050) and identify any deficiencies
- Assess whether the current Planning Criterion is adequate for meeting the capacity requirements of the SWIS

System Stress Modelling Methodology:



Modelling Methodology - Scenarios

Retirement Scenarios:

	2022	2030	2050
R1	Current capacity mix	Muja retires on schedule	All thermal plant retired
R2		All thermal baseload plant retires	

New Build Scenarios:

	2022	2030	2050
S1	Current capacity mix	New capacity as required in line with respective 2050 targets	Sufficient PV + wind by 2050 to meet energy requirement. Large storage capacity Some demand flexibility
S2			PV + Wind overbuild by 2050 reducing amount of storage required Less storage capacity Large demand flexibility
S3			Sufficient PV + wind by 2050 to meet energy requirement Green H2 thermal Some storage Some demand flexibility

Modelling Results – Capacity Additions

Capacity additions (MW) to achieve unserved energy (EUE) close to current reliability criterion:

Retirement scenario	New Build Scenario	Year	Solar	Wind	Green thermal (e.g. H2)	DSM/IR	Firming Resource (e.g. Storage)	Unserved Energy
R1	S1	2022	0	0	0	0	0	0.0000%
		2030	0	0	0	0	0	0.0000%
		2050	4445	4423	0	444	1333	0.0032%
	S2	2022	0	0	0	0	0	0.0000%
		2030	0	0	0	0	0	0.0000%
		2050	5721	5738	0	956	478	0.0031%
	S3	2022	0	0	0	0	0	0.0000%
		2030	0	0	0	0	0	0.0000%
		2050	5225	5200	522	522	522	0.0032%
R2	S1	2022	0	0	0	0	0	0.0000%
		2030	662	657	0	400	133	0.0001%
		2050	4445	4423	0	444	1333	0.0032%
	S2	2022	0	0	0	0	0	0.0000%
		2030	804	837	0	133	267	0.0013%
		2050	5721	5738	0	956	478	0.0031%
	S3	2022	0	0	0	0	0	0.0000%
		2030	662	657	133	133	267	0.0001%
		2050	5225	5200	522	522	522	0.0032%

Key:
New Build Capacities (MW)
Unserved Energy (%)

Modelling Results – Capacity Additions

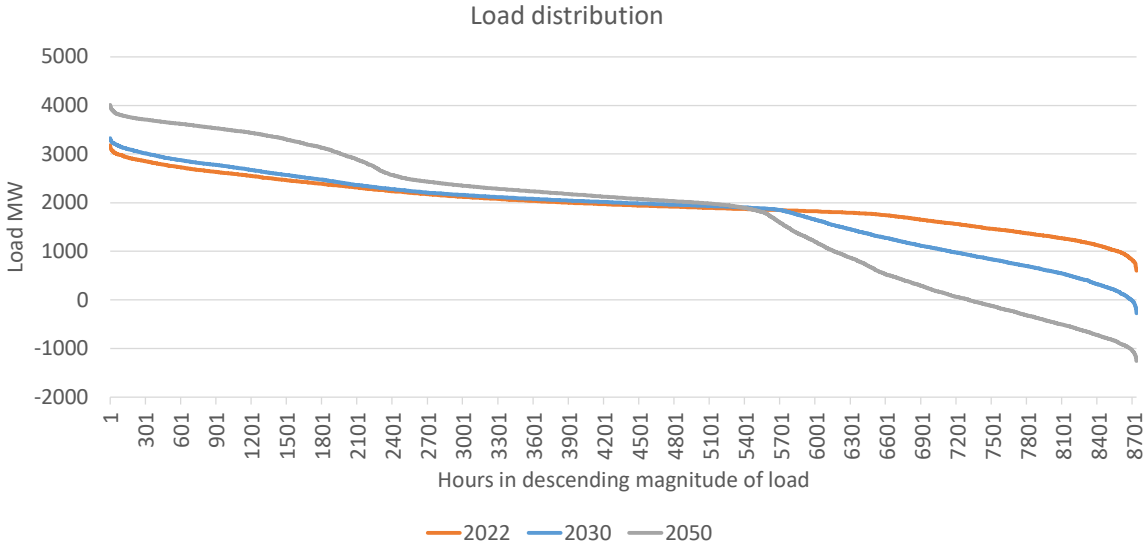
Key findings:

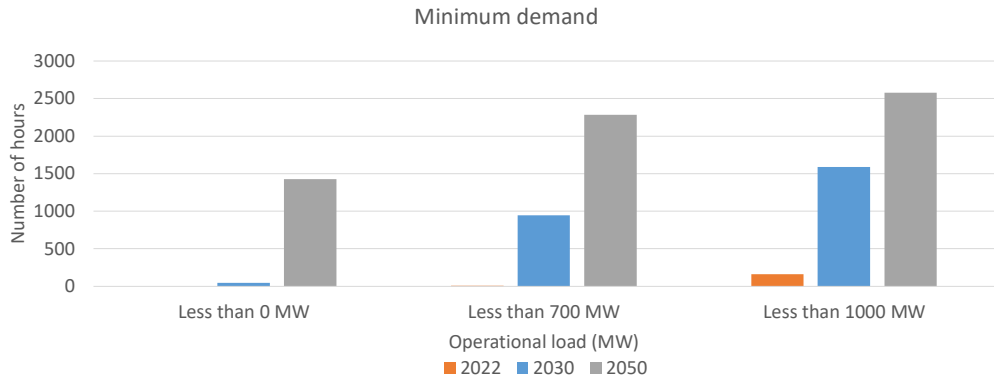
- Current excess of capacity in 2022
- Under retirement scenario R1 (Muja retires as planned), no additional capacity is required in 2030, and zero EUE results.
- Under retirement scenario R2 (All thermal baseload plant retires by 2030), > 1300 MW renewables build is required, plus storage/DSM to balance. EUE well under the current reliability criterion (0.002%) results
- New build scenario S1 (Sufficient PV + wind by 2050 to meet energy requirement) requires > 1.3GW firming resource to avoid excessive EUE
- New build scenario S2 (PV + Wind overbuild by 2050 reducing amount of storage required) requires almost 1GW of demand flexibility to avoid excessive EUE

Refinement of these scenarios is ongoing:

- Keep EUE of all scenarios within current planning criterion
- New build scenario S3 – More green thermal, less PV/wind

Modelling Results – Minimum Demand



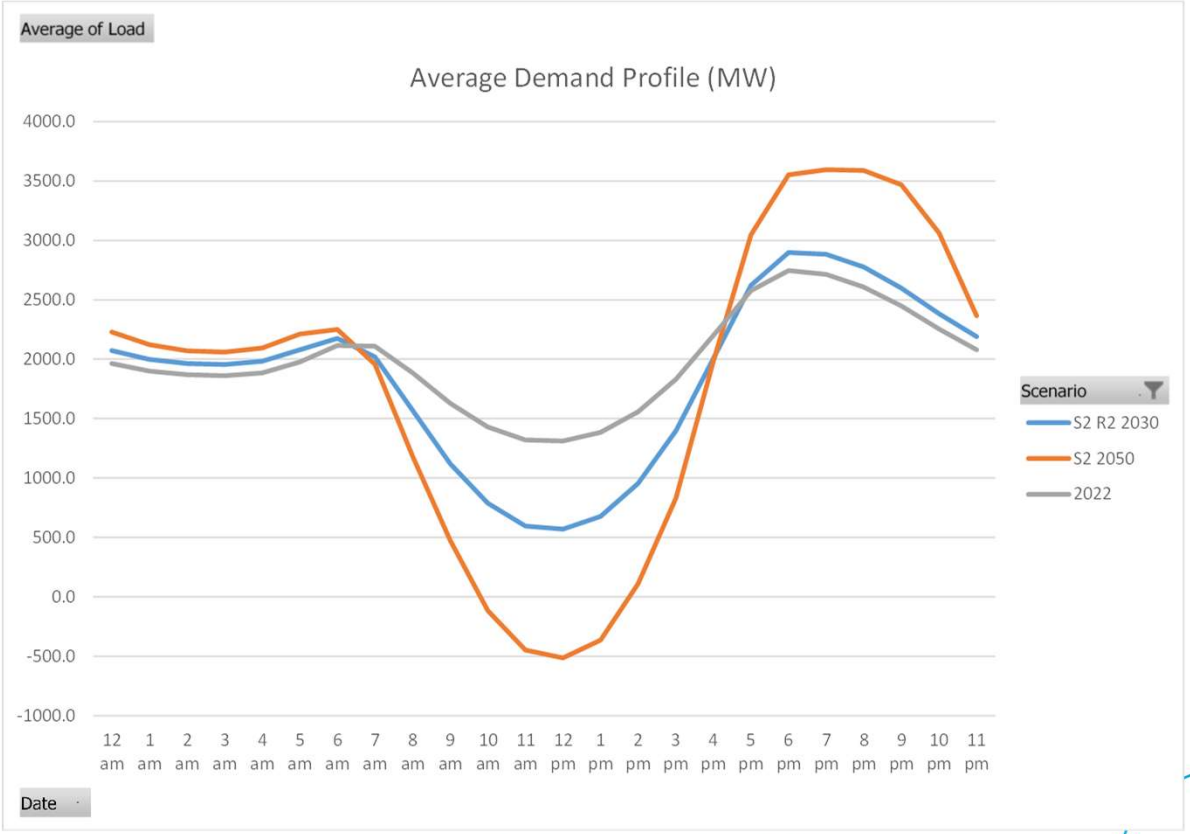


- Negative operational load experienced by 2030
- Significant negative operational demand experienced in 2050
- By 2050, demand is less than 700 MW for >2200 hours per year (25% of all periods)

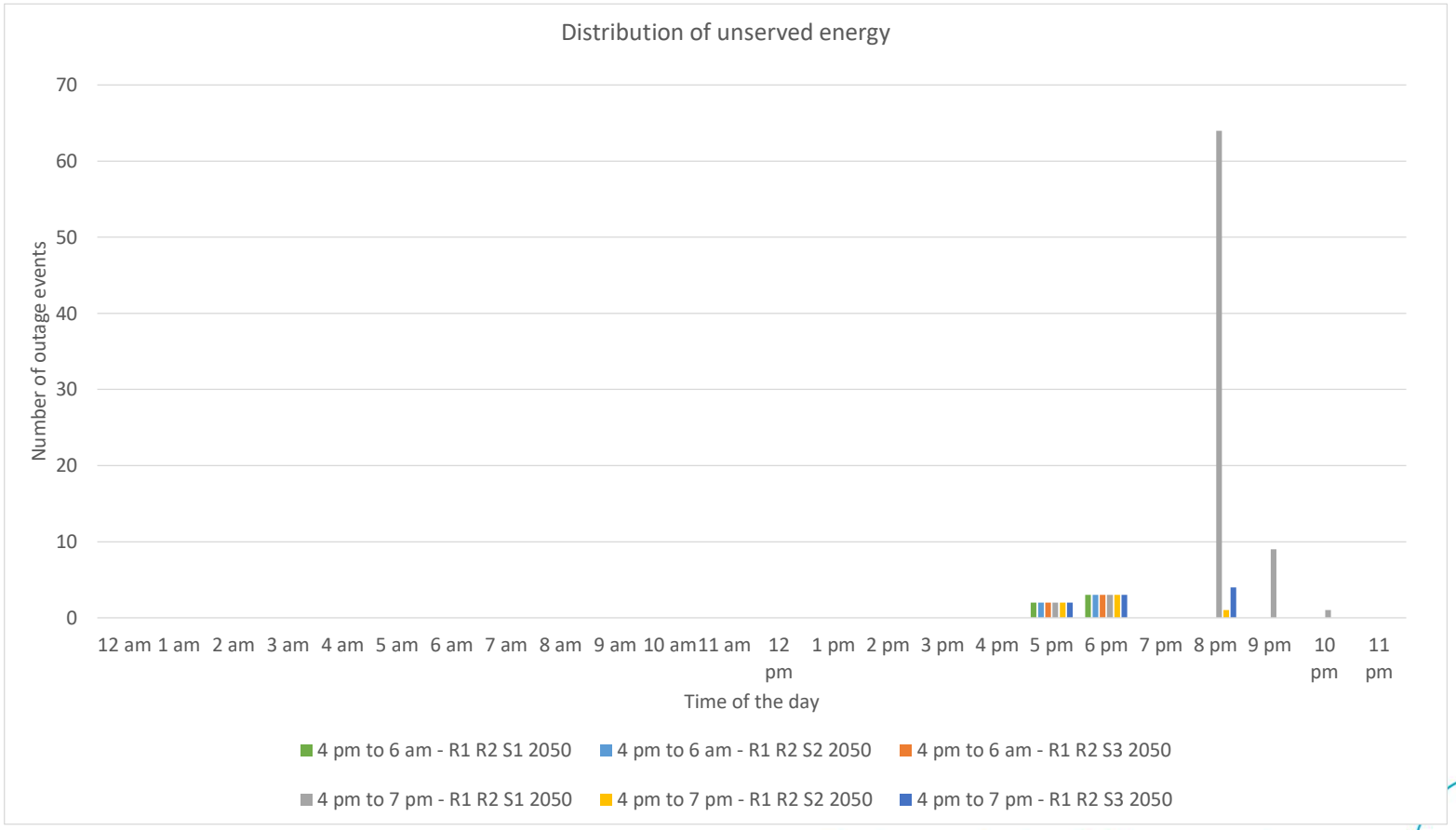
AEMO have previously cited 700 MW as the minimum level of operational demand for system stability – see https://www.aemo.com.au/-/media/Files/Electricity/WEM/Security_and_Reliability/2019/Integrating-Utility-scale-Renewables-and-DER-in-the-SWIS.pdf

Modelling Results – Evolving demand shape

System peak becomes later and flatter by 2050, occurring from 6:00pm to 9:00pm:

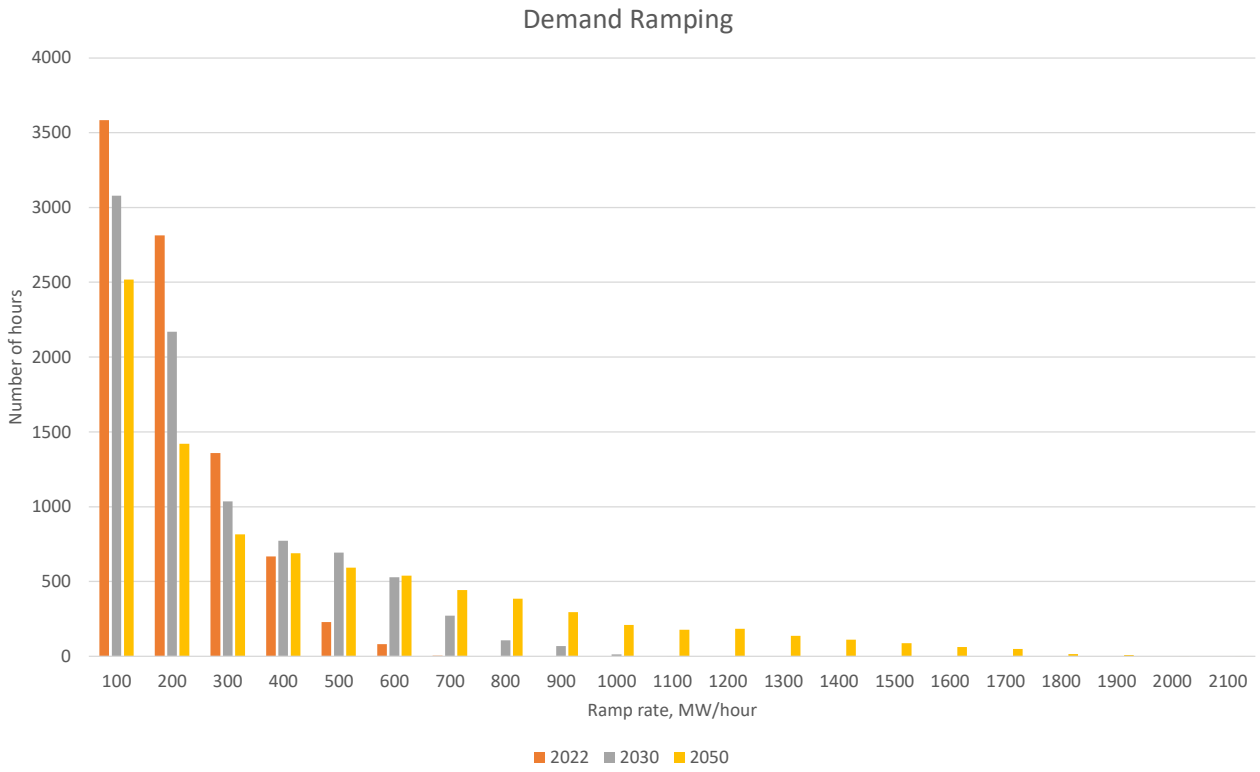


Modelling Results – Timing of firming resource



- If storage discharge periods are limited to the current RCM setting, unserved energy occurs up to 10:00pm in 2050 scenarios
- Extending storage availability overnight prevents this
- This indicates that capacity services are required for a broader range of hours in 2050, up to 10:00pm

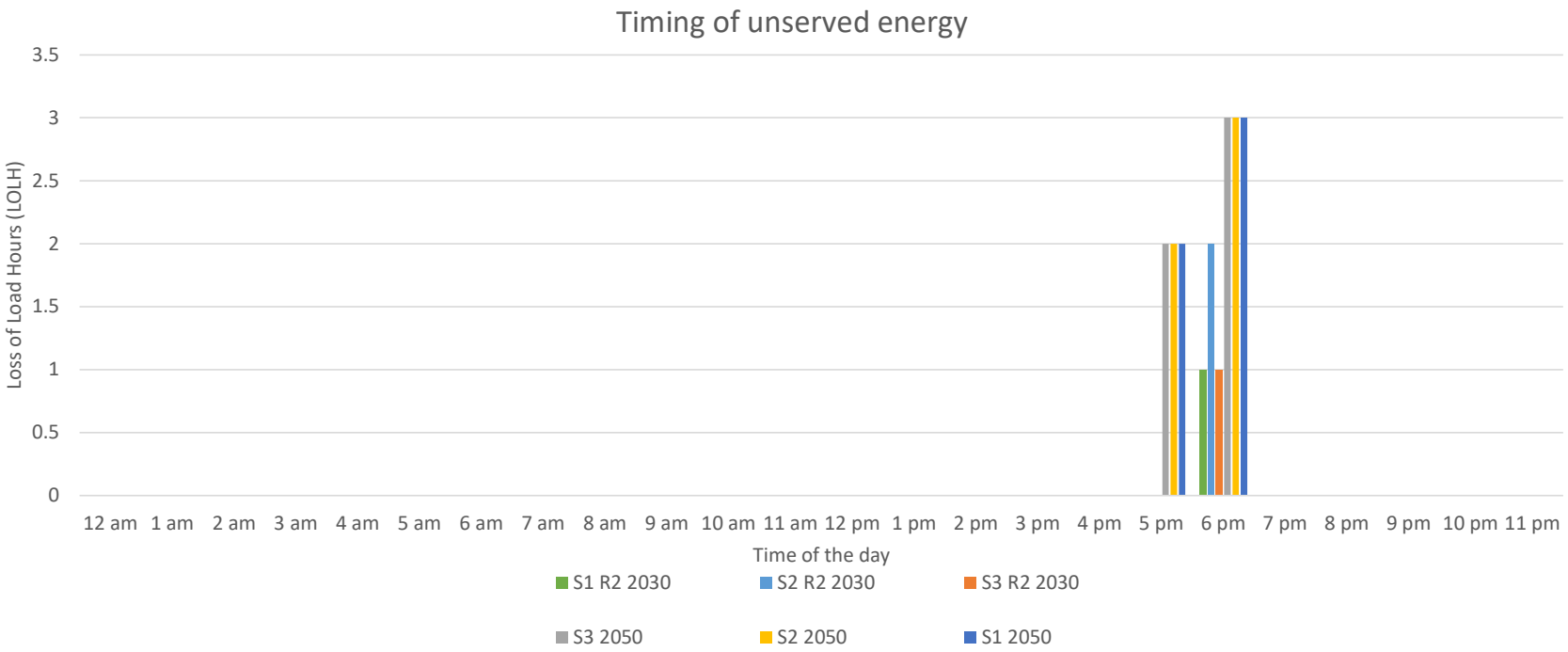
Modelling Results – Demand Ramping



- In later years, much higher demand ramping is experienced.
- The highest ramp rates in 2050 are >2000 MW/hr, 3x those in 2022
- However, these ramp rates are still well within the capabilities of current technologies (e.g. OCGT), as long as sufficient capacity is available.
- By 2050, >2GW of fast-ramping capacity (e.g. OCGT or battery) will be required.
- However, under a zero-emissions policy, options for ramping capacity are much more limited.

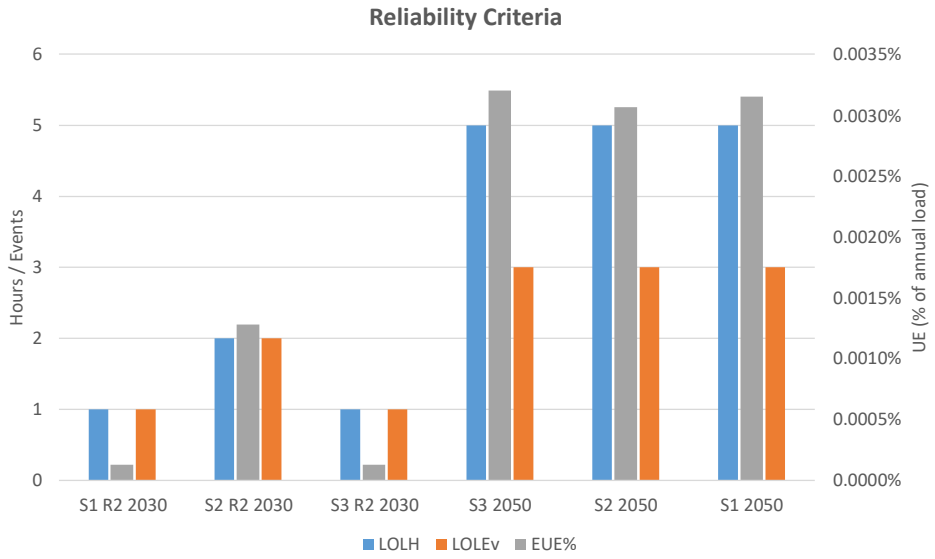
Modelling Results – Timing of Unserved Energy

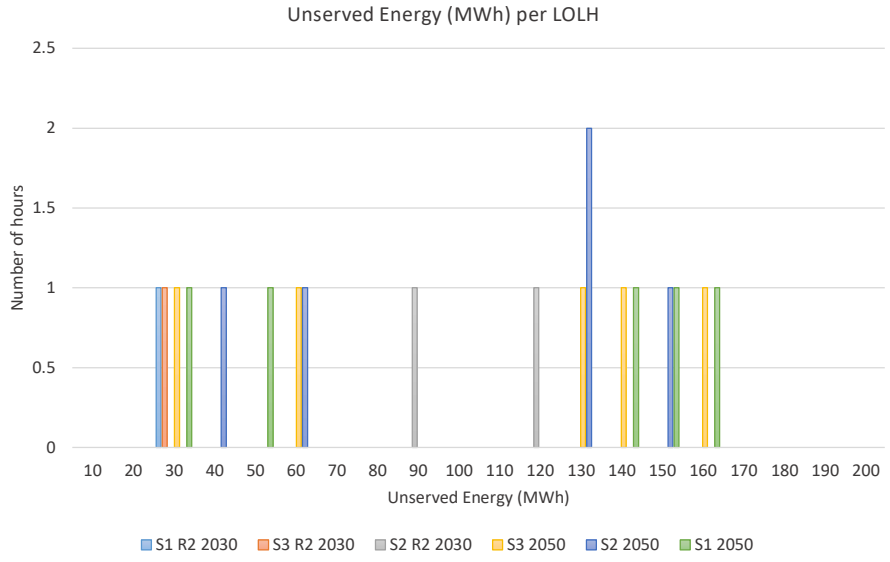
Unserved energy events concentrated around 5:00pm to 6:00pm:



Modelling Results – Measurements of unserved energy

- Unserved energy at current reliability criteria levels represents a very small number of loss of load hours (LOLH) or events (LOLEv)
- Each LOLH can represent a very wide range of MWh outage quantities
- UE remains the most nuanced measure of reliability impact.





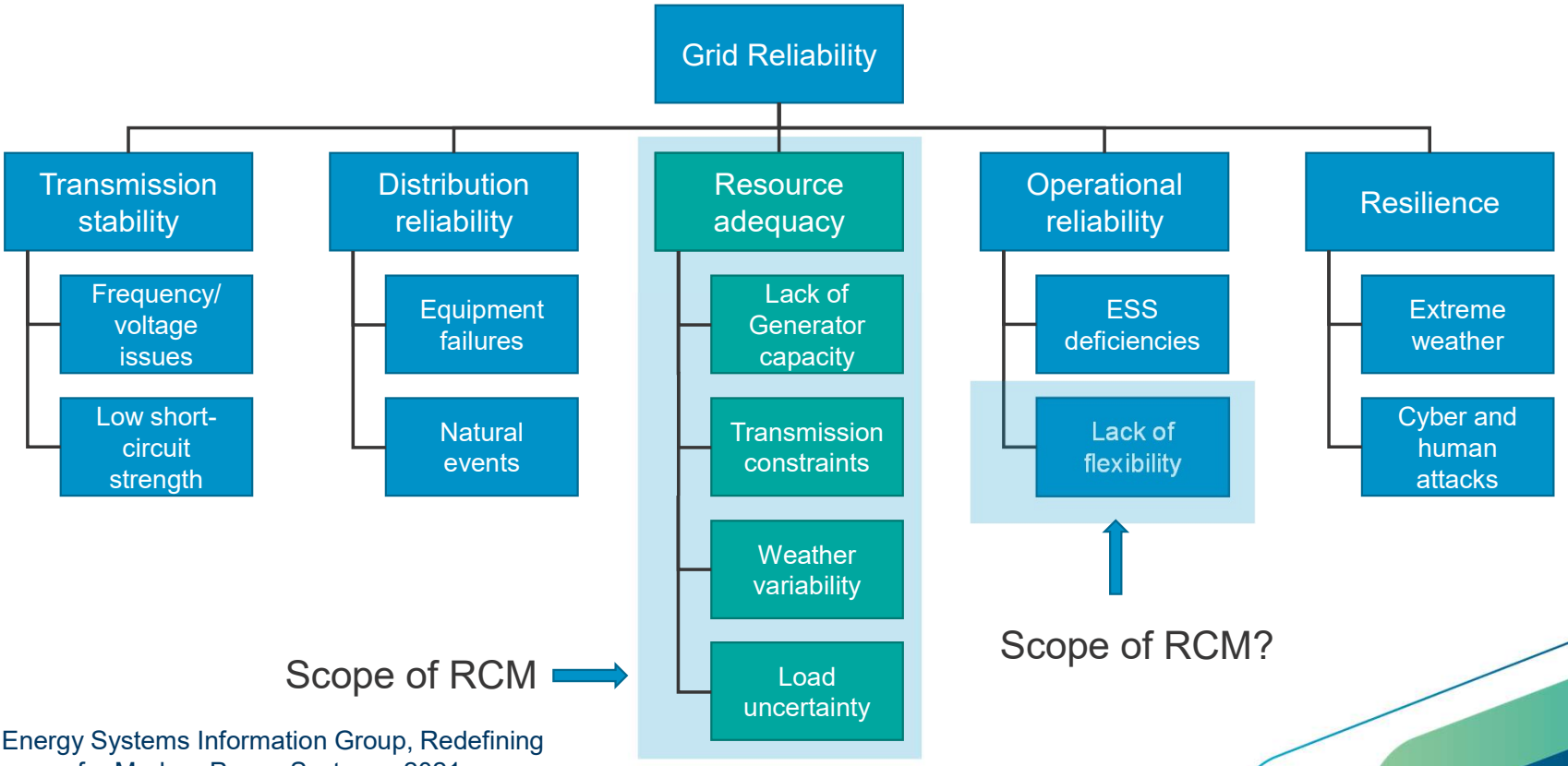
7. Capacity Service

What are the Characteristics of the Capacity we Need?

This analysis indicated the need for future capacity to have specific characteristics over and above a simple MW requirement:

- Assuming a 100% zero-carbon emission capacity mix by 2050, significant capacity to balance generation and demand is required.
- The hours that capacity services are required will broaden to cover up to at least 10:00pm by 2050.
- Demand flexibility: Assuming lower storage capacity and renewables overbuild, a high capacity of demand flexibility is required.
- Ramping: see the following slides
- Minimum demand: see the following slides

The Elements of Grid Reliability



Adapted from Energy Systems Information Group, Redefining Resource Adequacy for Modern Power Systems, 2021

Should Ramping Capability be part of a Capacity Mechanism?

From the modelling results, we draw the following conclusions regarding ramping:

- By 2050, demand ramp rates in excess of 2 GW/hour are experienced
- This is well within the capabilities of current technologies (e.g. OCGT and battery) as long as sufficient capacity is available (i.e. > 2GW)
- In a zero-carbon future, OCGT may not be an option, and the fast-ramping capacity required is in excess of the storage required for other purposes
- Therefore it may be necessary to ensure that sufficient fast-ramping capacity is available

Ways to achieve this:

- Build into the new RCM:
  - As a specific capacity product
  - As an availability class
  - Note that DSPs can assist with demand ramping, but in doing so will need to perform and be assessed on the same basis as other types of capacity
- Procure as an ESS (as AEMO is doing for the NEM)

Should Curtailed Injection be part of a Capacity Mechanism?

A key consideration is whether the future RCM will include a ‘reverse capacity’ product.

This product would give people credits for increasing load or reducing injection when needed.

This load increase or injection reduction would largely be there to ‘soak up’ behind the meter solar PV.

The RCM would need to define a planning criterion for low load situations, but instead of being there to avoid unserved energy, it would be there to avoid curtailed injection. Similar metrics could be used:

- Loss of injection probability
- Loss of injection hours
- Un-injected energy MWh

Based on the system stress modelling results, such a service could be called on more than 2200 hours per year (25% of periods) – more than the regular capacity service.

Should Curtailed Injection be part of a Capacity Mechanism? (continued)

Two key questions:

1. Should consumers have a right to inject whatever energy they wish onto the SWIS?
2. Does the load increase/BTM injection curtailment require significant capital expenditure with multi-year lead times?

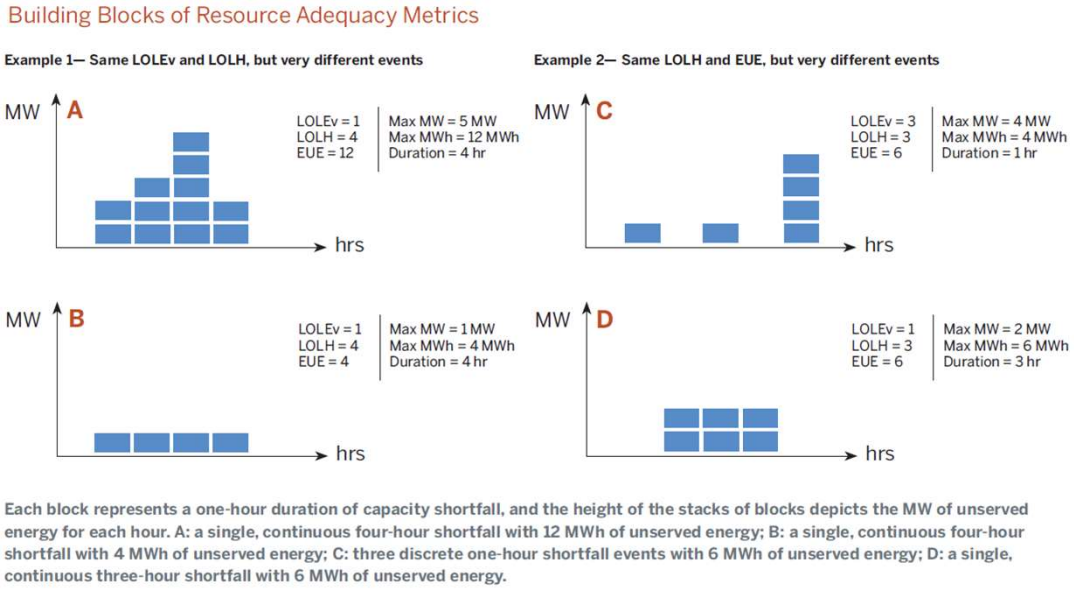
Preliminary direction: No and no, therefore load increase can be dealt with as an operational matter through Essential System Services and real-time market mechanisms.

8. Planning Criterion

Planning Criterion Dimensions

International review highlighted need for a multi-dimensional reliability criterion. But which dimensions?

- Lost load:
  - LOLEv (# of events/yr)
  - LOLH (# of hours/yr)
  - EUE (MWh unserved)
- Peak load (equivalent to LOLP if load is only lost in peak)



Options for the Planning Criterion

Three options:

1. EUE% only
2. EUE% plus LOLEv (instead of system peak load)
3. Retain current peak load + reserve margin and EUE%

Preliminary direction:

- System stress modelling shows increasing importance of EUE measure
- International scan identified need for multi-dimensional planning criterion
- No compelling reason to choose both LOLH and LOLEv, or to choose LOLH over LOLEv.
- Retain a two-limbed planning criterion
- Unclear whether using peak load or LOLEv is more appropriate.
- Model alternative planning criteria and assess effect on capacity target/system reliability.

Aspects of the peak load component

The current planning criterion includes an additional reserve margin "*equal to the greater of:*

i. 7.6% of the forecast peak demand (including transmission losses and allowing for Intermittent Loads); and

ii. the maximum capacity, measured at 41ºC, of the largest generating unit;

while maintaining the SWIS frequency in accordance with the Normal Operating Frequency Band and the Normal Operating Frequency Excursion Band."

Subclause i relates to the expected outage rate (so that the expected remaining capacity is sufficient to meet the 10% POE peak load). This value was last updated in 2012.

Subclause ii relates to the need for spinning reserve. It is not aligned with the current spinning reserve requirement (current largest contingency is transmission-related rather than a generation unit) and is not aligned with the future approach to co-optimisation of energy and contingency reserve.

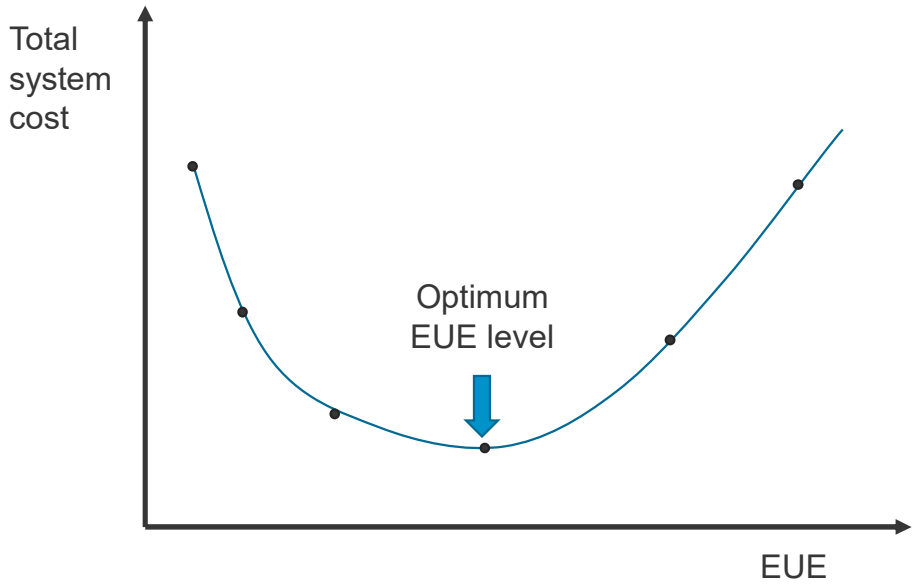
We will consider these elements further as we review options for using ICAP or UCAP, to ensure there is no double counting.

Recap: Approach to revising the Planning Criterion

To determine an appropriate metric for each limb of the planning criterion, we need to explore the trade-off between higher reliability requirements and cost (noting that the outcome of the review should not erode the current reliability standard).

For the EUE limb the methodology would be as follows:

1. Determine the lowest cost new entrant technology (previous studies assumed an OCGT, could be PV + storage)
2. Determine a Value of Customer reliability (VCR) for the SWIS (used Western Power value)
3. Perform system adequacy modelling (CAPSIM) with various levels of new capacity of the type determined in step 1 to determine the level of EUE (in MWh)
4. Determine total system cost at each level of new capacity, as EUE x VCR + cost of new capacity
5. Chart total system cost vs EUE, and determine the level of EUE at which minimum total system cost occurs.



The approach for an LOLEv limb would be similar, with an X axis of lost load frequency.

9. Support for Preliminary Directions

Decisions

1. Does the working group endorse the preliminary directions on capacity service?
2. Does the working group endorse the preliminary directions on the planning criterion?
3. If not, what aspects is there uncertainty over?

10. Next Steps

Next steps

- **Model alternative planning criteria and assess effect on capacity target/system reliability.**
- **Next Working Group meeting mid June 2022**
  - Capacity service and planning criterion update
  - Discussion: CRC allocation approaches
- **Questions or feedback can be emailed to energymarkets@energy.wa.gov.au**

11. General Business


We're working for
Western Australia.