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

GOVERNMENT OF WESTERN AUSTRALIA

TDOWG 54

Tranche 8 - new method to determine the Availability Duration Gap (ADG)

1 May 2025

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

Welcome

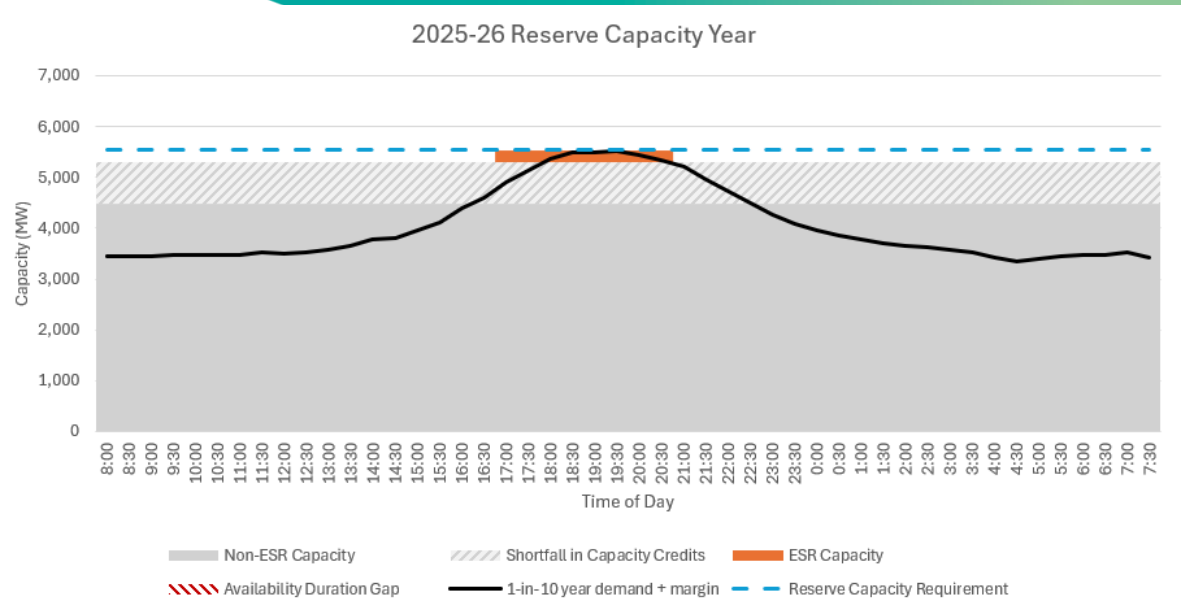
Please place your microphone on mute, unless you are asking a question or making a comment.

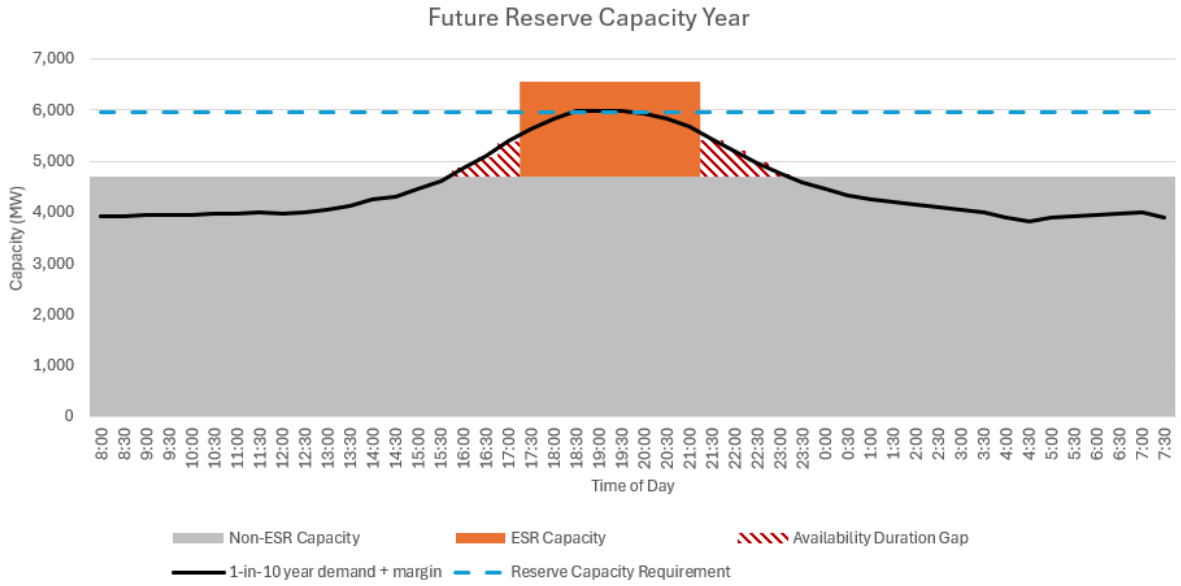
- **Please keep questions relevant to the agenda item being discussed.**
- **If there is no break in discussion and you would like to say something, you can 'raise your hand' by typing 'question' or 'comment' in the meeting chat. Questions and comments can also be emailed to energymarkets@demirs.wa.gov.au after the meeting.**
- **If you are having connection/bandwidth issues, you may want to disable the incoming and/or outgoing video.**

What is the ADG and why do we need these amendments

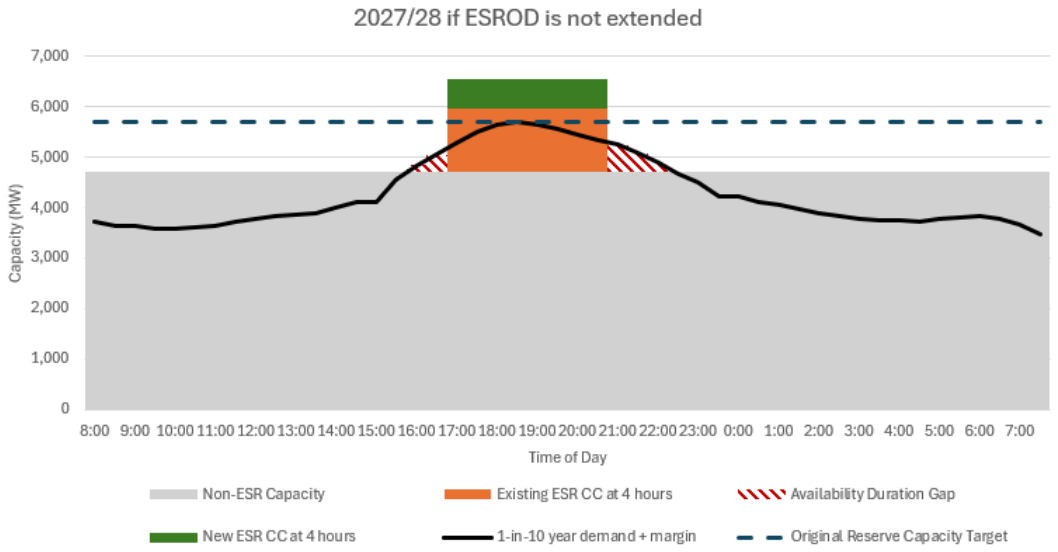
What is the ADG?

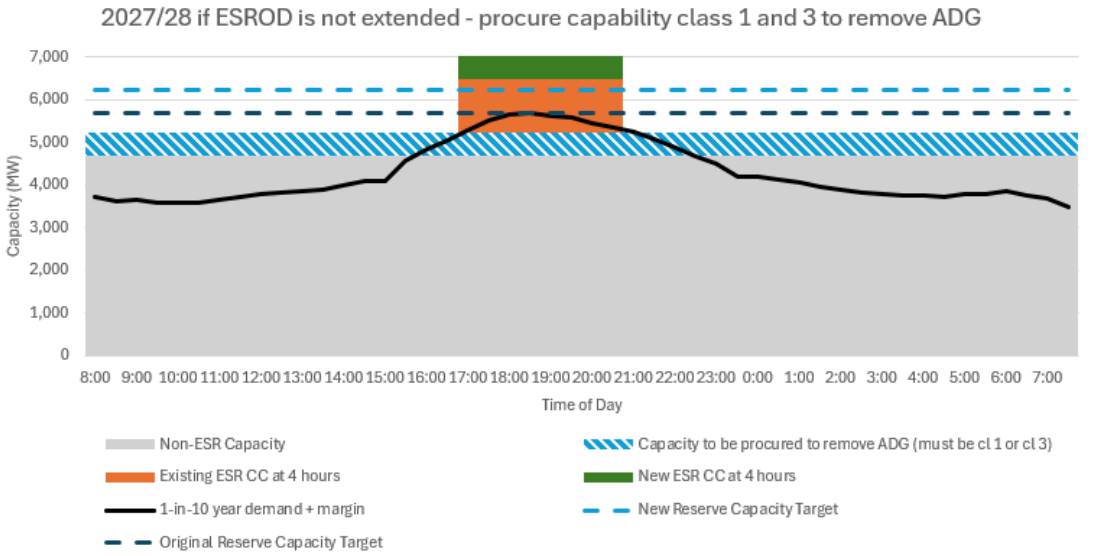
- **A shortfall in Electric Storage Resource (ESR) capacity at system peak**
- **Caused by energy / availability limitation of ESR capacity**
- **Forecast and published each year in the ESOO**
- **Input for determining Energy Storage Resource Duration Requirement (ESRDR) which sets:**
  - How long an ESR must be available each day
  - How many Capacity Credits new ESR can receive
- **The ADG determines how much the ESRDR must be increased from one Reserve Capacity Cycle to the next**
- **Existing ESR is currently protected from an increase to the ESRDR for 5 years**

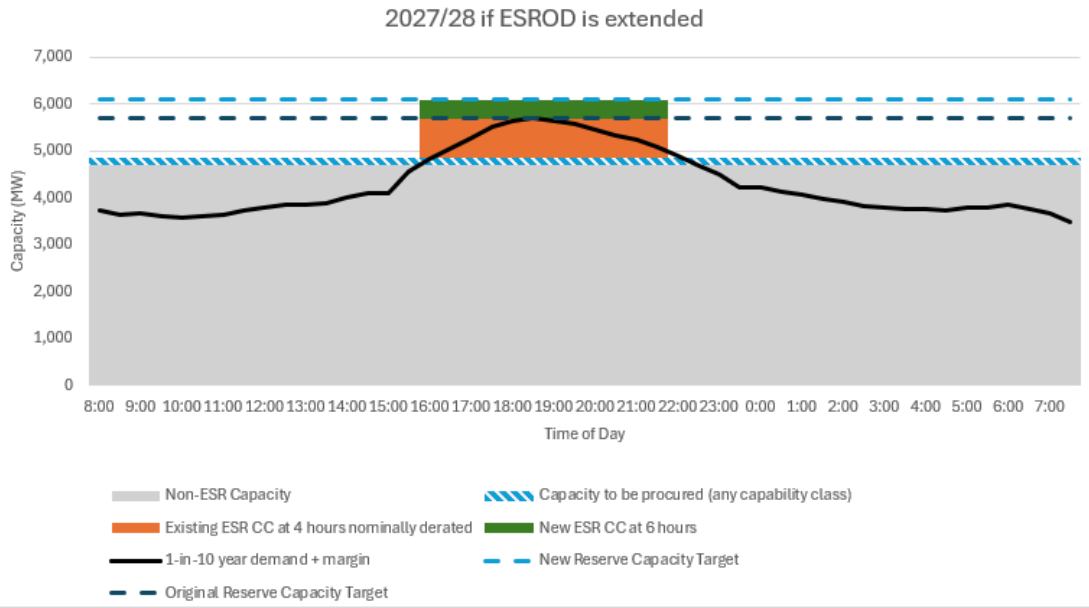




Why is it important to increase the ESRDR?







→ **If ESROD is NOT extended:**

- **Either** demand will not be served (left chart)
- **Or** more Capability Classes 1 and 3 will be required to serve demand (top right)

→ **ESROD needs to be extended (bottom right) to:**

- ensure reliability is maintained
- ensure customers' payments for capacity reflect its contribution to reliability
- ensure no unnecessary costs in the market

The Reason for this Review

- **The RCM review considered this in 2022/23 - the rules that implemented the first ADG methodology were made in 2023**
  - Original ADG method designed for known entry of ESR at the time
- **In preparation of the 2024 ESOO, AEMO applied the then methodology and determined unreasonably long ADG as it was looking at all days in the target year**
- **Rules were changed so only 90th percentile was used for 2024 ESOO**
  - ESOO applied this to the then existing ESR Capacity Credits (c.400MW) and indicated that ESRDR would extend to 4.5 hours (ESRDR was fixed in the Rules at 4 hours for the 2024 Reserve Capacity Cycle)
- **AEMO tested this method again in late 2024**
  - Indicating ESRDR of 15.5 hours due to the increase of ESR Capacity Credits (~1GW to a total of ~1.4GW)
- **“Backstop” change to the method - to only consider the peak day, was introduced in January 2025 (one of the methods presented today)**

Objectives of this Review

- **We then reviewed the methodology using 5 different methods and chose the method which balanced the interests of consumers/investors in the best way**
  - We had to balance the interest of consumers (e.g. make sure consumers don't pay for what they don't need) with investment certainty (unreasonably long ESRDR risks preventing investment in new, useful ESR)
- **ESRDR that is too short:**
  - can lead to lack of capacity during the system peak if ESR had fully discharged before the end of the peak demand period (see above)
  - does not signal that Long Duration Storage technologies (LDS) are needed by the market
- **For AEMO to apply the new ADG methodology in the 2025 Reserve Capacity Cycle, rules must be made by early May 2025**

Assessment Criteria for Methods considered

Criterion	Description
Adequate representation of ESR's contribution to reliability	• Treatment of existing and future ESR should ensure that reliability of supply is not eroded • Projection of ESROD should appropriately reflect the contribution of ESR to capacity adequacy and the reliability standard and incentivise investment in ESR as needed
Investment certainty - predictability of ESROD	• The method applied for the calculation of the ADG and ESROD is clearly documented and stakeholders including investors can make useful predictions with information that is readily available
Investment Certainty – volatility of ESROD	• Minimises year-to-year volatility for investors to the extend possible – volatility that reflects a change in contribution to reliability should not be eliminated
Sensitivity to "flat" demand shape	• The influence of potential individual future operational demand day forecasts on ESROD should be reduced
Sensitivity to step change in ESR capacity	• The influence of potential individual future ESR capacity changes on ESROD calculation should be minimised
practicality of implementation and rollout across 10 years	• The proposed method for calculation of ADG and ESROD should **be implementable** so as to enable preparation of a 10-year outlook of ESROD and capacity adequacy

Methods explored

Methods explored

Method	# of days assessed	ESROD	20 Jan 2025 actual demand profile assessed as sensitivity?	Application of ESR capacity (ESR Dispatch)
Fixed-duration ESROD	Top 1 day* (from each reference year) - current method	Fixed-duration ESROD (4 contiguous hours)	Yes	Even over ESROD (as per Capacity Credits)
Extending ESROD (until ADG = 0)	Top 1 day* (from each reference year)	Extending ESROD until ADG = 0 and nominally de-rating Capacity Credits	Yes	
Based on WEM ESOO dispatch modelling	Top 1 day* (from each reference year)	Assessment of the ESROD instead	Not modelled	Not even. ESR dispatched to meet demand that has not been met by other types of installed capacity.
Bottom-up Capacity Adequacy and ESR Contribution	Top 1 day* (from each reference year)	Assessment of the ESROD instead	Yes	Not even. ESR dispatched to meet demand that is not covered by other types of Capacity Credits.
Top-down "simple" method	Top 1 day* (from each reference year)	Assessment of the ESROD instead	Yes	Not even. ESR dispatched to minimise residual operational demand.

**Top 1 day means the day when annual peak demand occurred or is forecast to occur*
***Assessment based on 12 weather reference years (2010-11 to 2021-22)*

Current “Backstop” Method

Current “Backstop” ADG Method explained

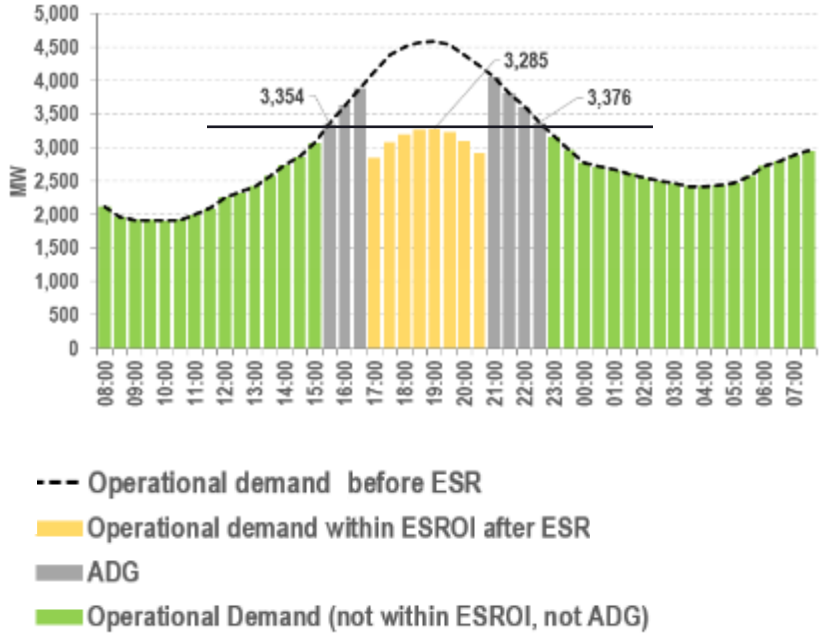
The current method determines the ADG by

- **Forecasting the 1 in 10 peak demand for the relevant Capacity Year**
- **Subtracting ESR capacity from it to determine the residual operational demand (yellow)**
- **Determining how many intervals have a higher demand than the highest interval within the ESROD (grey)**
- **This number of intervals is the ADG**
- **ADG is then used to calculate the new ESROD as ADG + old ESROD**

Fixed-duration ESROD

- 1,300^ MW of ESR
- 4 hr (8 TI) duration ESROD
- 5,198 MWh of ESR energy capacity

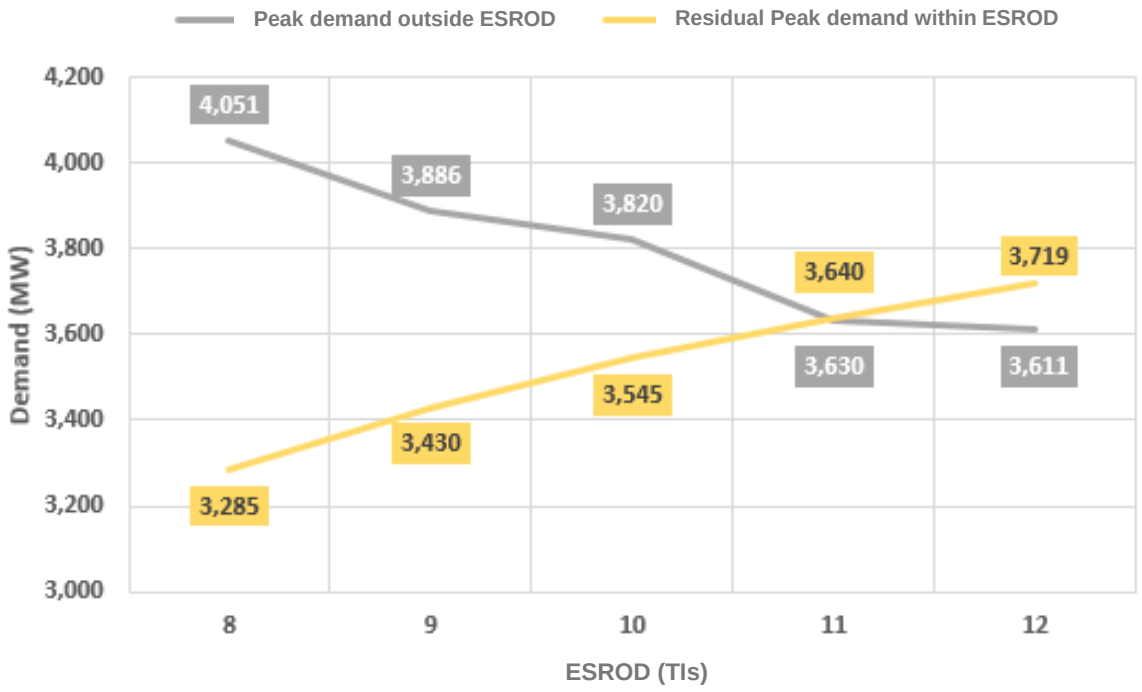
ESROD = 8 TI | **ADG = 7 TI** | **ESROD = 15 TI (7.5 hrs)**



Preferred Method - Extending the ESROD

Preferred Method: Extending ESROD

- This method builds on the Fixed-duration ESROD method but modifies it by conducting consecutive iterations in which ESROD is incrementally extended until ADG becomes zero
- From one iteration to another, extend ESROD by one half-hourly interval
- In each iteration, dispatch ESR capacity evenly
  - Even ESR “dispatch” means that in each interval ESR capacity is constant, gradually lower total remaining capacity with each iteration
- The iteration in which ADG reduces to zero (or demand adjacent to the ESROD period is lower than maximum demand within the ESROD period) determines the new ESROD
- The extended ESROD establishes the new ESROD



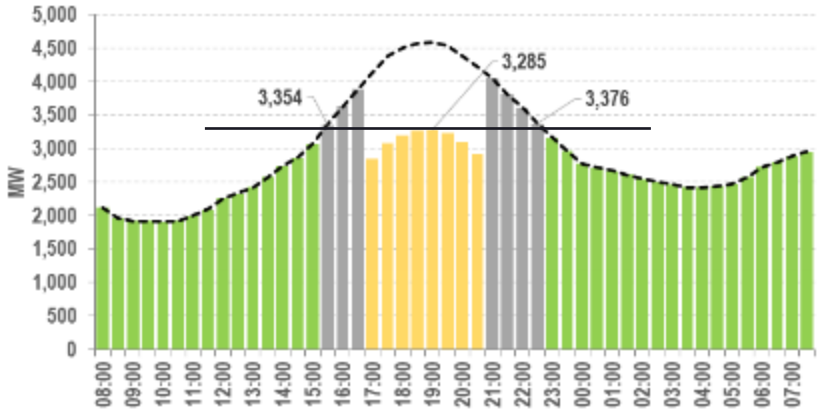
Fixed-duration ESROD and Extended ESROD methods illustrated

Top 1 day in CY 2027-28 (1 March 2028), based on RefYear 2016-17

Fixed-duration ESROD – "backstop" method (see early slides)

- 1,300^ MW of ESR
- 4 hr (8 TI) duration ESROD
- 5,198 MWh of ESR energy capacity

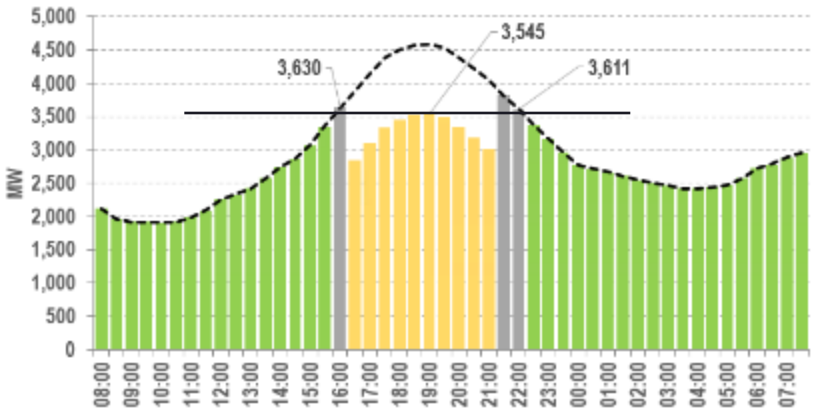
ESROD = 8 TI | **ADG = 7 TI** | **ESROD = 15 TI (7.5 hrs)**



Extended ESROD - preferred method (ADG not yet zero)

- ESR scaled to 1,040 MW
- 5 hr duration ESROD
- 5,198 MWh of ESR energy capacity

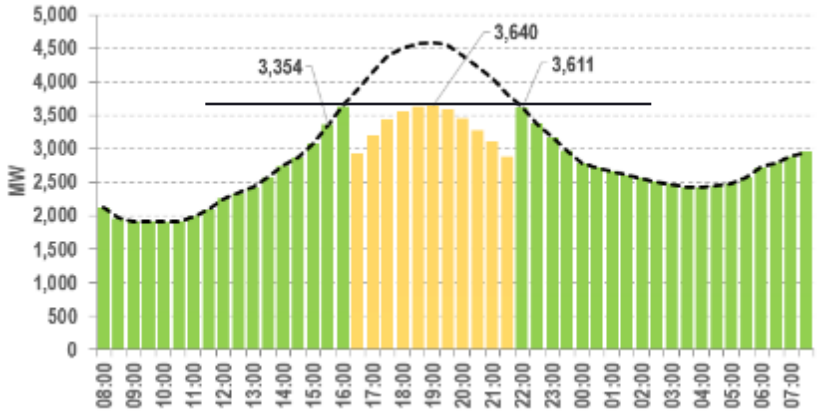
ESROD = 10 TI | **ADG = 3 TI** | **ESROD = 13 TI (6.5 hrs)**



Extended ESROD (ADG = 0)

- ESR Scaled to 945 MW
- 5.5 hr duration ESROD
- 5,198 MWh of ESR energy capacity

ESROD = 11 TI | **ADG = 0 TI** | **ESROD = 11 TI (5.5 hrs)**



Operational demand before ESR

Operational demand within ESROD after ESR dispatch

ADG

Operational Demand (not within ESROI, not ADG)

Steps taken:

- Extend the ESROD from 8 to 11 Tis (by one TI at a time)**
- Dispatch the same energy (MWh) over an increasing duration
- Calculate peak demand inside the ESROD after ESR dispatch
- Determine the initial ADG, continue until ADG = 0

Assessment based on WEM ESOO dispatch modelling

Steps of the Method

- Perform Limb B dispatch modelling according to the WEM ESOO methodology
- Use modelled ESR dispatch data as per modelling results from the WEM ESOO reliability assessment (Limb B modelling)
- For the top 1 day in the modelled future year of interest, count the number of half-hourly intervals over which ESR is dispatched
- The count of the intervals establishes the ESROD

Assessment based on 2024 WEM ESOO dispatch modelling Analysis for 2027-28, top 1 day, 10% POE Expected demand

			Modelled dispatch of ESR [MW]*																																																	
Top 1 day?	RefYear	Date	0:00	0:30	1:00	1:30	2:00	2:30	3:00	3:30	4:00	4:30	5:00	5:30	6:00	6:30	7:00	7:30	8:00	8:30	9:00	9:30	10:00	10:30	11:00	11:30	12:00	12:30	13:00	13:30	14:00	14:30	15:00	15:30	16:00	16:30	17:00	17:30	18:00	18:30	19:00	19:30	20:00	20:30	21:00	21:30	22:00	22:30	23:00	23:30	# of intervals	# of hours
Top 1	2010-11	25/02/2028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	65	396	552	692	743	760	711	624	506	427	255	105	11	0	15.0	7.5
Top 1	2011-12	26/01/2028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	58	318	279	274	374	371	255	19	5	0	0	0	10.0	5.0
Top 1	2012-13	15/02/2028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	83	272	601	774	742	689	665	679	585	426	324	117	10	0	0	14.0	7.0
Top 1	2013-14	18/01/2028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	26	242	396	354	353	282	121	15	2	0	0	0	10.0	5.0
Top 1	2014-15	26/01/2028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	72	361	645	806	816	807	718	531	376	105	12	1	0	13.0	6.5
Top 1	2015-16	13/03/2028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	138	352	563	662	729	763	794	754	589	371	266	96	10	0	0	15.0	7.5
Top 1	2016-17	1/03/2028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	65	351	607	731	781	796	747	567	336	174	27	3	0	0	13.0	6.5
Top 1	2017-18	14/03/2028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	42	118	372	630	843	923	902	825	650	450	283	55	5	0	0	14.0	7.0
Top 1	2018-19	10/02/2028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	14	43	34	41	18	3	0	0	0	0	0	7.0	3.5
Top 1	2019-20	1/02/2028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	257	638	824	911	905	897	886	673	452	260	46	5	0	14.0	7.0
Top 1	2020-21	7/01/2028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	152	365	495	520	510	499	381	197	86	18	1	0	13.0	6.5
Top 1	2021-22	16/02/2028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	16	33	98	162	109	58	6	1	0	0	0	0	0	10.0	5.0

Bottom-up Capacity Adequacy and ESR Contribution

Steps of the Method

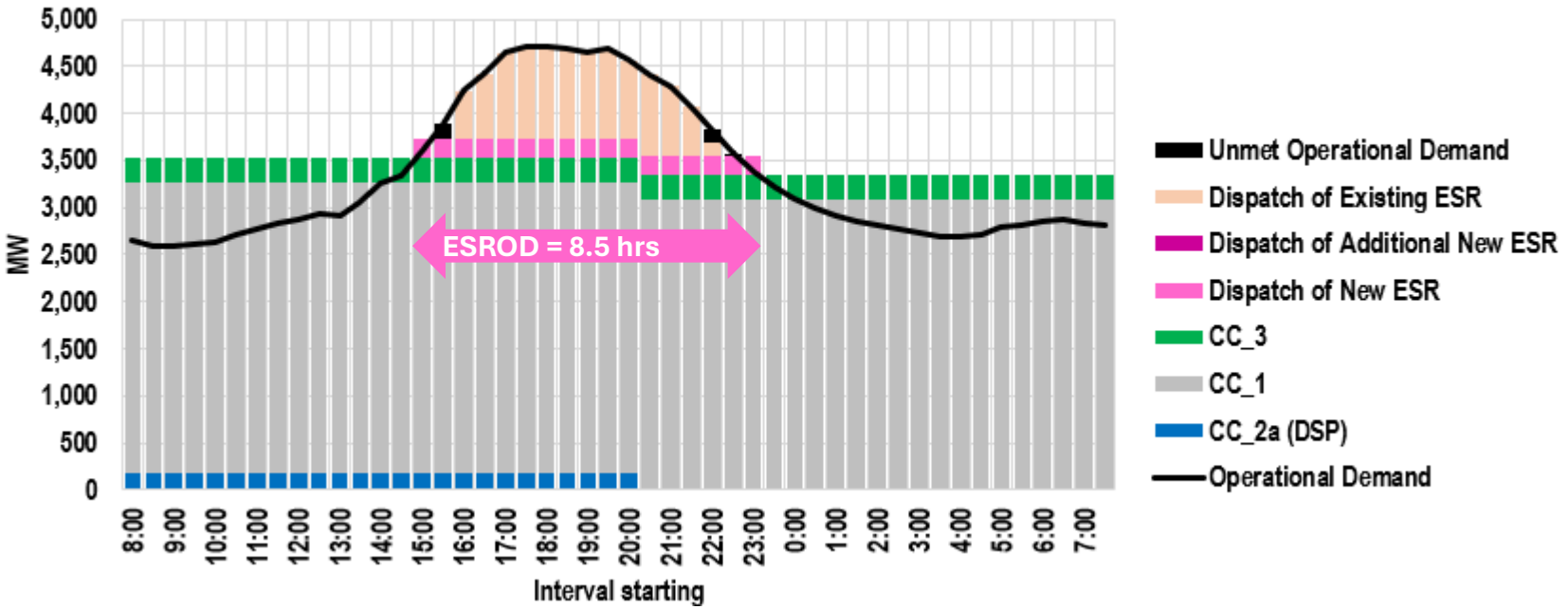
Capacity adequacy assessment

- For the top 1 day in the future year of interest:
  - Determine the operational demand profile
  - Compile the Capacity Credits stack for the following types of capacity
    - Capability Class 1 (CC_1, i.e. dispatchable thermal capacity)
    - Capability Class 2a (CC_2a, i.e. DSP)
    - Capability Class 3 (CC_3, i.e. intermittent renewables)
  - Determine the amount of ESR capacity (MW) required to meet the capacity adequacy target (the difference between the capacity adequacy target and the sum of Capacity Credits of CC_1, CC_2a and CC_3

ESR contribution

- For the top 1 day in the future year of interest:
  - Determine the operational demand profile
  - Compile the Capacity Credits stack for the following types of capacity
    - Capability Class 1 (dispatchable thermal capacity)
    - Capability Class 2a (DSP)
    - Capability Class 3 (intermittent renewables)
  - Determine the number of operational demand intervals not met by the sum of Capacity Credits of CC_1, CC_2a and CC_3
  - The number of demand intervals not met by the sum of Capacity Credits of CC_1, CC_2a and CC_3 determines the ESROD

Contribution of ESR capacity to meeting interval demand (ESROD assessment)



Top-down “simple” method

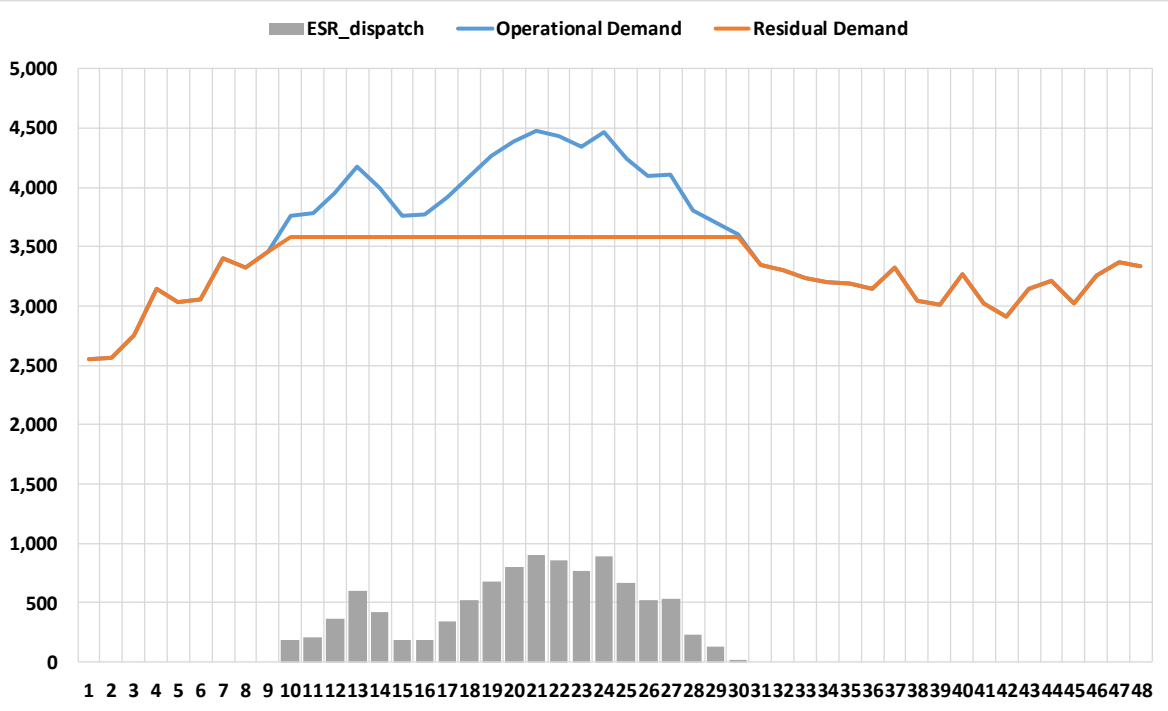
Steps of the Method

- Identify the annual peak operational demand day for the modelled future year of interest (top 1 day)
- Obtain the half-hourly demand profile (48 intervals) for that day
- Determine the quantity of ESR capacity (MW)
- Determine the quantity of ESR energy “reservoir” (MWh)
- “Dispatch” ESR capacity to minimise residual demand
  - “Dispatch” of ESR is not “even”
  - Residual demand in this instance means operational demand less contribution of ESR
- Count the number of half-hourly intervals over which ESR has been “dispatched” to determine the ESROD

Method illustrated

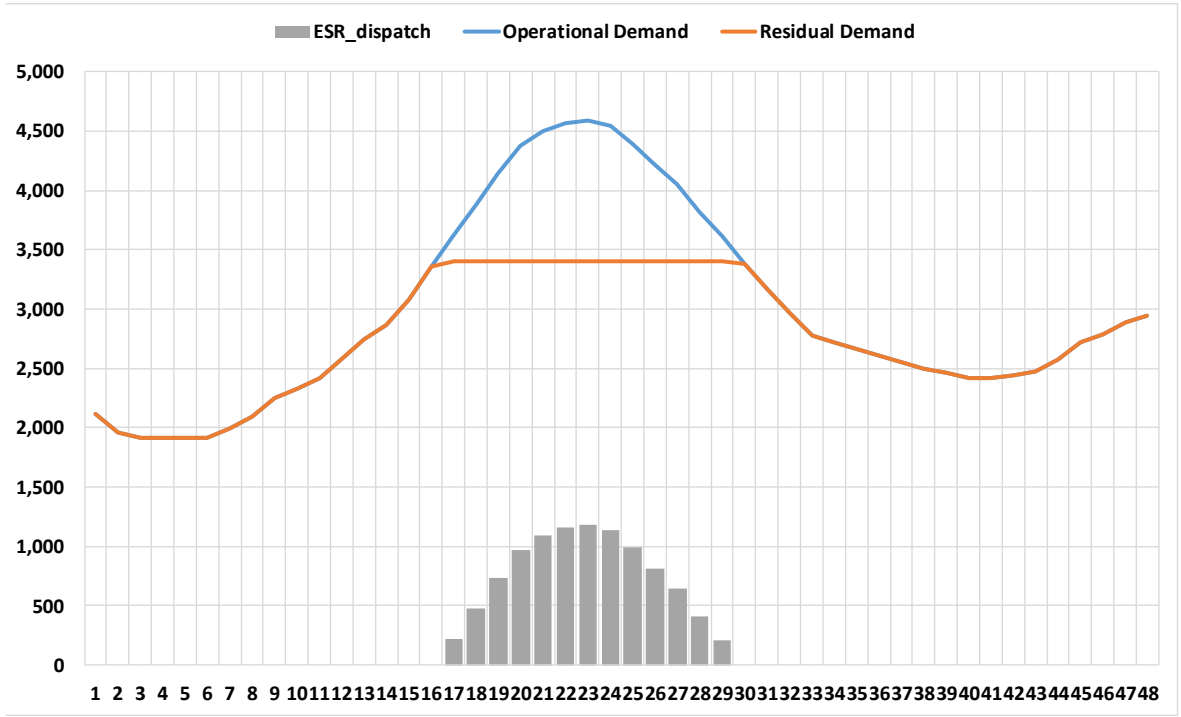
20 January 2025 (actual operational demand data)

ESROD 10.5 hrs



Top 1 day in CY 2027-28, based on RefYear 2016-17

ESROD 6.5 hrs



Methods Assessment

Analysis presented in the following slides

- **The analysis presented in the following slides is subject to change in the 2025 ESOO because:**
- It used 12 reference years used in the 2024 WEM ESOO reliability assessment (Limb B modelling)
- Another reference year will be added in the 2025 WEM ESOO reliability assessment

Summary of ESROD [hrs] by method

Analysis for 2027-28, top 1 day, 10% POE Expected demand

RefYear		Method 1 Fixed ESROD ("backstop" method)	Method 2 Extending ESROD (preferred method)	Method 3 WEM ESOO (2-4-C dispatch)	Method 4 Bottom-up Capacity Adequacy including Reserve Margin				Method 5 Top-down (peak lopping dispatch of ESR)
					Scen 1: Collie out	Scen 2: Scen 1 + Bluewaters out	Scen 3: Scen 2 + Muja G7 out	Scen 4: Scen 3 + Muja G8 out	
2010-11		8.5	6.5	7.5	10.0	18.5	23.5	24.0	7.5
2011-12		8.5	6.5	5.0	9.5	16.0	17.5	20.0	7.5
2012-13		8.0	6.5	7.0	10.5	20.5	23.0	24.0	7.0
2013-14		7.5	6.0	5.0	9.0	16.0	18.5	19.0	7.0
2014-15		7.5	6.0	6.5	8.5	13.5	21.0	24.0	7.0
2015-16		8.0	6.0	7.5	9.5	18.0	19.5	21.5	7.0
2016-17		7.5	5.5	6.5	8.0	13.0	17.0	19.0	6.5
2017-18		7.5	6.0	7.0	9.5	18.0	21.0	24.0	7.5
2018-19		7.5	6.0	3.5	8.0	11.0	16.5	18.5	7.0
2019-20		8.0	6.0	7.0	9.5	18.0	18.5	20.0	7.0
2020-21		9.0	6.5	6.5	9.5	16.5	19.0	21.0	8.0
2021-22		8.0	6.5	5.0	8.5	13.5	19.0	24.0	7.5
Across 12 RefYrs	median	8.0	6.0	6.5	9.5	16.3	19.0	21.3	7.0
	average	8.0	6.2	6.2	9.2	16.0	19.5	21.6	7.2
Across 5 RefYrs	*median*	*8.0*	*6.0*	*6.5*	*9.5*	*16.5*	*19.0*	*21.0*	*7.5*
	average	*8.0*	*6.2*	*5.8*	*9.0*	*15.4*	*18.8*	*21.5*	*7.4*

Coefficient of Variation (12 years)	6.3%	5.3%	20.3%	8.5%	17.4%	11.4%	10.6%	5.5%
Coefficient of Variation (5 years)	7.7%	4.4%	26.3%	7.9%	19.9%	8.5%	11.4%	5.7%

Methods assessed against the defined criteria

Method	ESR's contribution to reliability	Investment certainty - predictability of ESROD	Investment certainty – Volatility of ESROD	Sensitivity to "flat" demand shape	Sensitivity to step change in ESR capacity	Ease of implementation and rollout across 10 years
Fixed-duration ESROD ("Backstop" Method)	• Calculates the required duration of ESR (ESRDR). • Does not account for installed capacity or Capacity Credits from other supply technologies.	High	Low (CoV = 6.3%)	High	High (due to "even" dispatch of ESR)	Medium
Extending ESROD until ADG = 0 (preferred method)	• Calculates the required duration of ESR (ESRDR). • Does not account for installed capacity or Capacity Credits from other supply technologies.	High	Low (CoV = 5.3%)	Medium	Medium (despite "even" dispatch of ESR, this method de-rates capacity)	Medium
Based on WEM ESOO dispatch modelling results	• Calculates the required duration of ESR (ESRDR). • Accounts for installed capacity of the SWIS supply facilities • Applies dispatch modelling in line with the WEM ESOO assessment of unserved energy	Low	High (CoV = 20.3%)	Low	Low (dispatch of ESR is not "even")	Hard (requires market dispatch modelling in line with WEM ESOO Limb B assessment methodology)
Bottom-up Capacity Adequacy and ESR Contribution	• Calculates the required duration of ESR (ESRDR). • Considers the buildup of the Capacity Credits stack and confronts it with the Reserve Capacity Target. • Applies a simplified representation of dispatch-ability	Low	Medium (CoV = 8.5% to 17.4%)	Low	Low (dispatch of ESR is not "even")	Hard (requires a forecast of demand profiles and Capacity Credits / CRC for all SWIS fleet over the next 10 years)
Top-down "simple" method	• Calculates the required duration of ESR (ESRDR). • Applies a simplified representation of ESR "peak lopping"	High	Low (CoV = 5.5%)	Medium	Low (dispatch of ESR is not "even")	Medium (requires a forecast of demand profiles as well as Capacity Credits for ESR fleet over the next 10 years)

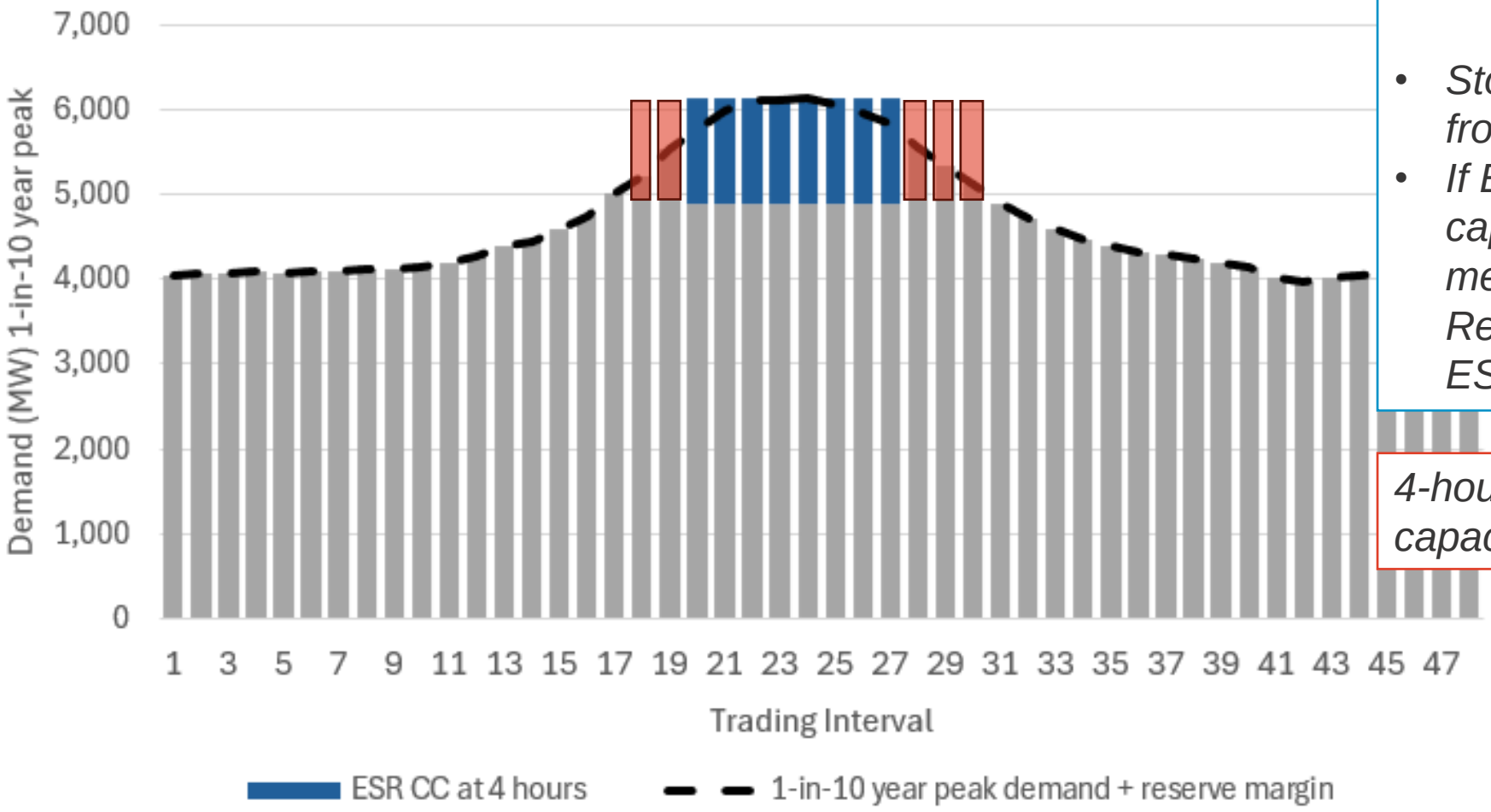
ESR Viability and Protections

ESR Protections and Viability

- **We have proposed to extend the protection for existing ESR from 5 to 10 (to balance 5 with 15 years)**
- Have already received mixed views on this
- **There will be one year BRCP lag**
- During Benchmark Capacity Provider Review, the second cheapest technology was marginally more expensive than a 4-hour ESR.
- This means that the BRCP is unlikely to change significantly unless technology costs have changed significantly.
- For clarity, new benchmark technology is not likely to be a 4-hour BESS derated to 6 hours
- **We also note that a decision was made to keep the gross CONE methodology ie not move to net CONE, which:**
- allows ESR facilities to over-recover their fixed costs in the energy/ESS markets
- should be sufficient for them to recover all of their fixed costs in the intervening year

ESR Duration Requirement Uplift

Why is the ESR Duration Requirement Uplift Required?

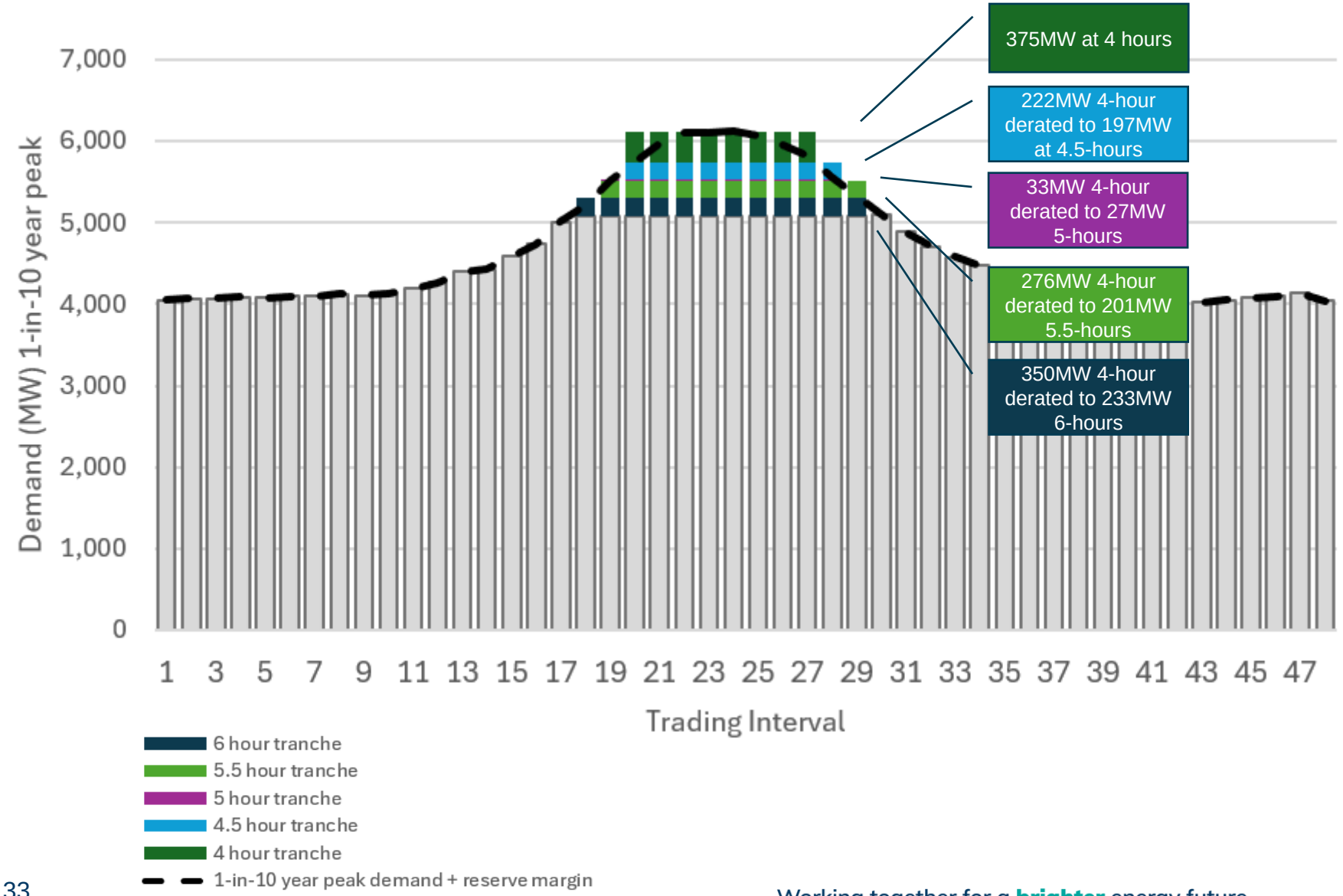


Example: 1255 MW of 4-hour ESR

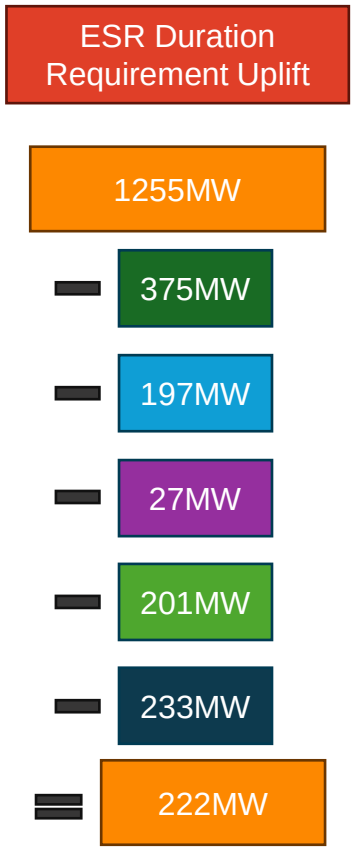
- *Storage receives a protection from change in ESROD.*
- *If ESROD increases, additional capacity must be procured to meet reliability (ESR Duration Requirement Uplift) due to the ESROD protection.*

4-hour storage leaves unmet capacity (red)

ESR Duration Requirement Uplift



Example: 1255 MW of 4-hour ESR



Comparison of Method 2 and 5 including RCT increase

RefYear		Method 2 Extending ESROD (preferred method)	Additional CCs needed in Method 2 to meet the adequacy criterion (Limb A)	Method 5 Top-down (peak lopping dispatch of ESR)	Additional CCs needed in Method 5 to meet the adequacy criterion (Limb A)
2010-11		6.5	192	7.5	267
2011-12		6.5	192	7.5	182
2012-13		6.5	192	7.0	260
2013-14		6.0	144	7.0	155
2014-15		6.0	144	7.0	119
2015-16		6.0	144	7.0	171
2016-17		5.5	97	6.5	94
2017-18		6.0	144	7.5	130
2018-19		6.0	144	7.0	129
2019-20		6.0	144	7.0	139
2020-21		6.5	192	8.0	186
2021-22		6.5	192	7.5	139
Across 12 RefYrs	median	6.0	144	7.0	147
	average	6.2	160	7.2	164
Across 5 RefYrs	*median*	*6.0*	*144*	*7.5*	*139*
	average	*6.2*	*164*	*7.4*	*145*

Coefficient of Variation (12 years)	5.3%	19.4%	5.5%	32.5%
Coefficient of Variation (5 years)	4.4%	16.0%	5.7%	16.3%