Bidirectional unit implementation design workshop

Integrating Energy Storage Systems

21 March 2023

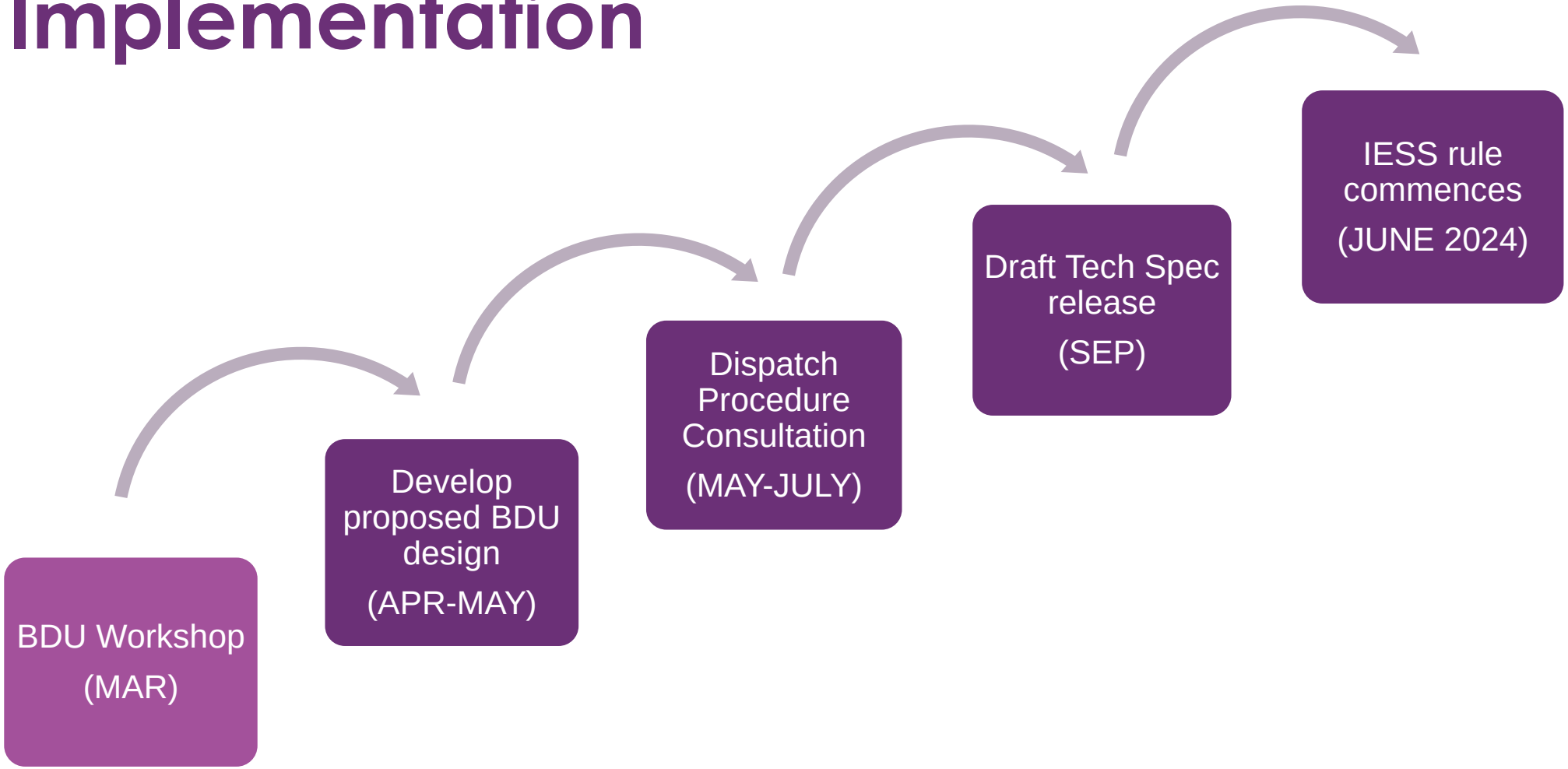
Welcome

Ulrika Lindholm

We acknowledge the Traditional Owners of country throughout Australia and recognise their continuing connection to land, waters and culture.

We pay respect to their Elders past, present and emerging.

Engagement on BDU Design Implementation



Ongoing industry readiness engagement via the NEM Reform Implementation Forum and 1to1 conversations.

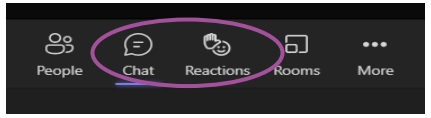
Introductions

Session purpose

- Inform industry stakeholders of bidding and dispatch changes for bi-directional units (BDUs).
- Seek industry feedback on implementation arrangements, either during the workshop or in writing by 04 Apr 2023.
- Out of scope:
  - Session will not cover changes to settlements under the IESS rule. A separate session was conducted on 21 February 2023. Reach out to the project to access the materials and get involved in future engagement at iess@aemo.com.au.
  - Discussion of policy on bidirectional units. Expression of interest are sought for a separate listening session.

Ways of collaborating

To support discussion during this forum, we ask all attendees to please raise their virtual hand when they intend to speak or post questions in the Teams chat and be respectful to others speaking. There will be breaks to verbally answer questions throughout the presentation as well as at the end.



Please introduce yourself (name & organisation) before you speak.

AGENDA

#	Timing (EDST)	Item	Presenter
1	15:00 – 15:05	Welcome	Ulrika Lindholm (Chair)
2	15:05 – 15:15	Context	Emily Brodie, Luke Barlow
3	15:15 – 15:30	Bid structure, validation and interface	Basilisa Choi
4	15:30 – 15:40	Ramp rates	
5	15:40 – 16:00	Energy storage limits	Ross Gillett
6	16:00 – 16:10	Price ties	
7	16:10 – 16:30	FCAS enablement	
8	16:30 – 16:45	SCADA requirements and Dispatch instructions	
9	16:45 – 16:55	Industry BDU transitions	Emily Brodie
10	16:55 – 17:00	Next steps & close	Ulrika Lindholm
APPENDICES			
A	Glossary		
B	Summary of feedback questions		
C	Application of aggregated dispatch conformance to BESS		
D	AEMO Competition Law - Meeting Protocol		

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Context

Emily Brodie
Luke Barlow

Refresher: IESS high-level timeline

23 Aug 2019
Rule change request

→

02 Dec 2021
AEMC Final determination

→

16 Dec 2021
AEMO IESS high level design v1.0

→

Q2, 2022
Final AEMO IESS high level design

31 Mar 2023
SGAs can apply to provide FCAS

→

09 Aug 2023
Aggregated dispatch conformance

→

TBC: 02 Jun 2024
Non-energy cost recovery changes

→

03 Jun 2024
IESS effective (IRP/BDU)

Focus of today's workshop

SGA	Small generation aggregator
FCAS	Frequency control ancillary service/s
IRP	Integrated resource provider
BDU	Bi-directional unit

REFERENCES

- **AEMC**: IESS rule change
- **AEMC:** Implementing IESS rule change
- **AEMO**: IESS High Level Design and Implementation Strawperson
- **AEMO:** Toolbox for SGAs providing FCAS

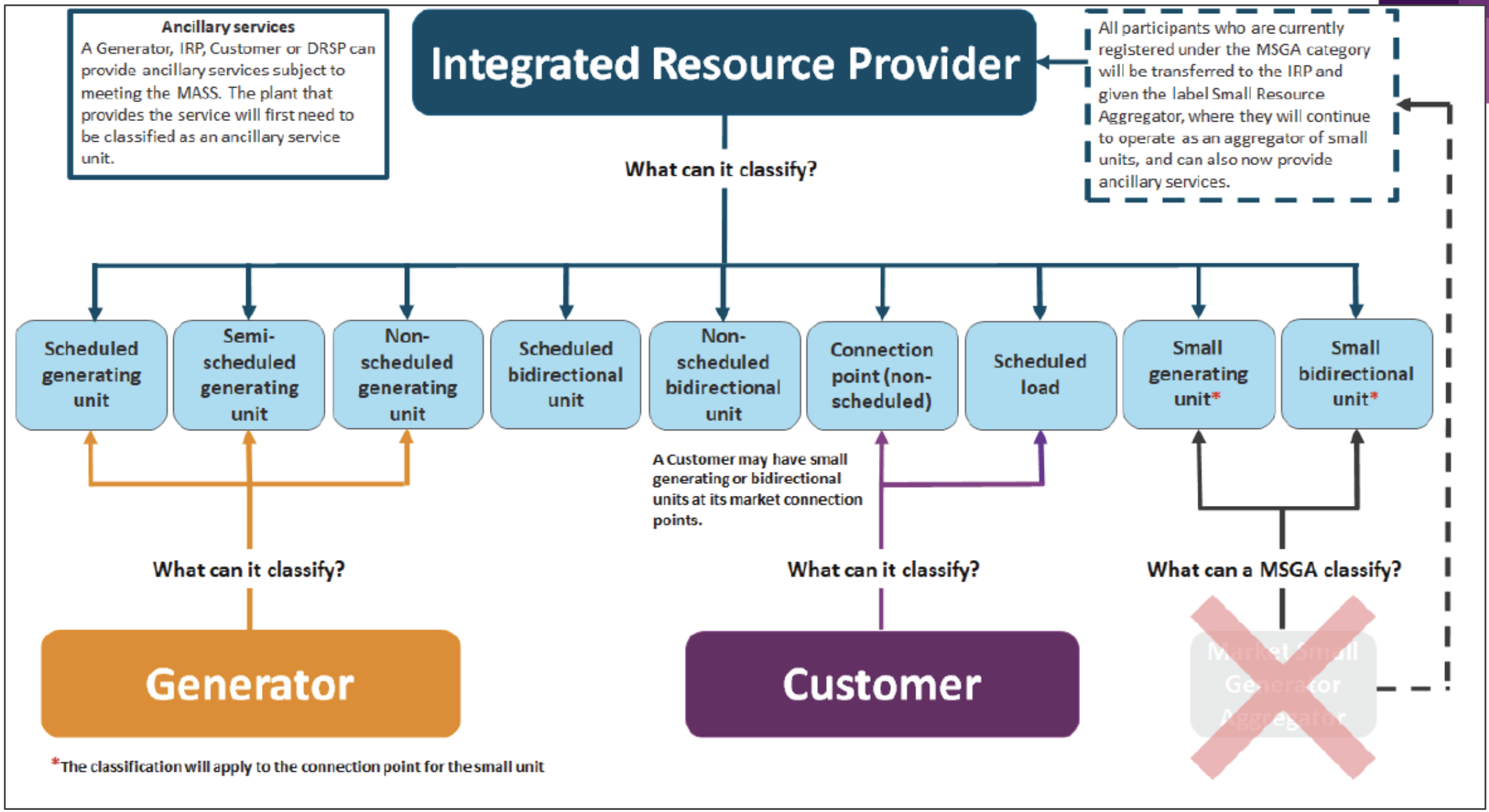
IESS introduces market efficiencies & has several releases

Date	Release	Affected Participants	High Level Scope
31 Mar 2023	FCAS option for Small Generation Aggregators (SGAs)	• SGAs	• Optional for participants. • Allows aggregators of small-scale plant to provide frequency support
09 Aug 2023	Aggregate dispatch conformance (ADC)	• Aggregate system operators • Developers • Control system vendors	• Optional for participants. • Gives grid-scale "aggregate" facilities more flexibility to dispatch energy at the connection point from any combination of its units (with some restrictions) rather than on a unit-by-unit basis. This change is important as we see more and more hybrid systems connecting. • Aggregate system ~ grid-scale, behind the connection point e.g. solar farm plus BESS.
02 Jun 2024*	Non-energy cost recovery (NECR) changes	Most participants (excluding metering service providers, network service providers, embedded network managers)	• Mandatory change for market participants • Changes the way market participants pay for "non-energy" services, making payments fairer and future-proofing non-energy cost recovery. • Non-energy services include costs of ancillary services, interventions etc.
03 Jun 2024	Introducing: • Integrated Resource Provider (IRP) category • Bi-directional Unit (BDU) classification & bidding	• BDU participants • SGAs	Makes it easier for grid-scale batteries to register, bid and be dispatched in the electricity market. **Market registration changes:** • IRPs introduced, alongside new classification and exemption criteria • Existing BDU participants (generator/customer) transition to IRPs • SGAs become IRPs • BDUs introduced • Ancillary service loads (ASL) & relevant generating units become ancillary service units (ASU) **Bidding changes:** • One bid form for BDU energy • One bid form for BDU FCAS

*AEMO has asked the AEMC to consider shifting the settlements go-live to a Sunday. Rule change request on AEMC website.

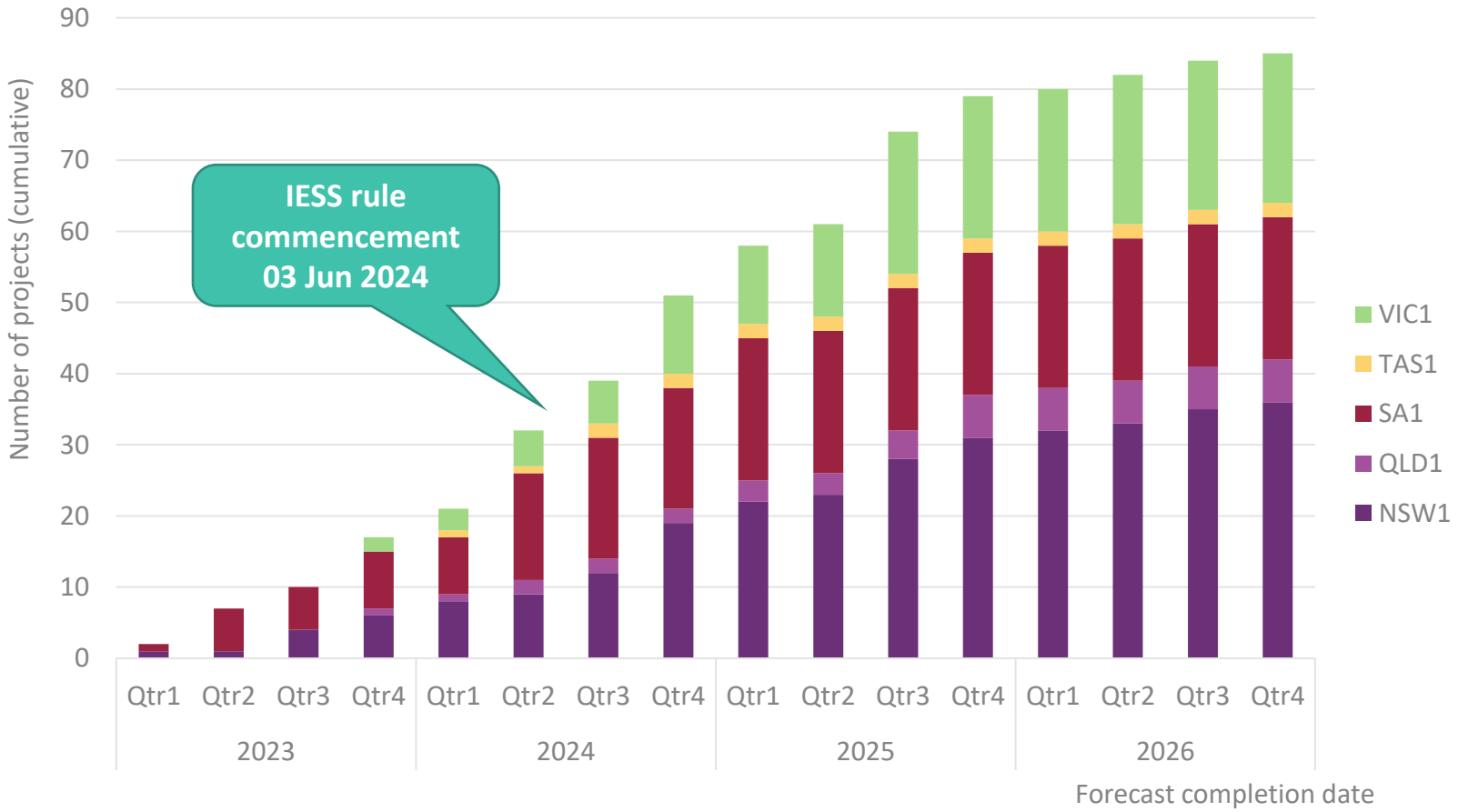
IRP classifications & services from 03 Jun 2024

Source: Australian Energy Market Commission, IESS Final Determination, 02 Dec 2021. p iv.



BESS project pipeline

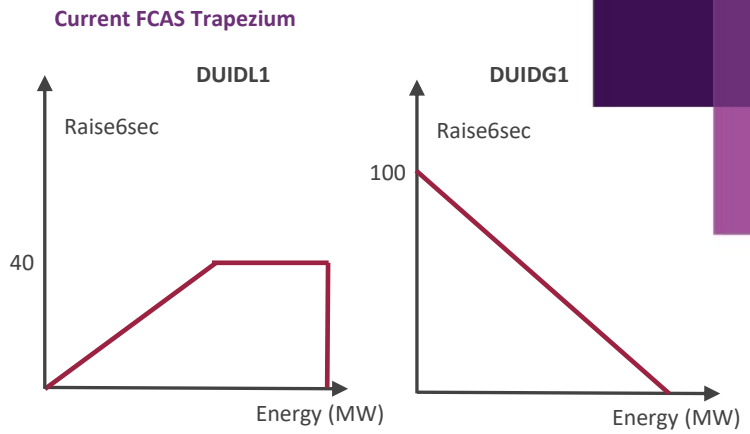
Connection enquiries & applications as at Feb 2023



Bid structure

Basilisa Choi

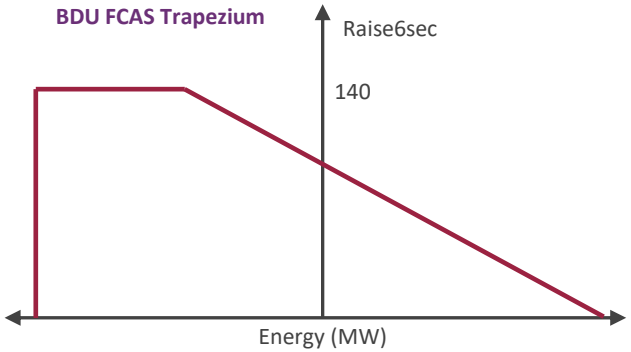
Bid structure: FCAS



Current Model

DUID	BIDTYPE	PriceBand1	PriceBand2	…	PriceBand9	PriceBand10
DUIDG1	RAISE6SEC	$0.00	$1.00	…	$128.00	$256.00
DUIDL1	RAISE6SEC	$0.00	$1.00	…	$128.00	$256.00

DUID	TI	BandAvail1	BandAvail2	…	BandAvail9	BandAvail10	Max Avail	Enablement Min	Low BreakPoint	High BreakPoint	Enablement Max
DUIDG1	1	0	0	…	15	50	100	0	0	0	100
DUIDL1	1	0	10	..	10	50	40	0	40	100	100



BDU Model

DUID	BIDTYPE	PriceBand1	PriceBand2	…	PriceBand9	PriceBand10
DUID_BDU1	RAISE6SEC	$0.00	$1.00		$128.00	$256.00

DUID	TI	BandAvail1	BandAvail2	…	BandAvail9	BandAvail10	Max Avail	Enablement Min	Low BreakPoint	High BreakPoint	Enablement Max
DUID_BDU1	1	0	10	…	25	100	140	-100	-100	-40	100

Bid structure: Energy

Design 1 (AEMO Preferred)	Load	Generation
Price Bands	1 to 10	11 to 20
Band Availabilities	Negative • Load Band MW ≥ Registered Minimum Capacity • ∑ Load Bands MW ≤ Registered Minimum Capacity	Positive • Gen Band MW ≤ Registered Maximum Capacity • ∑ Gen Bands MW ≥ Registered Maximum Capacity
Capacity	Negative	Positive
Ramp Rate Up/Down	Positive/Positive	Positive/Positive
PASA Availability	Negative	Positive

Design 2	Load	Generation
Price Bands	1 to 10	11 to 20
Band Availabilities	Positive • Load Band MW ≤ Registered Maximum Load Capacity • ∑ Load Bands MW ≥ Registered Maximum Load Capacity	Positive • Gen Band MW ≤ Registered Maximum Capacity • ∑ Gen Bands MW ≥ Registered Maximum Capacity
Capacity	Positive	Positive
Ramp Rate Up/Down	Positive/Positive	Positive/Positive
PASA Availability	Positive	Positive

Bid structure: Design details

- Removal of Fast Start Inflexibility Profile parameters is currently under consultation by the AEMC
- Bid "DailyEnergyConstraint" for the existing two-DUID model (defined for a trading day) will change to a more generic interval-based bid Min Energy/Max Energy for the single DUID BDU model

Design 1 (AEMO Preferred)

			Consumption		Production						
TI	Min Avail	Max Avail	Load Ramp Up Rate	Load Ramp Down Rate	Gen Ramp Up Rate	Gen Ramp Down Rate	Fixed Load	Min Energy	Max Energy	PASA Min Avail	PASA Max Avail
1	-100	250	6	8	8	6		0	350	-100	250
2	-200	180	6	8	8	6		0	350	-200	180
3	-200	250	6	8	8	6	10	0	350	-200	250
4	-200	250	6	8	8	6		0	350	-200	250
5	-200	250	6	8	8	6	-50	0	350	-200	250

Design 2

			Consumption		Production						
TI	Min Avail	Max Avail	Load Ramp Up Rate	Load ROC Down	Gen Ramp Up Rate	Gen Ramp Down Rate	Fixed Load		Min Energy	Max Energy	PASA Min Avail	PASA Max Avail
							Load	Gen				
1	100	250	6	8	8	6			0	350	100	250
2	200	180	6	8	8	6			0	350	200	180
3	200	250	6	8	8	6		10	0	350	200	250
4	200	250	6	8	8	6			0	350	200	250
5	200	250	6	8	8	6	50		0	350	200	250

Bid structure: Bands

Consumption | **Production**

Price Band1	Price Band2	…	Price Band9	Price Band10	Price Band11	Price Band12	…	Price Band19	Price Band20
-$1,000.00	-$71.65	…	$302.98	$13,398.40	-$999.00	-$70.65	…	$302.98	$13,399.40

Design 1 (AEMO Preferred)

Consumption | **Production** | **FCAS**

TI	Band Avail1	Band Avail2	…	Band Avail9	Band Avail10	Band Avail11	Band Avail12	…	Band Avail19	Band Avail20	Enablement Min	Low BreakPoint	High BreakPoint	Enablement Max
1	-200	0	…	0	0	0	10	…	30	250	-200	-200	-80	200
2	-200	-20	…	-20	0	0	0	…	50	180	-200	-200	-80	200
3	-200	-50	…	-10	0	0	0	…	20	250	-200	-200	-80	200
4	-200	-20	…	-20	0	0	0	…	50	250	-200	-200	-80	200
5	-200	0	…	0	0	0	0	…	30	250	-200	-200	-80	200

Design 2

Consumption | **Production** | **FCAS**

TI	Band Avail1	Band Avail2	…	Band Avail9	Band Avail10	Band Avail11	Band Avail12	…	Band Avail19	Band Avail20	Enablement Min	Low BreakPoint	High BreakPoint	Enablement Max
1	200	0	…	0	0	0	10	…	30	250	-200	-200	-80	200
2	200	20	…	20	0	0	10	…	50	180	-200	-200	-80	200
3	200	50	…	10	0	0	20	…	20	250	-200	-200	-80	200
4	200	20	…	20	0	0	10	…	50	250	-200	-200	-80	200
5	200	0	…	0	0	0	10	…	30	250	-200	-200	-80	200

Bid structure: Band Cumulation

Consumption | **Production**

Price Band1	Price Band2	…	Price Band9	Price Band10	Price Band11	Price Band12	…	Price Band19	Price Band20
-$1,000.00	-$71.65	…	$302.98	$13,398.40	-$999.00	-$70.65	…	$302.98	$13,399.40

Design 1 (AEMO Preferred)

Consumption | **Production** | **FCAS**

TI	Band Avail1	Band Avail2	…	Band Avail9	Band Avail10	Band Avail11	Band Avail12	…	Band Avail19	Band Avail20	Enablement Min	Low BreakPoint	High BreakPoint	Enablement Max
1	-100	-100	…	0	0	0	10	…	220	250	-200	-200	-80	200
2	-200	-180	…	-20	0	0	0	…	180	180	-200	-200	-80	200
3	-200	-150	…	-10	0	0	0	…	230	250	-200	-200	-80	200
4	-200	-180	…	-20	0	0	0	…	200	250	-200	-200	-80	200
5	-200	0	…	0	0	0	0	…	220	250	-200	-200	-80	200

Design 2

Consumption | **Production** | **FCAS**

TI	Band Avail1	Band Avail2	…	Band Avail9	Band Avail10	Band Avail11	Band Avail12	…	Band Avail19	Band Avail20	Enablement Min	Low BreakPoint	High BreakPoint	Enablement Max
1	100	100	…	0	0	0	0	…	220	250	-200	-200	-80	200
2	200	20	…	20	0	0	0	…	180	180	-200	-200	-80	200
3	200	20	…	10	0	0	0	…	230	250	-200	-200	-80	200
4	200	20	…	20	0	0	0	…	200	250	-200	-200	-80	200
5	200	0	…	0	0	0	0	…	220	250	-200	-200	-80	200

Bid validation

Basilisa Choi

Bid validation (Design 1 only)

BAND PRICES

- Load
  - PriceBand1 < PriceBand2 < … < PriceBand9 < PriceBand10
  - Minimum Band1 price = MFP * Load Loss Factor
  - Maximum Band10 price = MPC * Load Loss Factor
- Generation
  - PriceBand11 < PriceBand12 < … < PriceBand19 < PriceBand20
  - Minimum Band11 price = MFP * Gen Loss Factor
  - Maximum Band20 price = MPC * Gen Loss Factor

BAND AVAILABILITIES

- Load
  - Band availability for each BandAvail1 to BandAvail10 ≥ Registered Load Capacity
  - Sum of availabilities BandAvail1 to BandAvail10 ≤ Registered Load Capacity
- Generation
  - Band availability for each BandAvail11 to BandAvail20 ≤ Registered Generation Capacity
  - Sum of availabilities BandAvail11 to BandAvail20 ≥ Registered Generation Capacity

Bid convexity validation

Bid convexity validation for each trading interval:

- Prevents the concurrent dispatch of Load and Generation bands
- Load Bands with non-zero availability are validated against Generation Bands with non-zero availability (effective bands)
- "Effective band" refers to non-zero band MW capacity limited by bid MinAvail / MaxAvail
    - Bidding MinAvail = 0 allows the participant to shift band MW capacity into MFP-priced Gen Band 11 without violating the bid convexity rule

      This allows the BDU to compete with other BDU's and Gens at the MFP (and vice versa applies)
- **MLF-adjusted band prices for these effective bands must monotonically increase from Band 1 to Band 20**
- Load Bands should only have availability in bands priced lower than any of the Generation Bands with availability

Load	Band1	Band2	Band3	...	Band8	Band9	Band10
Price Band (MLF adj)	-$1,000.00	-$500.00	-$300.00		**$0.00**	$30.00	$300.00
Band Availability (MW)	-20	-20	-20		**-20**	-20	-20

Generation	Band11	Band12	Band13	...	Band18	Band19	Band20
Price Band (MLF adj)	-$962.00	**-$23.99**	$0.01		$300.01	$7,500.01	$15,500.00
Band Availability (MW)	0	**50**	100		0	0	100

Band x < Band y	Band1	Band2	Band3	...	Band8	Band9	Band10
Band11							
Band12	TRUE	TRUE	TRUE		**FALSE**	**FALSE**	**FALSE**
Band13	TRUE	TRUE	TRUE		TRUE	**FALSE**	**FALSE**
...							
Band18							
Band19							
Band20	TRUE	TRUE	TRUE		TRUE	TRUE	TRUE

Bid structure and validation: Seeking feedback

- What are your views on the proposed bid structure designs and why?
- Under the current proposal, Min Energy and Max Energy fields are only available for BDU and used to model SoC. Could this potentially be extended in future for other registration classifications?
- Any other bid validations to be considered?

Bidding interfaces

Basilisa Choi

Bidding interfaces

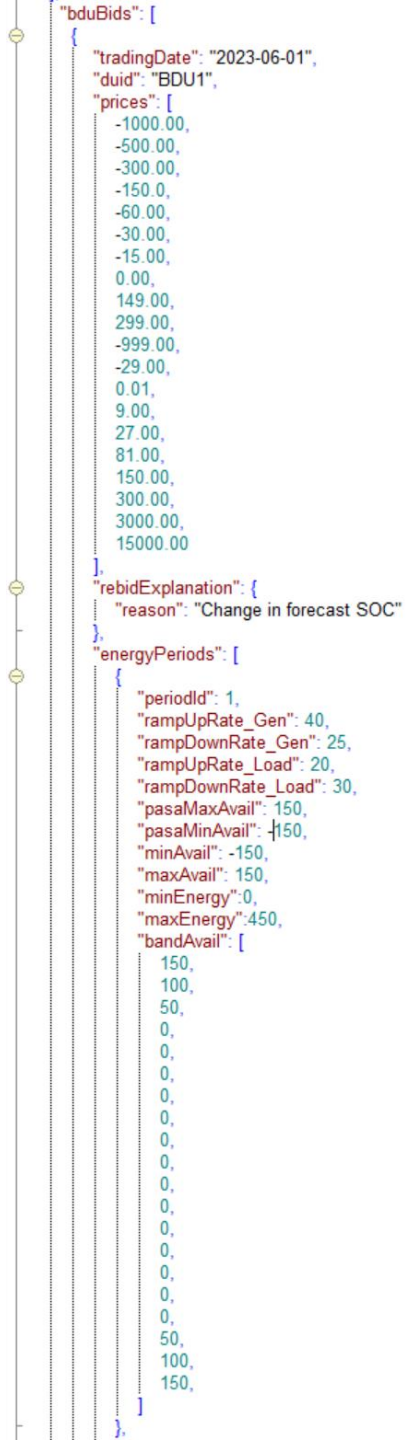
- System to System interfaces (via FTP and API) will be adjusted to include a section for BDU

  Information specific to BDU includes:

  - 20 Price Bands
  - 2 sets of Ramp Rates
  - 2 sets of Availabilities
  - Minimum and Maximum Energy (optional)
- Web-user interface:
  - Review submitted bids
  - Enter Bids
  - Upload Bids
- No bid changes for other types of units

Seeking feedback:

- What else should be considered in relation to IESS bidding interface changes? Why?



Ramp rates

Basilisa Choi

Ramp rates

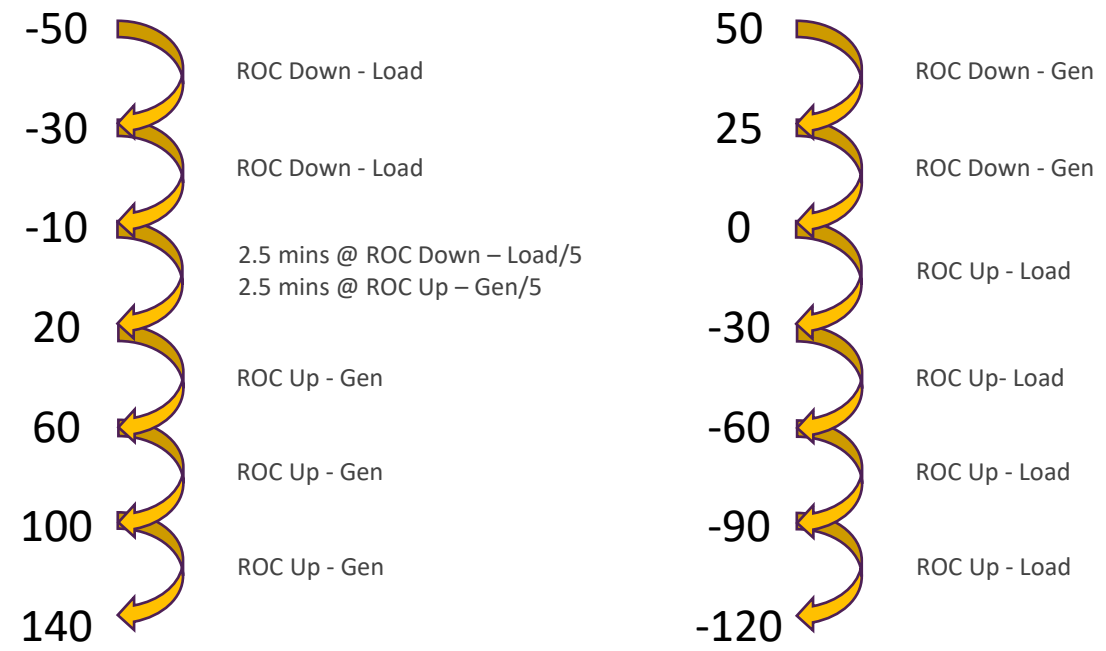
- A separate set of Ramp Rates (all positive) are defined for each direction and for each of Generation and Load sides
  - Registration (Maximums)
  - Bid
- NEMDE calculates composite bid Ramp Up and Ramp Down constraints:
  - When ramping from load to generation:
    - Use the bid Load Ramp Down Rate to reduce load to 0, then
    - Use the bid Gen Ramp Up Rate to increase generation from 0
  - When ramping from generation to load:
    - Use the bid Gen Ramp Down Rate to reduce generation to 0, then
    - Use the bid Load Ramp Up Rate to increase load from 0
- SCADA Ramp Up and Ramp Down Rates (directional only, not defined for each side)
- NEMDE uses the minimum (SCADA, Composite bid Ramp Rate) for first TI

Ramp rates example

ROC Up - Load	ROC Down - Load	ROC Up - Gen	ROC Down - Gen
30	20	40	25

Assume ROC (Rate of Change) = Ramp Rate x 5

Swap	Load to Generation	Generation to Load
InitialMW 0000	-50	50
TI 0005	-30	25
TI 0010	-10	0
TI 0015	20	-30
TI 0020	60	-60
TI 0025	100	-90
TI 0030	140	-120



Composite ramp rate constraint

- Composite ramp up rate constraint
  - Target MW ≤

    min {Initial MW + [SCADA Ramp Up Rate * TimePeriodConstant*60]

    ,

    If Initial MW >0

    then Initial MW + [Gen Bid Ramp Up Rate * TimePeriodConstant*60]

    else

    min {0, Initial MW + [Load Bid Ramp Down Rate * TimePeriodConstant*60]} +

    [Gen Bid Ramp Up Rate * max {0,(TimePeriodConstant*60 – [ABS(Initial MW)/Load Bid Ramp Down Rate])}]

    }

- Composite ramp down rate constraint
  - *Target MW ≥*

    max {Initial MW - [SCADA Ramp Up Rate * TimePeriodConstant*60]

    ,

    If Initial MW <0

    then Initial MW - [Load Bid Ramp Up Rate * TimePeriodConstant*60]

    else

    max {0, Initial MW - [Gen Bid Ramp Down Rate * TimePeriodConstant*60]} -

    [Load Bid Ramp Up Rate * max {0,(TimePeriodConstant*60 – [ABS(Initial MW)/Gen Bid Ramp Down Rate])}]

    }

Ramp rates: Seeking feedback

- What are your views on the composite ramp rates calculation?

Energy storage limits (State of charge)

Ross Gillett

Issues with current Energy Storage model

Current bid daily energy limit model is problematic for BDU, and is not recommended:

- Energy limit is defined for a trading day and not profiled over the trading day
- Energy limit applies once over the whole trading day, rather than potentially multiple times within and across trading days
- Model only applies to PASA and NEMDE Pre-dispatch, not NEMDE Dispatch and 5MPD
- Model does not initialise to the current SCADA stored energy, but to the bid daily energy limit *minus* energy used since 0400 (based on dispatch targets)
- Model does not recognise energy storage headroom limits
- Because of these limitations, many existing BESS appear not use the current model

Proposed BDU Energy Storage model: Information requirements

REGISTERED STANDING DATA

- **Minimum Energy** (typically zero) and **Maximum Energy** (MWh)
- **Import Loss Factor** and **Export Loss Factor** (between 0..1)
  - Export LF = (Exported Energy / Stored Energy)
  - Import LF = (Stored Energy / Imported Energy)
  - Energy Storage conversion efficiency = (Import LF * Export LF)
  - Use these factors instead of separate modelling of energy limits for the generation and load sides
- **FCAS Raise Regulation Usage Factor** and **FCAS Lower Regulation Usage Factor** (between 0..1)
  - Regulation Used / Regulation Enabled
  - Use in energy storage calculation, to adjust the dispatch target by deemed amount of regulation energy used
  - Determined by AEMO based on historical analysis, or provided by participant

BID DATA

- **Minimum Energy** and **Maximum Energy** (MWh)
  - Either null (no energy limit) or defined for all trading intervals of trading day bid
  - Must be ≤ Registered values
  - In NEMDE/PASA, energy storage value applies for current & subsequent intervals until the next change in energy storage value

SCADA DATA

- **Current Energy** (MWh, aka State of Charge for BESS or Initial SOC)
- **Current Maximum Energy** (MWh, aka Full Pack Energy for BESS or Initial MaxSOC)

Proposed BDU Energy Storage model: Tracking Energy Storage

Remaining Energy (aka Target SOC) is calculated after NEMDE determines dispatch target (aka Target MW) for the trading interval:

Target SOC = Max [0 , Initial SOC – Energy Used]

Energy Used = { (Initial MW + Target MW) / 2 * Time Period
+ (Raise Reg Enabled MW * Raise Reg Usage Factor)
- (Lower Reg Enabled MW * Lower Reg Usage Factor) }

where;

Initial MW = current SCADA active power (first interval) , or previous trading interval's Target MW; positive or negative

Initial SOC = current SCADA SOC (first interval), or previous trading interval's Target SOC (tracked); always positive

Target MW = NEMDE dispatch target ; positive or negative

Raise Reg Enabled MW , Lower Reg Enabled MW; positive

Raise Reg Usage Factor, Lower Reg Usage Factor; positive between 0..1

Time Period = Interval Length (hours)

Proposed BDU Energy Storage model: Application of Energy Storage Limits

Dispatch Target constraints due to Energy Storage Limits.
Only apply if bid Min Energy and Max Energy are defined for the trading day.

Upper bound (constrain-off generation to avoid going below minimum energy storage)…

Target MW ≤ Max **{** 0, **[{** (Initial SOC – bid Min Energy) / (Time Period/2) **}** - Initial MW **]** * Export LF **}**

Lower bound (constrain-off load to avoid going above maximum energy storage)…

Target MW ≥ Min **{** 0, **[{** (Initial SOC – Min(bid Max Energy, Initial MaxSOC)) / (Time Period/2) **}** - Initial MW **]** / Import LF **}**

where;

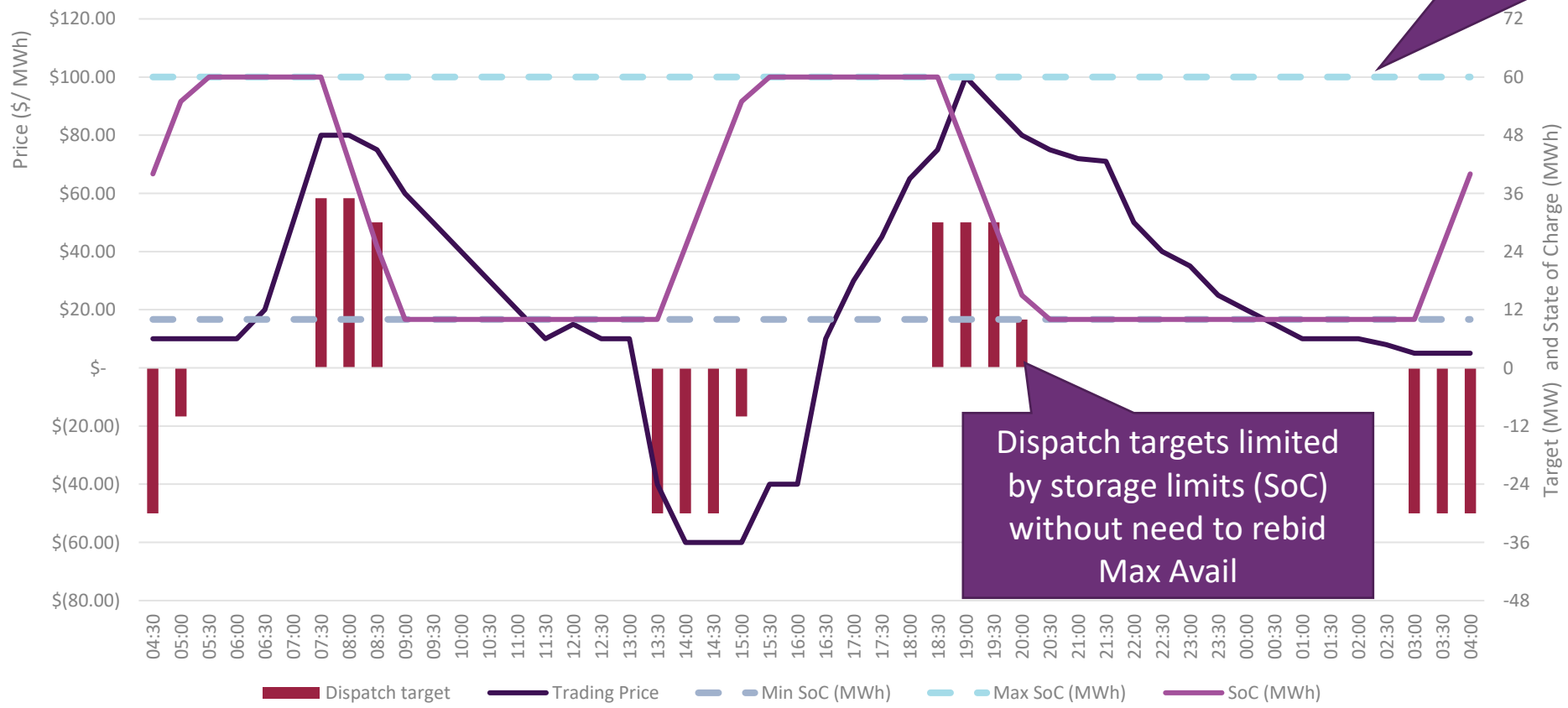
Min Energy = Minimum energy storage; positive

Max Energy = Maximum energy storage; positive

Initial MaxSOC = current SCADA Maximum SOC (if available) - only applies in first interval; always positive

Application of Energy Storage Limits

Example dispatch profile of a 30 MW / 60 MWh battery



Energy storage limits: Seeking feedback

- What are your views on the proposed energy limits model and why?
- Should the model also apply to NEMDE DS, 5MPD?
- Should the model initialise to SCADA current SOC?
- Should the tracked energy storage reflect both dispatch targets AND regulation usage component? How should regulation usage be determined?
- Should NEMDE allow the maximum/minimum energy storage limits to violate (prompting the participant to rebid)

  OR

  Should NEMDE constrain-on generation/load targets to avoid violating the maximum/minimum energy storage limits?
- Should energy storage continue to be tracked, even if no energy limits are defined? Should they be reported?

Price ties

Ross Gillett

Price ties and energy dispatch

No change proposed to the current principles for resolving price-tied energy bands based on their relative Band MW:

- BDU Load Bands are pro-rata dispatched against other price-tied BDU Load Bands and Scheduled Loads within the same region
  - Includes scheduled loads for legacy 2-DUID BDUs
- BDU Gen Bands are pro-rata dispatched against other price-tied BDU Gen Bands and Scheduled/Semi-Scheduled Gens within the same region
  - Includes scheduled generating units for legacy 2-DUID BDUs

Price ties: Seeking feedback

- What are your views on proposed price-tie model and why?
- Should Band MW for price-tied band be availability-limited? (broader issue than just for BDUs)

FCAS Enablement

Ross Gillett

FCAS enablement: Extension to existing pre-conditions

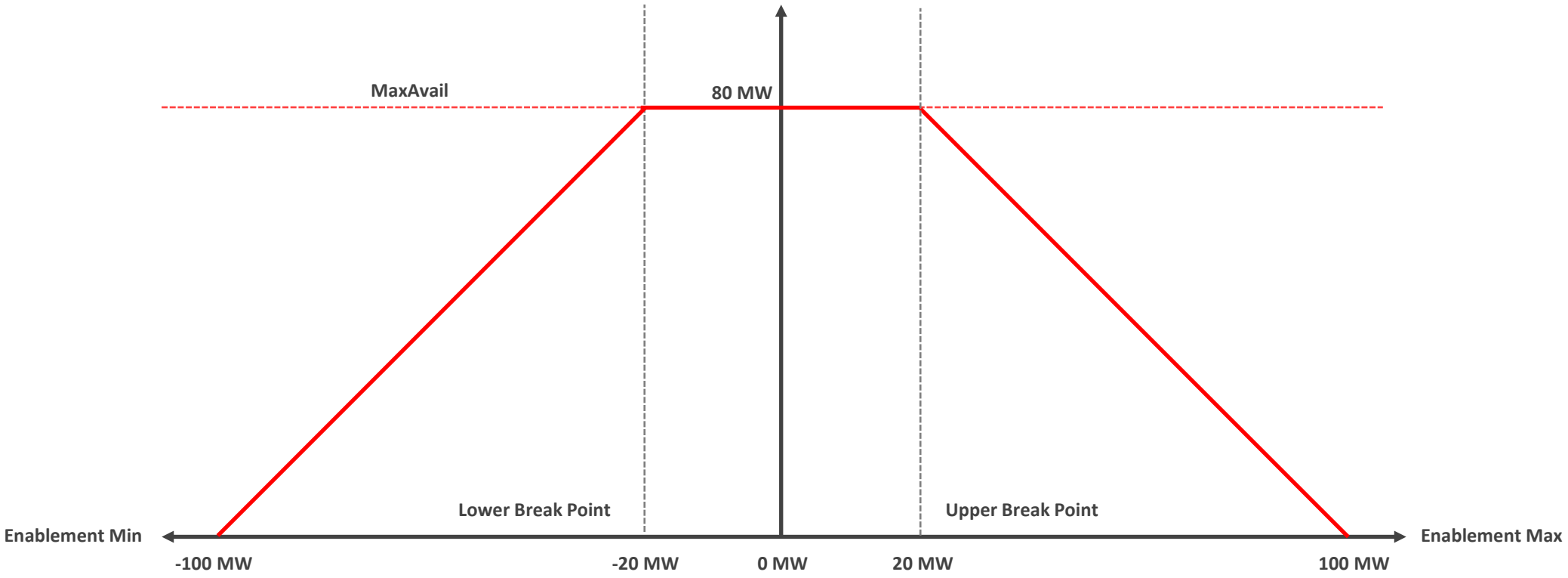
- All existing FCAS pre-conditions in NEMDE that apply to scheduled generating units also apply to BDUs, with these additional conditions:
  - If Bid Max Avail < XX FCAS EnablementMin → disable XX FCAS trapezium
  - If Bid Min Avail > XX FCAS EnablementMax → disable XX FCAS trapezium
- All existing FCAS Regulation trapezium scaling in NEMDE for scheduled generating units also applies to BDU:
  - SCADA AGC Upper Limit
  - SCADA AGC Lower Limit
  - SCADA Ramp Rates

FCAS enablement: Pre-conditions due to energy storage limits

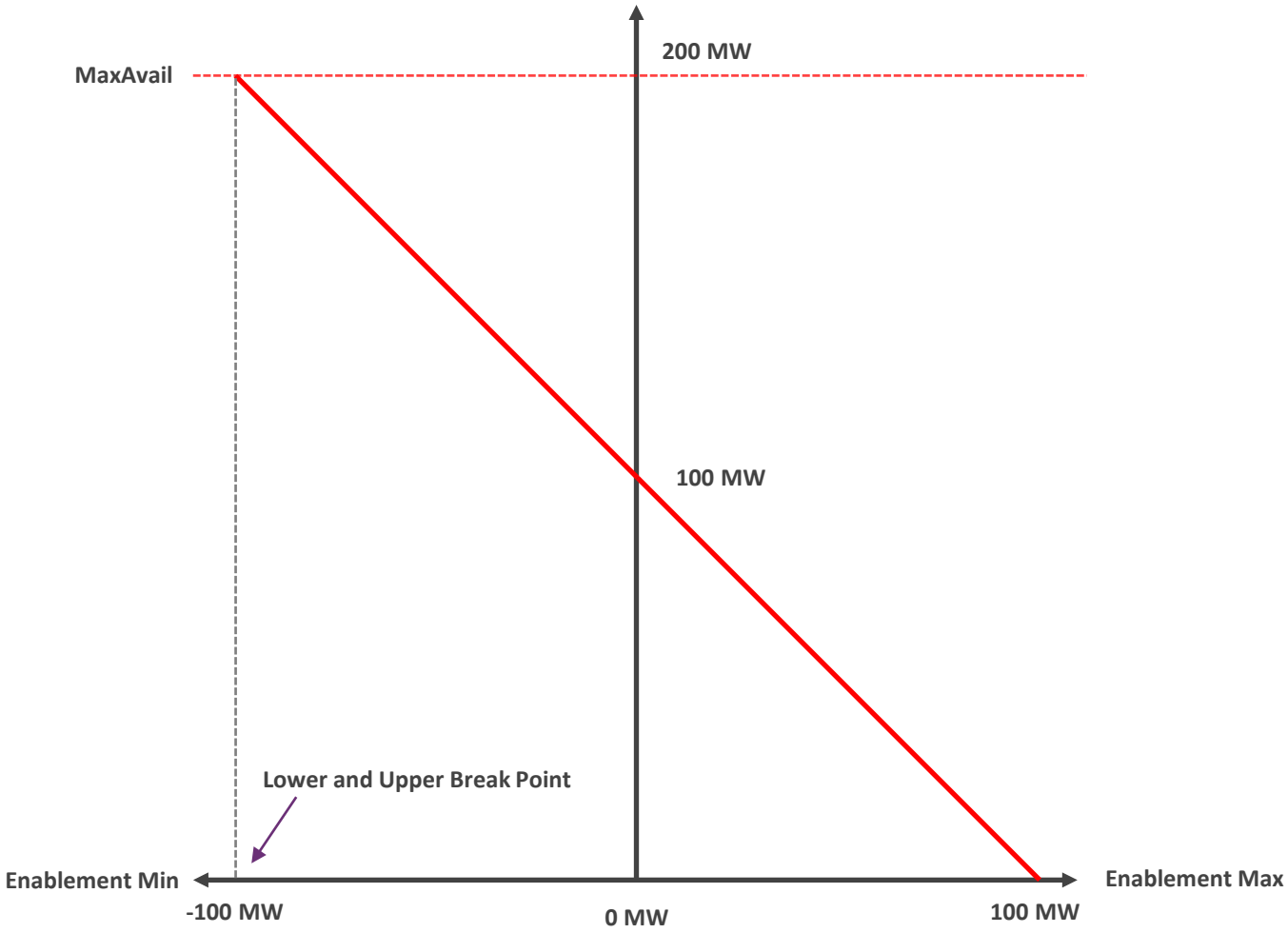
The following only applies if the participant has submitted bid Minimum and Maximum Energy Storage limits:

- If Initial SOC ≤ Bid Min Energy → disable all XX FCAS Raise trapeziums
  - **Assumption:** Bid Min Energy has sufficient margin above empty storage to support the delivery of all enabled XX FCAS Raise Max Avail
- If Initial SOC ≥ min(Bid Max Energy, Initial MaxSOC) → disable all XX FCAS Lower trapeziums
  - **Assumption:** Bid Max Energy has sufficient margin below full storage to support the delivery of all enabled XX FCAS Lower Max Avail

Sample FCAS trapezium (1)



Sample FCAS trapezium (2)



FCAS enablement: Seeking feedback

- What are your views on the proposed pre-conditions for FCAS enablement relating to energy storage limits? Why?

SCADA requirements & dispatch instructions

Ross Gillett

SCADA requirements

No Changes

- Active Power (+/-, MW)
- Ramp Rates (+, MW/min)
  - Ramp Up (Import to Export direction)
  - Ramp Down (Export to Import direction)
- State of Charge (+, MWh)
  - Current (Initial SOC)
  - Maximum (Initial MaxSOC)
- AEMO's AGC calculation:
  - AGC Status (ON/OFF)
  - AGC Ramp Up Rate (+)
  - AGC Ramp Down Rate (+)
  - AGC Upper Limit (+/-)
  - AGC Lower Limit (+/-)

Dispatch instructions

DISPATCH INSTRUCTIONS

- Dispatch Target (MW) via market systems/AGC
  - Negative for load (consumption)
  - Positive for generation (production)
- Conformance Mode (only applicable if participating in Aggregated Dispatch Conformance)
- FCAS Enabled (MW)
  - Positive (no change)

ENERGY STORAGE (MWh)

- Indicative only
- Apply to NEMDE Dispatch/5MPD/Pre-dispatch/PD7DAY
- Future PASA only (post-July 2025)

SCADA requirements and dispatch instructions: Seeking feedback

- What are you views on the reporting of the tracked Energy Storage?
- Why?

Industry BDU transition

Emily Brodie

IESS rule transition arrangements

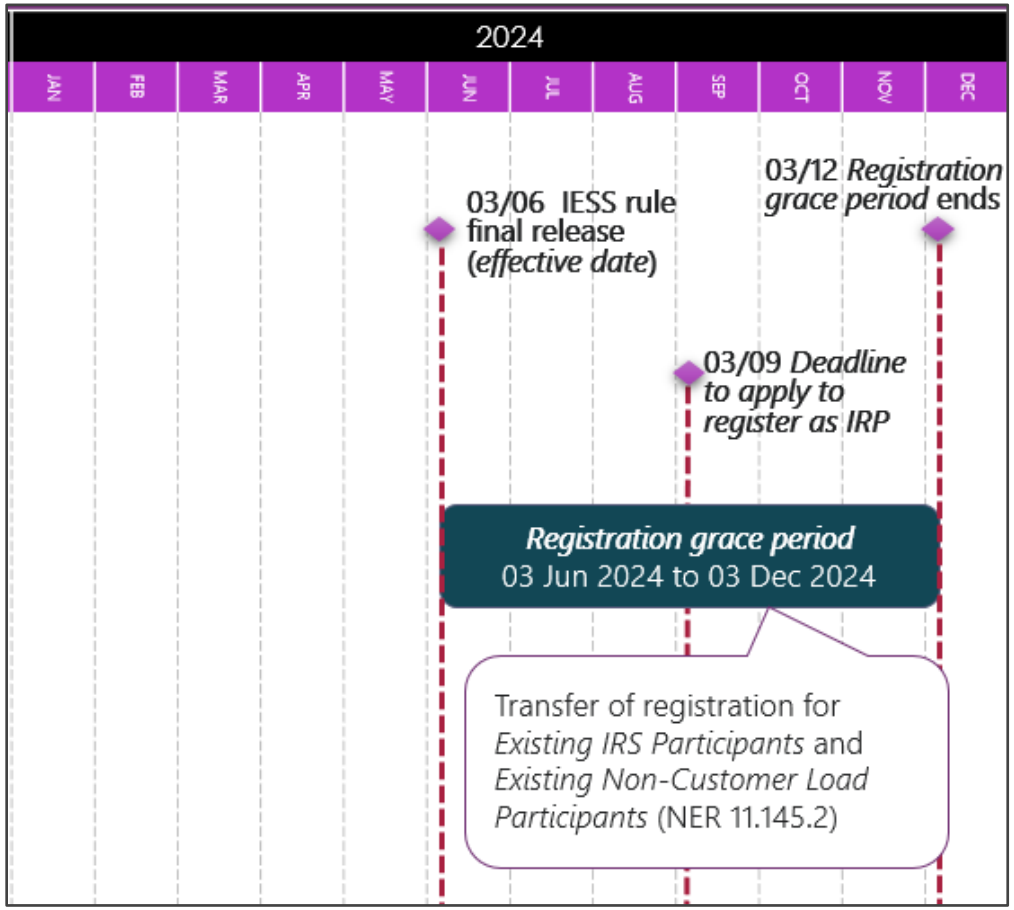
IESS final determination & rule were published 02 Dec 2021

Existing IRS participant*

- Registered prior to 02 Dec 2021
- Need to have applied to register as an IRP by 03 Sep 2024
- Need to have completed registration by 03 Dec 2024

New IRS participant*

- Registered between 02 Dec 2021 & 02 Jun 2024
- Move to 1-DUID on 03 Jun 2024



* Defined terms in IESS transitional rule (NER 11.145.1)

Industry engagement on BDU transition

02 Dec 2021

- IESS rule made

Apr – Nov 2022

- IESS working group
- Stakeholder/ AEMO one-to-one discussions
- Early feedback helping to form BDU transition approach.

28 Feb 2023

- Discussion at NEM Reform Implementation Forum on ***draft*** IESS industry readiness approach.
- Includes consideration of need for various testing, transition and go-live plans.

Apr 2023

- Discussion at Implementation Forum on ***final*** IESS industry readiness approach.
- Will include proposed timelines for developing testing, transition and go-live plans.

Mid to late 2023

- Develop and implement testing, transition and go-live plans in conjunction with industry via Implementation Forum.

03 Jun 2024

- IESS rule effective date

Stakeholder feedback

In Q3/4 2022, the IESS project team held some one-to-one discussions with incumbent battery operators and bidding software vendors, along with discussions in the IESS working group.

Stakeholder feedback to date	In response, AEMO is considering:
For some participants that have both an 'existing' and a 'new' bidirectional resource, there is a preference to move all bidirectional resources to the 1-DUID model at the same time i.e. use the grace period for their new BDU/s.	Introducing flexibility for these participants to move all of their bidirectional resources to the 1-DUID model at the same time (within the grace period).
Preference for a longer grace period or grandfathering of the 2-DUID model.	Introducing flexibility for existing bi-directional units to have a longer (but not indefinite) grace period.
Need for technical specifications to be released in time for bidding software vendors to design, build and test IESS changes and allow time for their customers' to participant in market trial.	Scheduling the release of the draft technical specification in late Sep 2023.

Industry BDU transitions: Next steps

- Industry readiness preparations, starting with developing Industry readiness approach in Q1/Q2 2023 via the NEM Reform Implementation Forum
- Industry readiness approach will include scope and timing for:
  - ADC go-live plan
  - BDU transition plan (existing BDUs)
  - BDU cutover plan (new BDUs)
  - Market trial and industry testing plan

Next steps & Close

Ulrika Lindholm

BDU design: Next steps

DATE	ACTION	RESPONSIBLE
Tue 04 Apr 2023	Provide detailed feedback on BDU design elements to iess@aemo.com.au	Industry stakeholders, including this group
Late May to early July 2023	Consultation on accommodating relevant BDU design elements in dispatch procedure	All
End Sep 2023	Release draft technical specification for comment	All
Ongoing	Industry readiness engagement via the NEM Reform Implementation Forum	All
Mon 03 Jun 2024	IESS rule commences	All

AEMO is open to running further sessions as needed. Expressions of interest are sought for a Listening session for existing participants in relation to concerns around the BDU model.

Session close

iess@aemo.com.au

IESS Project

Appendix: A

Glossary

Glossary

Term	Definition
ADC, ADG	Aggregated Dispatch Conformance, Aggregate Dispatch Group
API	Application Programming Interface
BDU	Bidirectional unit
BESS	Battery energy storage system
DUID	Dispatchable unit identifier
FTP	File Transfer Protocol
IESS	Integrating Energy Storage Systems rule
MLF	Marginal Loss Factor
NEMDE	NEM Dispatch Engine
PASA	Projected Assessment of System Adequacy
ROC	Rate of Change
SCADA	Supervisory Control and Data Acquisition
SGA	Small Generation Aggregator
SOC	State of Charge

APPENDIX B

Summary of feedback questions

Summary of feedback questions (1/2)

Topic	Slide/s	Question
Bid structure and validation	21	1. What are your views on the proposed bid structure designs and why? 2. Under the current proposal, Min Energy and Max Energy fields are only available for BDU and used to model SoC. Could this potentially be extended in future for other registration classifications? 3. Any other bid validations to be considered?
Bidding interfaces	23	1. What else should be considered in relation to IESS bidding interface changes? Why?
Ramp rates	28	1. What are your views on the composite ramp rates calculation?
Energy storage limits	35	1. What are your views on the proposed energy limits model and why? 2. Should the model also apply to NEMDE DS, 5MPD? 3. Should the model initialise to SCADA current SOC? 4. Should the tracked energy storage reflect both dispatch targets AND regulation usage component? How should regulation usage be determined? 5. Should NEMDE allow the maximum/minimum energy storage limits to violate (prompting the participant to rebid) OR Should NEMDE constrain-on generation/load targets to avoid violating the maximum/minimum energy storage limits? 6. Should energy storage continue to be tracked, even if no energy limits are defined? Should they be reported?

Summary of feedback questions (2/2)

Topic	Slide/s	Question
Price ties	38	1. What are your views on proposed price-tie model and why? 2. Should Band MW for price-tied band be availability-limited? (broader issue than just for BDUs)
FCAS enablement	44	1. What are your views on the proposed pre-conditions for FCAS enablement relating to energy storage limits? Why?
SCADA requirements and dispatch instructions	48	1. What are you views on the reporting of the tracked energy storage? Why?

APPENDIX C

Application of aggregated dispatch conformance to BESS

Transition of two-DUID BDUs into aggregated dispatch conformance

09 Aug 2023
ADC starts

All 2-DUID BDUs that are BESS will be linked to an Aggregate Dispatch Group (ADG), either:

- Automatically by AEMO, and assigned a Conformance Type = Target; or
- If requested by the participant, assigned a Conformance Type = Mixed if the BDU is part of a generating system with other scheduled resources.

For Conformance Type = Target:

- Conformance Mode in dispatch instructions always = 1, and can be ignored

From 03 Jun 2024
Move to 1-DUID

- When a two-DUID BDU transitions to a single DUID, its ADG linkage will be removed if its Conformance Type = Target

For more information:

- Dispatch procedure – update for ADC
- ADC information session 30 Nov 2023

APPENDIX D

AEMO Competition Law – Meeting Protocol

AEMO Competition Law - Meeting Protocol

AEMO is committed to complying with all applicable laws, including the Competition and Consumer Act 2010 (CCA). In any dealings with AEMO, all participants agree to adhere to the CCA at all times and to comply with appropriate protocols where required to do so.

AEMO has developed meeting protocols to support compliance with the CCA in working groups and other forums with energy stakeholders. Before attending, participants should confirm the application of the appropriate meeting protocol.

Please visit: https://aemo.com.au/en/consultations/industry-forums-and-working-groups