IESS BDU DUID bid format

Integrating Energy Storage Systems

12 December 2023

Bid structure: Energy

	Load	Generation
Price Bands	1 to 10	1 to 10
Band Availabilities	Positive • Band MW ≤ Registered Load Capacity • ∑ Bands MW ≥ Registered Load Capacity	Positive • Gen Band MW ≤ Registered Gen Capacity • ∑ Gen Bands MW ≥ Registered Gen Capacity
Ramp Rate Up/Down	Positive/Positive	Positive/Positive
Max Availability	Positive	Positive
PASA Availability	Positive	Positive
Energy Limit (optional)	Positive (Max Energy Limit)	Positive (Min Energy Limit)

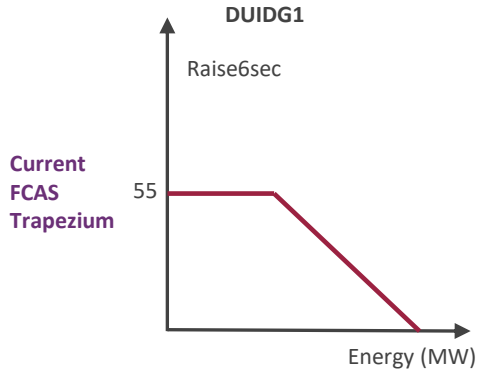
Bid structure: FCAS

	Regulation		Contingency
	Load	Gen	
Price Bands	1 to 10	1 to 10	1 to 10
Max Availability	Positive	Positive	Positive
Band Availabilities	Positive ∑ Load Bands MW + ∑ Gen Bands MW ≥ Registered Max Capacity Band MW ≤ Registered Max Capacity	Band MW ≤ Registered Max Capacity	Positive ∑ Bands MW ≥ Registered Max Capacity Band MW ≤ Registered Max Capacity
Minimum Enablement	Negative or 0	0 or Positive	Negative or Positive
Maximum Enablement	Negative or 0	0 or Positive	Negative or Positive
Low Breakpoint	Negative or 0	0 or Positive	Negative or Positive
High Breakpoint	Negative or 0	0 or Positive	Negative or Positive

Bid structure: Contingency FCAS

Current Model

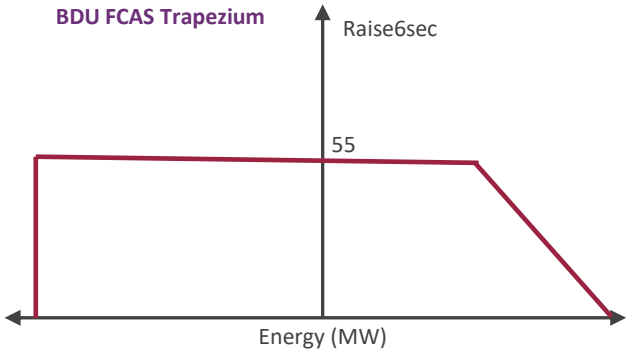
DUID	BIDTYPE	PriceBand1	PriceBand2	…	PriceBand9	PriceBand10
DUIDG1	RAISE6SEC	$0.00	$1.00	…	$128.00	$256.00



DUID	TI	BandAvail1	BandAvail2	…	BandAvail9	BandAvail10	Max Avail	Enablement Min	Low BreakPoint	High BreakPoint	Enablement Max
DUIDG1	1	0	0	…	15	40	55	0	0	45	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	20	55	-100	-100	45	100

NOTE: In this example, Max Avail of 55 MW and trapeziums reflect limitations for droop settings on the BESS.

Bid structure: Design details

- Bid “DailyEnergyConstraint” for the existing two-DUID model (defined for a trading day) will change to an interval-based bid Min Energy/Max Energy limit for the single DUID BDU model.
- NOTE: The option for semi-scheduled generating units and bidirectional units to submit fast start inflexibility profiles has been removed from the NER.

Energy

TI	DUID	Direction	BidType	Max Avail	Ramp Up Rate	Ramp Down Rate	Fixed Load	Energy Limit	PASA Avail
1	DUID_BDU1	GEN	ENERGY	250	8	8		0	250
1	DUID_BDU1	LOAD	ENERGY	200	6	6	10	100	220

FCAS

TI	DUID	Direction	BIDTYPE	Max Avail	Enablement Min	Low BreakPoint	High BreakPoint	Enablement Max
1	DUID_BDU1	GEN	RAISEREG	100	0	0	0	100
1	DUID_BDU1	LOAD	RAISEREG	40	-100	-100	-40	0
1	DUID_BDU1		RAISE6SEC	40	-100	-100	60	100

Bid structure: Bands

Price Bands

Settlement Date	DUID	Direction	BidType	PriceBand1	PriceBand2	…	PriceBand9	PriceBand10
31/12/2024	DUID_BDU1	GEN	ENERGY	$0.00	$10.00	…	$302.98	$13,398.40
31/12/2024	DUID_BDU1	LOAD	ENERGY	-$1,000.00	-$171.65	…	$60.21	$299.50
31/12/2024	DUID_BDU1	GEN	RAISEREG	0.00	$10.00	…	$30.98	$348.40
31/12/2024	DUID_BDU1	LOAD	RAISEREG	$25.00	$35.65	…	$160.21	$299.50
31/12/2024	DUID_BDU1		RAISE6SEC	$1.00	$6.65	…	$50.21	$299.50

Band Quantities

TI	Settlement Date	DUID	Direction	BidType	MaxAvail	BandAvail1	BandAvail2	…	BandAvail9	BandAvail10
1	31/12/2024	DUID_BDU1	GEN	ENERGY	250	100	50	…	20	250
1	31/12/2024	DUID_BDU1	LOAD	ENERGY	200	150	20	…	0	0
1	31/12/2024	DUID_BDU1	GEN	RAISEREG	100	100	50	…	20	100
1	31/12/2024	DUID_BDU1	LOAD	RAISEREG	40	5	10	…	0	40
1	31/12/2024	DUID_BDU1		RAISE6SEC	40	25	5	…	0	40

Bid validation

BAND PRICES

- Load
  - PriceBand1 < PriceBand2 < … < PriceBand9 < PriceBand10
  - Minimum Band1 price = MFP * Load Loss Factor
  - Maximum Band10 price = MPC * Load Loss Factor
- Generation
  - PriceBand1 < PriceBand2 < … < PriceBand9 < PriceBand10
  - Minimum Band1 price = MFP * Gen Loss Factor
  - Maximum Band10 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 BandAvail1 to BandAvail10 ≤ Registered Generation Capacity
  - Sum of availabilities BandAvail1 to BandAvail10 ≥ Registered Generation Capacity

Bid convexity validation

Bid convexity validation for each trading interval:

- An NER Rule requirement to validate **band prices monotonically increase**
- 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 MaxAvail
    - Bidding MaxAvail = 0 on Load-side allows the participant to shift band MW capacity into MFP-priced Gen Band 1 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 10 for both Load and Generator side**
- 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	Band1	Band2	Band3	...	Band8	Band9	Band10
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

$ Load < $ Generation	Band1	Band2	Band3	...	Band8	Band9	Band10
Band1							
Band2	TRUE	TRUE	TRUE		**FALSE**	**FALSE**	**FALSE**
Band3	TRUE	TRUE	TRUE		TRUE	**FALSE**	**FALSE**
...							
Band8							
Band9							
Band10	TRUE	TRUE	TRUE		TRUE	TRUE	TRUE

Regulation FCAS trapezium parameters

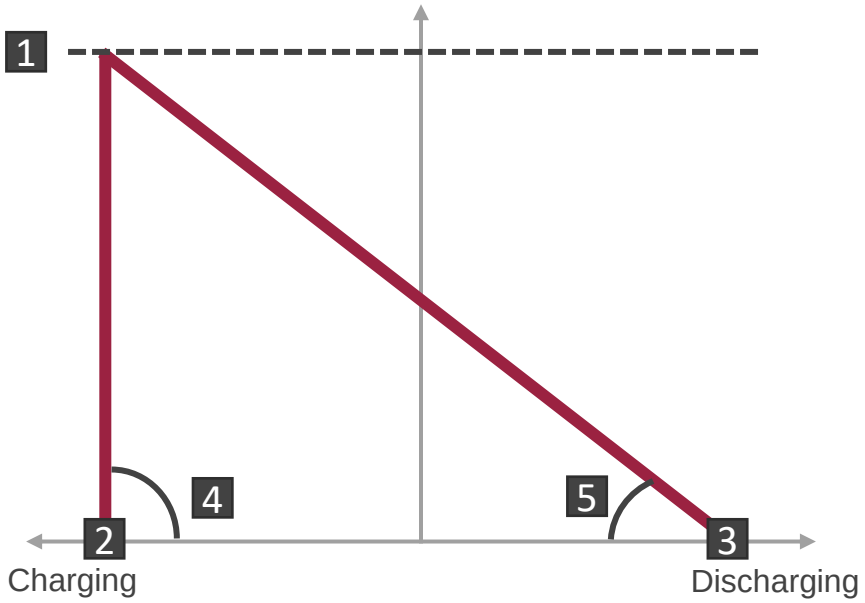
Registration data (Sch 3.1 Bid Validation Data)

- Maximum Capacity (1)
- Minimum Enablement Level (2)
- Maximum Enablement Level (3)
- Maximum Lower Angle (4)
- Maximum Upper Angle (5)

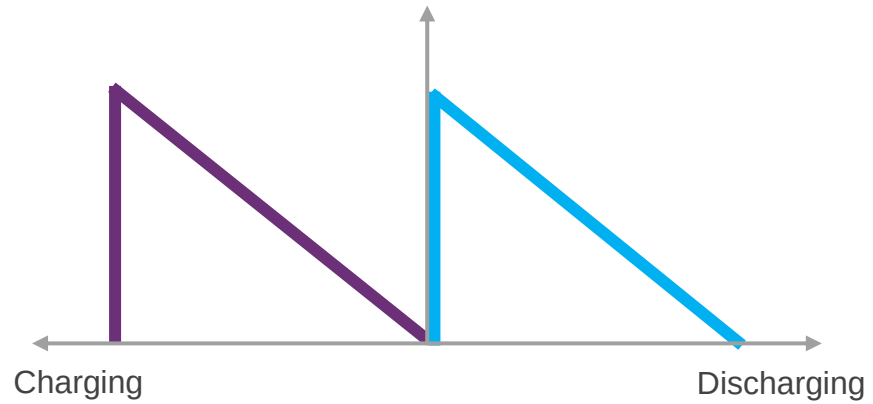
Separate bids for load + gen sides, but bids for both sides must be submitted simultaneously for validation

Load side	Generation side
$MaxAvail_{Load}$	$MaxAvail_{Gen}$
$EnablementMin_{Load}$	$EnablementMin_{Gen}$
$EnablementMax_{Load}$	$EnablementMax_{Gen}$
$LowBreakpoint_{Load}$	$LowBreakpoint_{Gen}$
$HighBreakpoint_{Load}$	$HighBreakpoint_{Gen}$

Conceptual registration trapezium



Regulation FCAS trapeziums in NEMDE (raise)

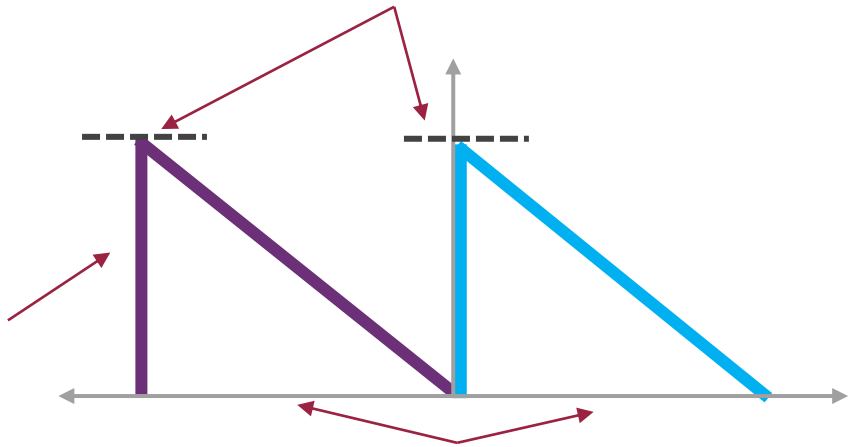


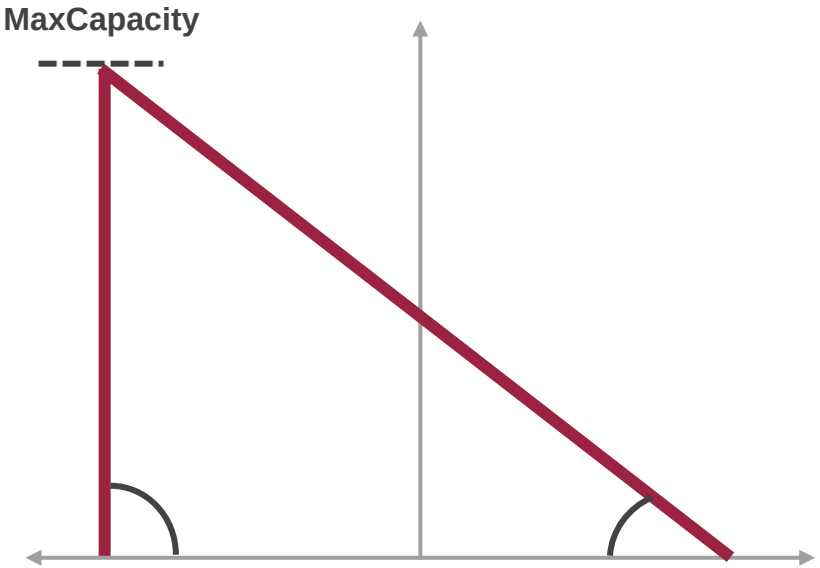
Validation of regulation FCAS trapeziums (1)

Ensures the trapeziums have a standard shape, and – when combined - are within the registered trapezium.

1. Combined load and generation regulation max availability must not exceed registered regulation max capacity: $MaxAvail_{Load} + MaxAvail_{Gen} <= MaxCapacity.$
2. Gen trapezium is defined on the positive side, and load trapezium is defined on the negative side.
3. Trapezium has a 'standard' shape: *EnablementMin <= LowBreakpoint <= High Breakpoint <= EnablementMax*.

Parameters define a standard trapezium shape.

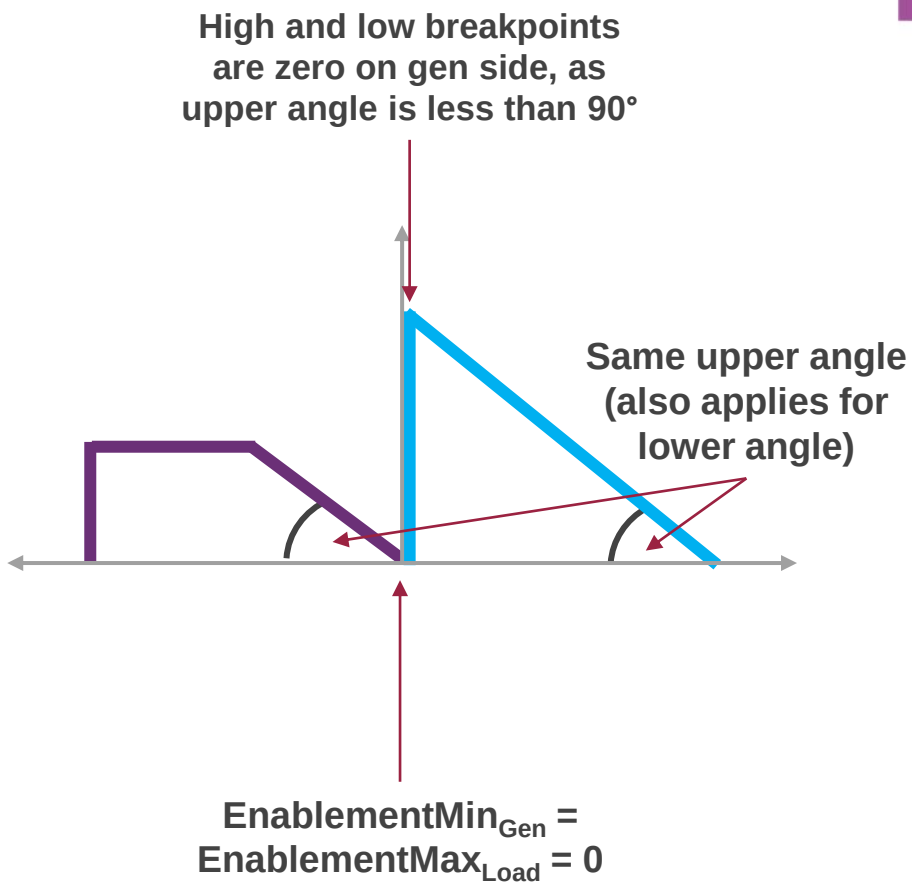




Validation of regulation FCAS trapeziums (2)

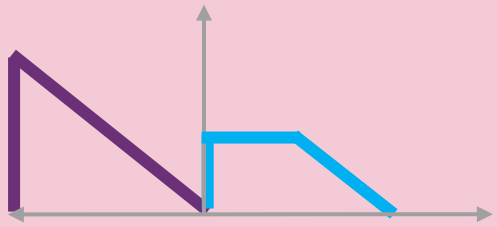
The following apply only if there is bid non-zero regulation max availability on <u>both</u> the load and gen sides:

1. Must be no ‘gaps’ between trapeziums:
   - $\text{EnablementMin}_{\text{Gen}} = 0$
   - $\text{EnablementMax}_{\text{Load}} = 0$
2. Both trapeziums must have the same upper angle.
3. Both trapeziums must have the same lower angle.
4. If the upper angle is less than 90°, high and low breakpoints <u>on the generation trapezium</u> must be set to zero.
5. Similarly, if the lower angle is less than 90°, high and low breakpoints <u>on the load trapezium</u> must be set to zero.

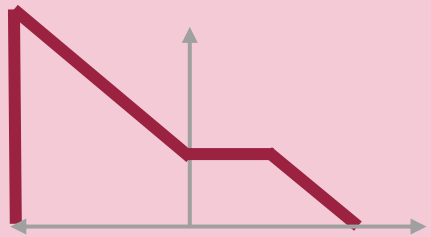


Examples of invalid regulation trapeziums (1)

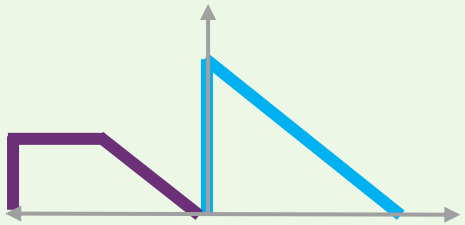
Invalid trapezium



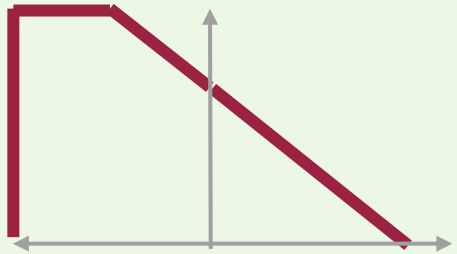
Combined



Valid alternative



Combined

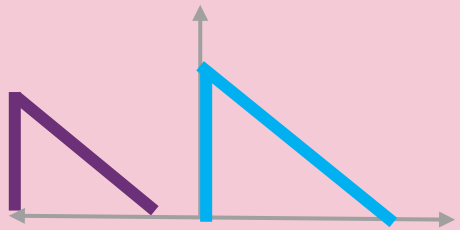


Explanation

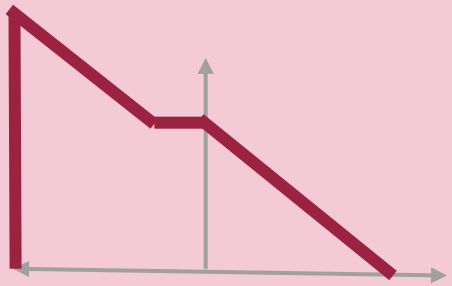
If the upper angle is less than 90°, both the low and high breakpoint on the generation side must be zero.

Examples of invalid regulation trapeziums (2)

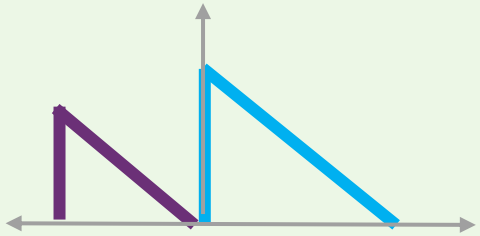
Invalid trapezium



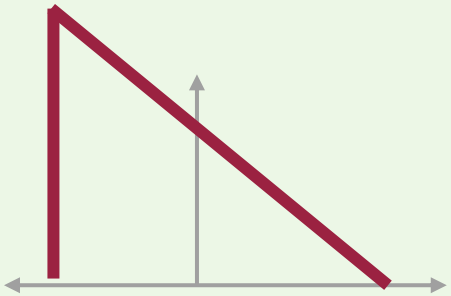
Combined



Valid alternative



Combined



Explanation

A gap between the trapeziums allows for non-convex solutions.

Resolved by setting $MaxEnablement_{Load} = 0$ (shown)
or $MaxAvail_{Gen} = 0$