TECHNICAL WORKING GROUP

OPERATIONAL SUBGROUP

ENERGY SECURITY BOARD

25 AUGUST 2022

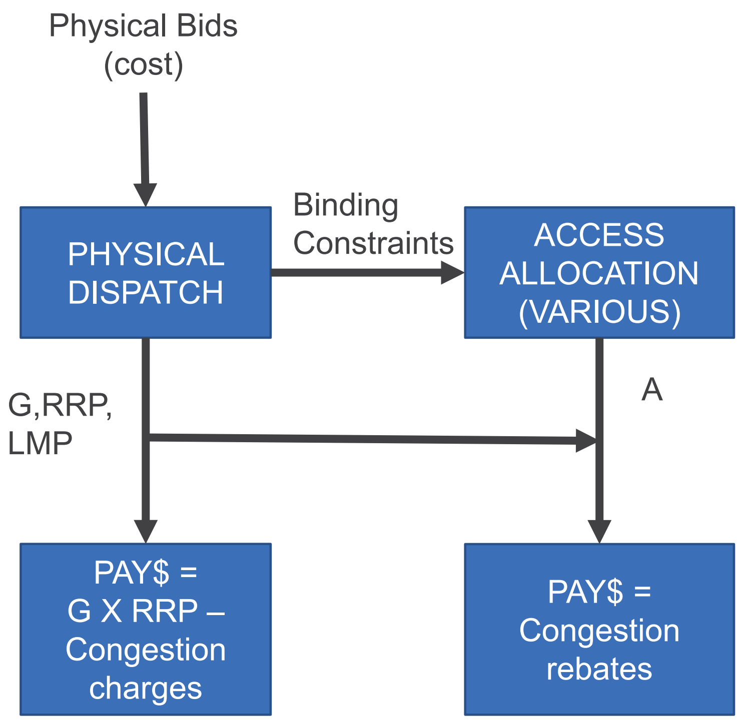
AGENDA

Time	Topic
2:00	Welcome, objectives and agenda
2:05	Recap of dispatch and settlement architectures
2:15	Impact on out-of-merit generators
3:15	Impact on PPAs
3:55	Next steps and close

RECAP OF DISPATCH AND SETTLEMENT ARCHITECTURES

CMM

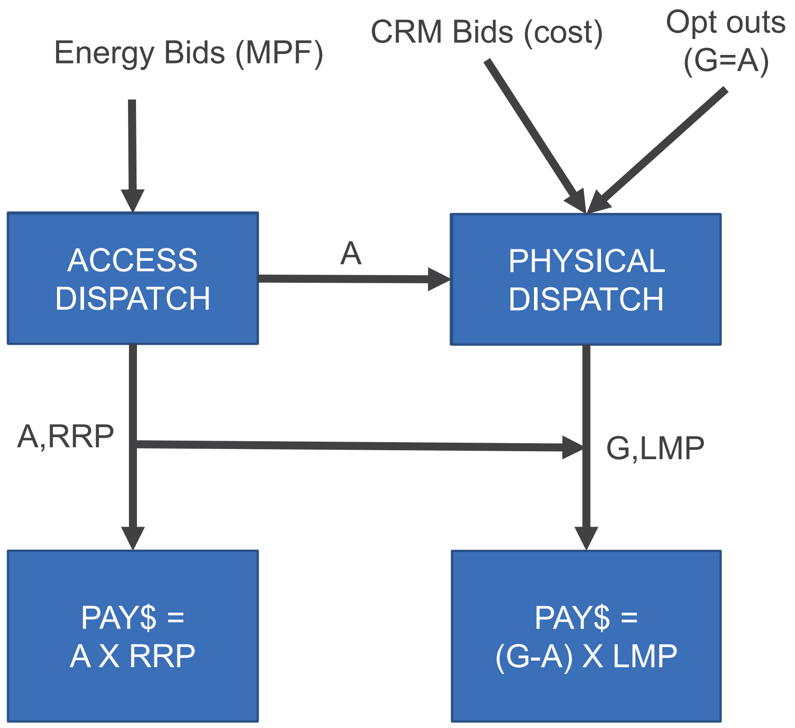
CMM$ = A x RRP + (G-A) x LMP



Access determined *after* dispatch

CRM

CRM$ = A x RRP + (G-A) x LMP



Access determined *before* dispatch

TREATMENT OF OUT OF MERIT GENERATORS

Status quo

The energy market determines access and physical dispatch at the same time.

If cost < RRP, the generator wants access.

If *cost > RRP*, it does not want access because it'll incur the cost of physical dispatch.

Generators only seek access to RRP if they are in-merit.

CMM

Access is decided by a rebate allocation method.

If the allocation does not consider costs, it will grant access to in-merit and out-of-merit generators.*

Access to in-merit generators is diluted.

CRM

Access is decided by bids into the access dispatch (energy market).

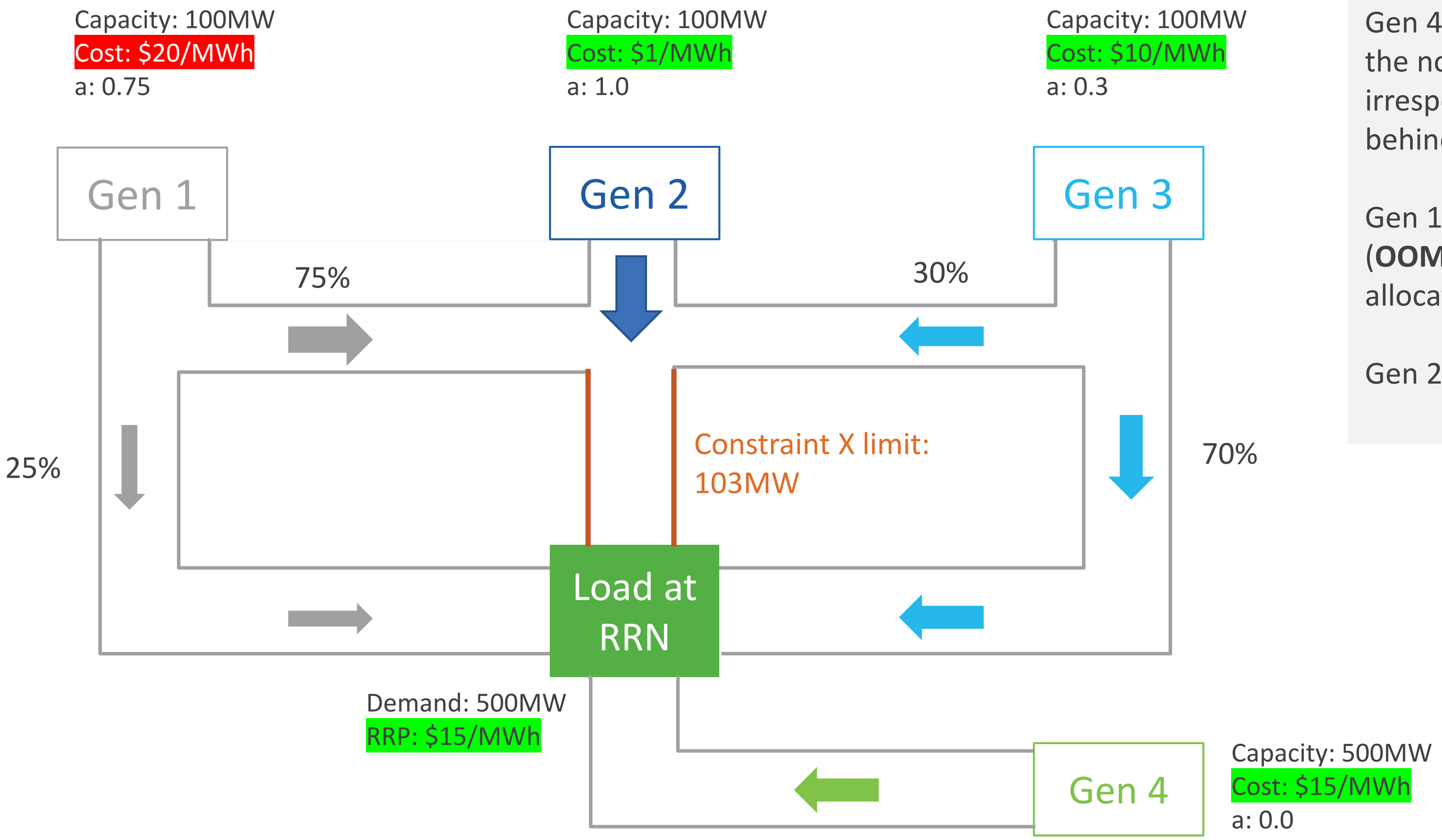
Constrained generators can adjust their bids to secure access i.e. where *LMP < RRP*, bid -$1000/MWh.

Access to in-merit generators is diluted.

** Unless the eligibility criteria are adjusted, access is granted to OOM generators in the following CMM rebate allocation methods: pro-rata access, pro-rata entitlement, winner takes all. The inferred economic dispatch method does factor in estimated costs and hence excludes OOM.*

OUT OF MERIT - REFERENCE SCENARIO

Reference scenario modified for Gen 1 costs ($20/MWh)



Gen 4 offers $15/MWh. As a large generator at the node, this ties the RRP to its offer price, irrespective of bidding behaviour by generators behind the constraint.

Gen 1 has costs of $20/MWh and is out of merit (**OOM**). Under the status quo, Gen 1 will not be allocated access or physical dispatch.

Gen 2 and Gen 3 are in merit.

OUT OF MERIT – STATUS QUO

Status quo

Unit	G *MW*	G x RRP $	Cost $	Profit $
Gen 1	0	0	0	0
Gen 2	73	1,095	73	1,022
Gen 3	100	1,500	1,000	500
Total	**173**	**2,595**	**1,073**	**1,522**

No dispatch, no cost and no profit for OOM

We are investigating the impact of OOM generators. Gen 2 and Gen 3 are dispatched efficiently in this simplified status quo scenario. It does not illustrate the issues of disorderly bidding. Refer to previous working papers for this concept.

OUT OF MERIT – CMM

*Pro-rata access model **including** OOM*

Gen 1 is OOM but granted access

Unit	A *MW*	G *MW*	A x RRP $	(G-A) x LMP $	Cost $	Profit $
Gen 1	50	0	754	-226	0	528
Gen 2	50	73	754	23	73	703
Gen 3	50	100	754	537	1,000	291
Total	**150**	**173**	**2,261**	**334**	**1,073**	**1,522**

Profit transfers to OOM

CMM achieves a cost efficient outcome

*Pro-rata access model **excluding** OOM*

Gen 1 is OOM and excluded access

Unit	A *MW*	G *MW*	A x RRP $	(G-A) x LMP $	Cost $	Profit $
Gen 1	0	0	0	0	0	0
Gen 2	79	73	1,188	-6	73	1,109
Gen 3	79	100	1,188	224	1,000	413
Total	**158**	**173**	**2,261**	**218**	**1,073**	**1,522**

Profit retained by in-merit generators

Refer to 20220721 TWG working paper CMM allocation methods final for detailed calculations.

OUT OF MERIT – CRM

CRM bids for access and physical dispatch

Unit	Cost $/MWh	Bid - access $/MWh	Bid – physical $/MWh
Gen 1	20	-1000	20
Gen 2	1	-1000	1
Gen 3	10	-1000	10
Gen 4	15	15	15

Gen 1 is OOM and bids to the floor to secure access.

Profit transfers to OOM

CRM achieves the same cost efficient outcome as CMM in this scenario

Gen 1 has more favourable contribution factor than Gen 2 and secures access.

*Outcomes for access and physical dispatch **including** OOM*

Unit	A MW	CRM MW	G MW	Total cost $	Access profit $	CRM profit $	Total profit $
Gen 1	97	-97	0	0	-487	1,509	1,022
Gen 2	0	73	73	73	0	0	0
Gen 3	100	100	100	1,000	500	0	500
Subtotal	**197**	**-24.3**	**173**	**1,073**	**13**	**1,509**	**1,522**
Gen 4	303	24.3	327	4,905	0	0	0
Total	**500**	**0**	**500**	**5,978**	**13**	**1,509**	**1,522**

Refer to 20220721_TWG working paper_CRM reference paper_final for detailed calculations.

OUT OF MERIT – CRM

*Outcomes for access and physical dispatch **excluding** OOM*

Unit	A *MW*	CRM *MW*	G *MW*	Total cost *$*	Access profit *$*	CRM profit *$*	Total profit *$*
Gen 1	0	0	0	0	0	0	0
Gen 2	73	0	73	73	1,022	0	1,022
Gen 3	100	0	100	1,000	500	0	500
Subtotal	**197**	**0**	**173**	**1,073**	**1,522**	**1,522**	**1,522**
Gen 4	303	0	327	4,905	0	0	0
Total	**500**	**0**	**500**	**5,978**	**1,522**	**1,522**	**1,522**

*Gen 1 is OOM and **excluded** from access dispatch*

Profit retained by in-merit generators

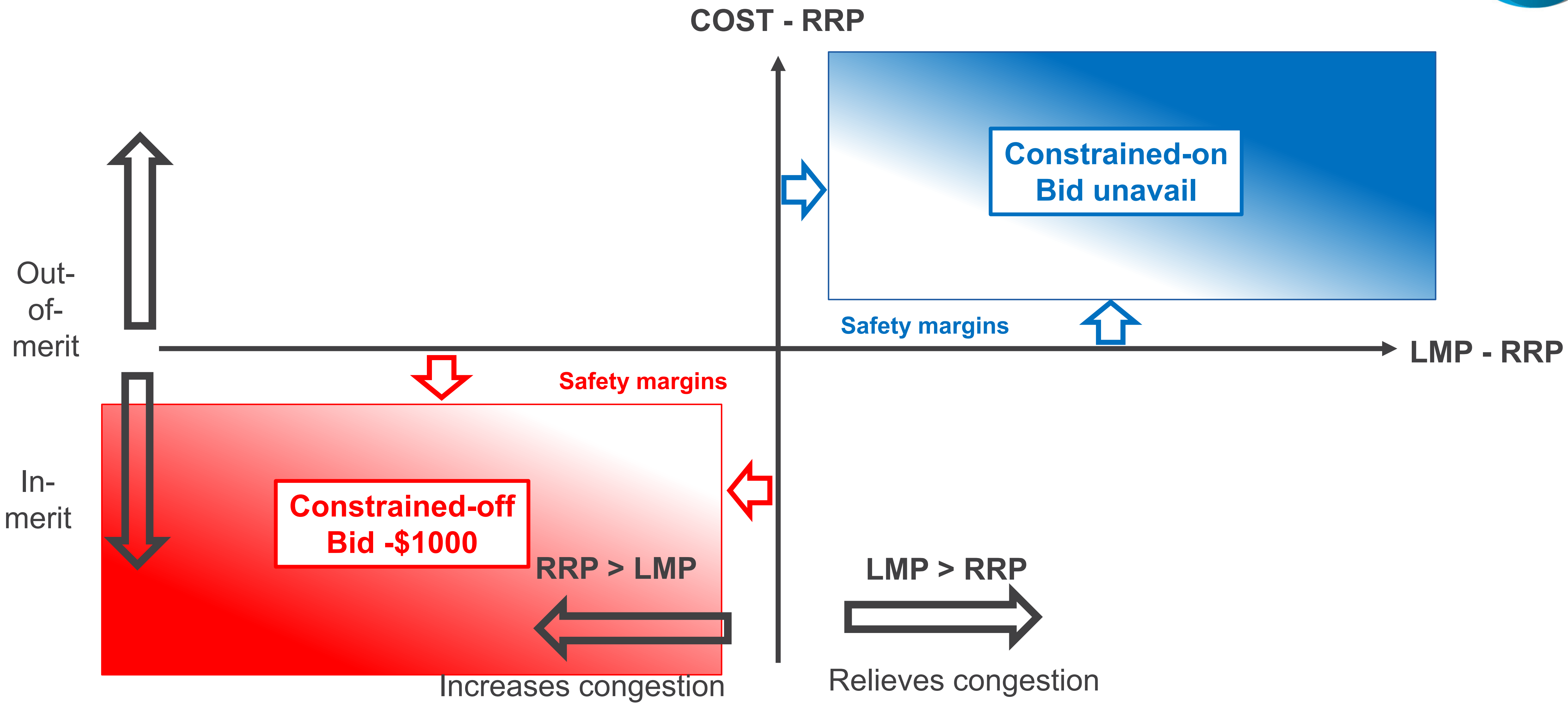
Refer to 20220721_TWG working paper_CRM reference paper_final for detailed calculations.

OUT OF MERIT – COMPARISON

***Profit** outcomes for access and physical dispatch - summary*

Unit	Status quo $	CMM incl OOM $	CMM excl OOM $	CRM incl OOM $	CRM excl OOM $
Gen 1	0	528	0	1022	0
Gen 2	1022	703	1109	0	1,022
Gen 3	500	291	413	500	500
Subtotal	**1522**	**1522**	**1522**	**1522**	**1522**
Gen 4	0	0	0	0	0
Total	**1522**	**1522**	**1522**	**1522**	**1522**

BIDDING INCENTIVES – STATUS QUO



BIDDING INCENTIVES – CRM

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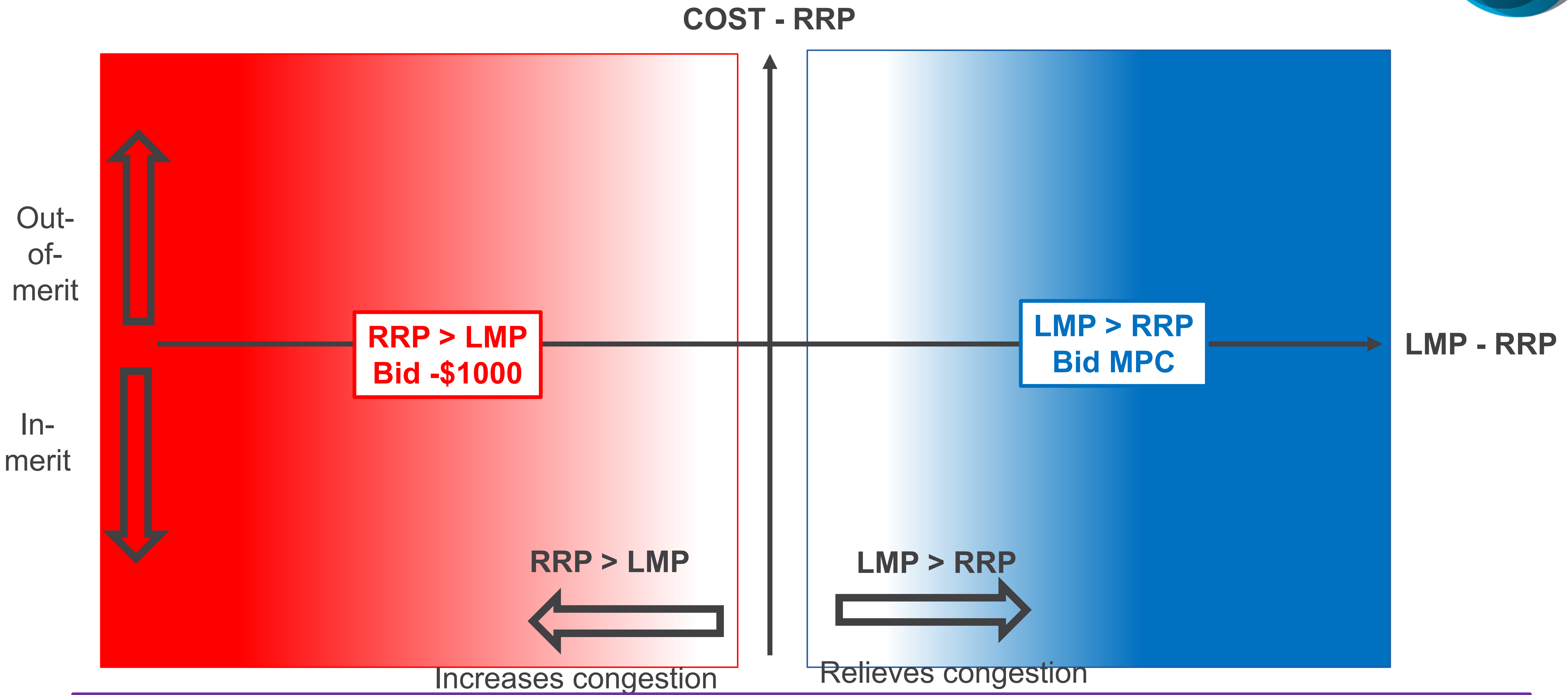


Is this bidding, and associated access dilution, a concern?
If so, how could this be prevented or mitigated?

OUT OF MERIT - OPTIONS

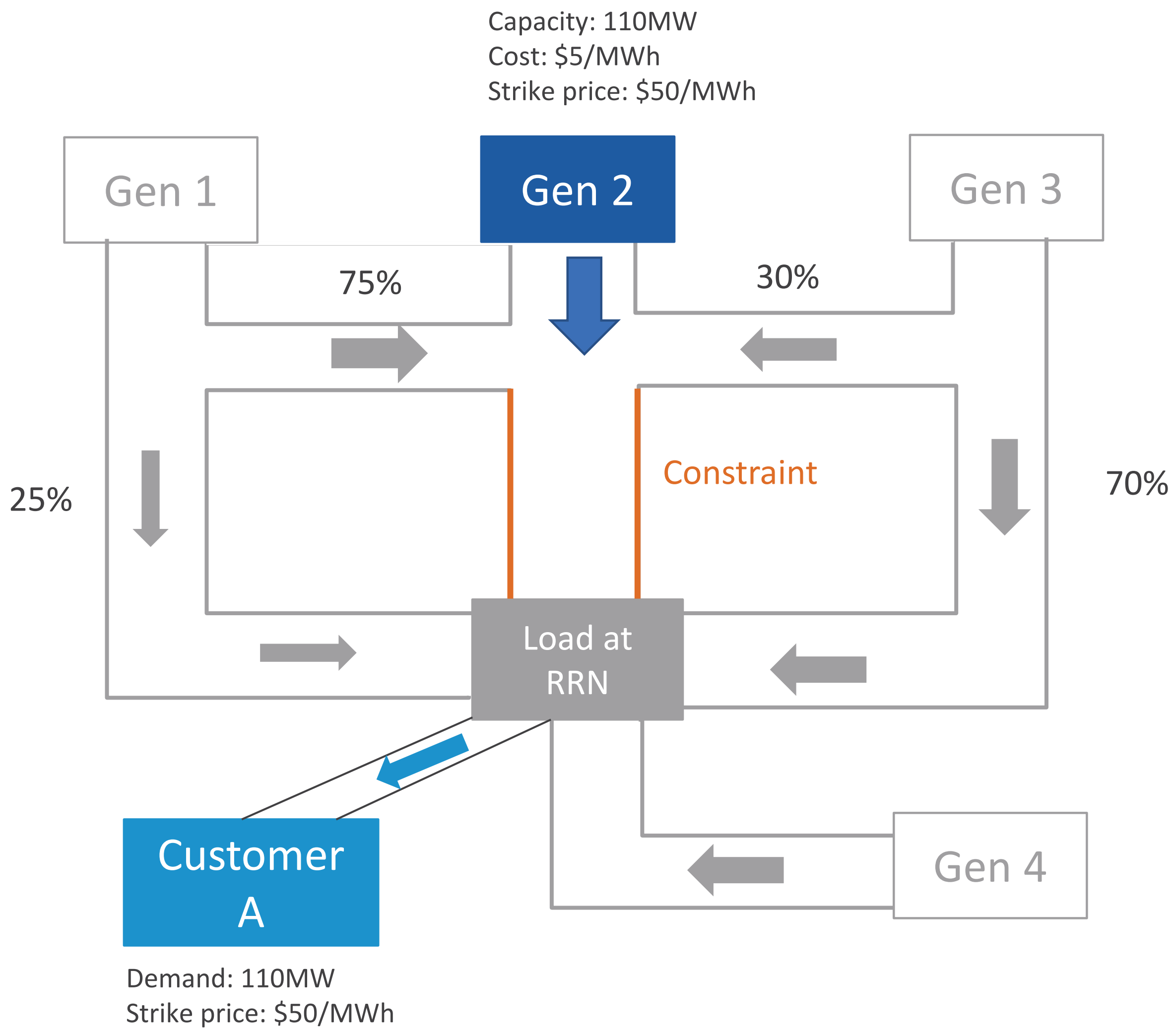
Option 0	Option 1	Option 2	Option 3	Option 4a	Option 4b
Accept that OOM generators are allocated access.	Exclude OOM from access allocation based on physical bids e.g. exclude if physical bid > RRP. It is implicitly assumed that generators bid at or close to cost.	Bidding guidelines to prohibit OOM bidding lower than "normal" to gain access. Monitoring of bidding performed by AER to identify anomalies.	Exclude OOM from access allocation based on estimated generating costs e.g. exclude if estimated costs > RRP. Costs could be estimated or inferred by [AEMO].	Exclude OOM from access allocation based on contracted and grandfathered costs e.g. new entrants nominate an operating cost. Higher nominated cost = less access = lower connection fee. Lower nominated cost = more access = higher connection fee. Costs nominated by the generator during connection fee. More relevant for thermal and some renewables.	Apply energy constraints in CMM/CRM i.e. relevant for hydro, pumped hydro, batteries.

- *What criteria would you use to assess the alternatives?*
- *What are your initial assessments?*
- *What additional analysis will support a decision on preference/s?*

CONTRACTUAL ARRANGEMENTS

PPA SCENARIO

Modified reference scenario with PPA



Simplified extract of contract terms

Contract term	Value
Party 1 – Buyer	Customer A
Party 2 – Seller	Gen 2
Capacity	110 Mwac
Contracted	100%
Minimum generation	[ ] MWh
Type	Contract for difference
NEM spot price	Regional reference price (RRP)
RRP floor	[ ] $/MWh
Strike price	$50/MWh

PPA SCENARIO – STATUS QUO

Status quo

PPA $ = G x (RRP – strike price)

Generator profit = G x RRP – G x cost – PPA $

= G x (strike price – cost)

Generator receives fixed price for its output

Customer cost = D x RRP – PPA $

= G x strike price + (D-G) x RRP

Customer is hedged for quantity G and only exposed to spot price (RRP) for differences between D and G

Where

G Generator's physical output

D Customer load

PPA $ CfD payment/receipt between parties

Illustrative results for reference scenario

	Value
Input	
RRP	$100/MWh
Strike price	$50/MWh
Cost	$5/MWh
G	100MW
D	110MW
Output	
PPA $	$5,000
Gen 2 profit	$4,500
Customer A cost	$6,000

Gen 2 is constrained and dispatches 100MW

Customer A pays strike price for 100MW and RRP for 10MW

PPA SCENARIO – CRM

<u>*Congestion relief market – potential modification to PPAs*</u>

CRM profit$ = (G – A) x (LMP – cost)

If CRM bidding at cost, CRM profit$ ≥ 0

PPA $ = A x (RRP – strike price) + $\boxed{\text{k x CRM profit\$}}$

Profit sharing efficiency gain

Generator profit = A x RRP – (G – A) x LMP – G x cost – PPA $

= A x (strike price – cost) + (1-k) x CRM profit$

Customer cost = D x RRP – PPA $

= A x strike price + (D-A) x RRP + k x CRM profit$

D is hedged for quantity A and receives share of CRM profit$ ≥ 0

Where

G	Generator's physical output
D	Customer load
LMP	Locational marginal price
0 < k < 1	Negotiated sharing of efficiency gain

<u>*Illustrative results for reference scenario*</u>

	Opt out	Opt in
<u>Input</u>		
RRP	$100/MWh	$100/MWh
LMP	n/a	$55/MWh
Strike price	$50/MWh	$50/MWh
Cost	$5/MWh	$5/MWh
A	100MW	100MW
G	100MW	110MW
D	110MW	110MW
k	n/a	0.5
<u>Output</u>		
CRM profit$	n/a	$500
PPA $	$5,000	$5,250
Gen 2 profit	$4,500	$4,750
Customer A cost	$6,000	$5,750

Gen 2 profit has increased

Customer A costs have decreased

PPA CONSIDERATIONS

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Potential modifications to PPAs

- Negotiated outcome for sharing efficiency gain $0 < k < 1$
  - If $k = 1$, customer receives full benefit of efficiency gain and generator has no LMP exposure.
  - If $k = 0$, generator receives full benefit of efficiency gain and customer has no LMP exposure.
  - Potential impact on strike prices depending on % efficiency gain shared between parties and/or appetite for LMP exposure.
- Price floors / caps for the net price outcomes for both parties in each dispatch interval
- Cumulative cap for payments by customer to generator for LMP impacts e.g. $[x] per annum or per contract term where [x] is a bid value as part of negotiations (initial position for negotiation in the draft generation LTESA)
- Exclude constraint events from minimum generation guarantees (may pass price risk to customers for increased firming).

Group discussion

- *What are your views on potential commercial responses to the CRM and CMM for the customer, retailer and generator?*
- *What other factors determine whether parties will 'opt in' to the CRM?*
- *Are there key commercial items missing from our considerations?*

GROUP DISCUSSION

NEXT STEPS

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Upcoming meetings – *amended to reflect latest schedule*

Date	Investment	Operational	Description
1 September 2022	☑		Focus area 1 working papers Initial discussion of focus area 3 issues
15 September 2022	☑		Discussion of focus area 1 working papers Focus area 2 working papers to be shared
22 September 2022		☑	Workshop: interconnectors (access allocation, inter-regional settlement residue and settlement residue auction)
29 September 2022	☑	☑	Review outputs of NERA modelling Focus area 3 working papers (as necessary)
6 October 2022		☑	Workshop: follow up discussion on energy storage and scheduled load
October 2022			*Draft report (date to be confirmed)*

Details of focus areas for investment timeframes are provided overleaf.

FOCUS ISSUES FOR DETAILED DESIGN

Focus area 1

Parties subject to the access arrangement

Quantifying available transmission hosting capacity

Process used to quantify transmission hosting capacity

Basis of connection fees

Focus area 2

Process for allocating transmission queue positions

Maximising hosting capacity of available transmission (incl. safety net)

Signals for congestion relief

Focus area 3

Efficient retirement decisions

Treatment of pre-existing generators

Governance

Payment arrangements

Integration with jurisdictional schemes

Interaction with other schemes

Focus area 4

Modelling of impacts

Implementation

Transitional arrangements

Cost benefit analysis

Use of revenues

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