Australian Government
Department of Climate Change, Energy, the Environment and Water

Congestion Management Public Forum

Agenda and pre-reading

Agenda

TIME	ITEM
09:30	Welcome, acknowledgement of country and introductions Paul Johnson, Commonwealth, on behalf of Energy Senior Officials
09:40	Key themes of stakeholder feedback - Anna Collyer, ESB (pre-reading available)
09:50	Evolution of the CRM design – Amanda Sinden, ESB (pre-reading available)
09:55	Stakeholder presentations • Clean Energy Investor Group (CEIG) • Clean Energy Council (CEC) • RES Australia • Tilt Renewables • Neoen • Australian Financial Markets Association (AFMA) • Energy Consumers Australia (ECA)
11:00	Q & A – Anna Collyer
11:20	Next steps – Anna Collyer
11:25	Close – Paul Johnson
11:30	End

TRANSMISSION ACCESS REFORM

JOINT SENIOR OFFICIALS – ESB PUBLIC FORUM

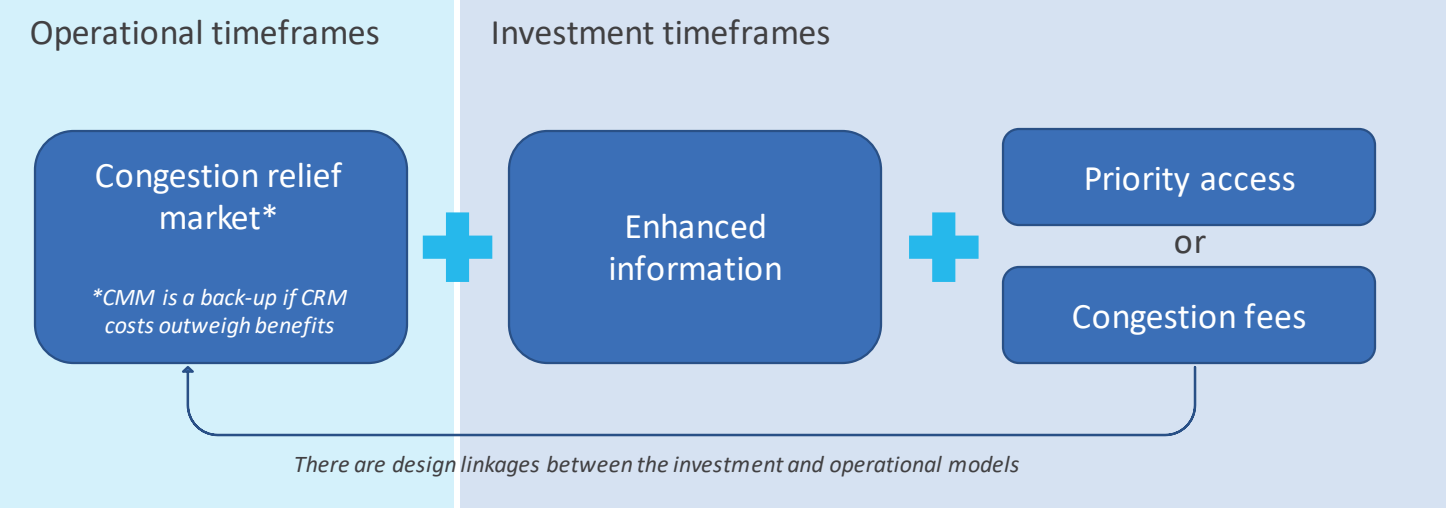
PRE-READING

25 January 2023

KEY THEMES OF SUBMISSIONS

The Directions Paper proposed a hybrid model including the congestion relief market, enhanced information and two variants (priority access or congestion fees).

Figure 1. Core elements of the hybrid model

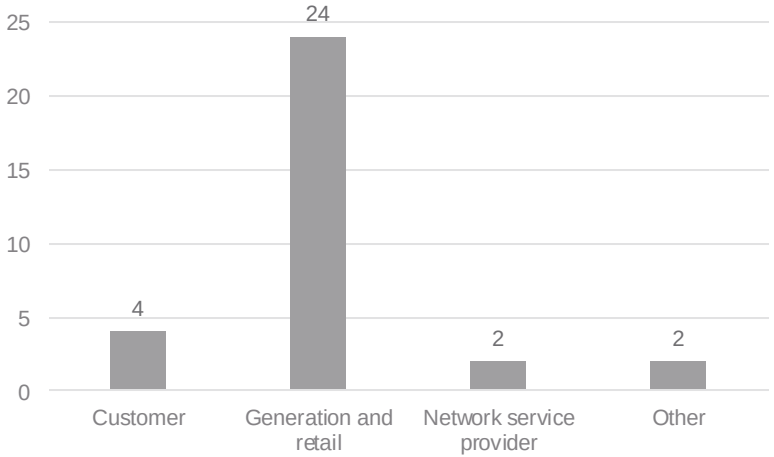


The final package needs to deliver a coherent approach to meeting access reform objectives and result in implementable systems with secure and economic dispatch.

SUBMISSIONS

32 submissions were received as at 16 January 2023.

Figure 1. Stakeholder representation (count of submissions)



Notes:

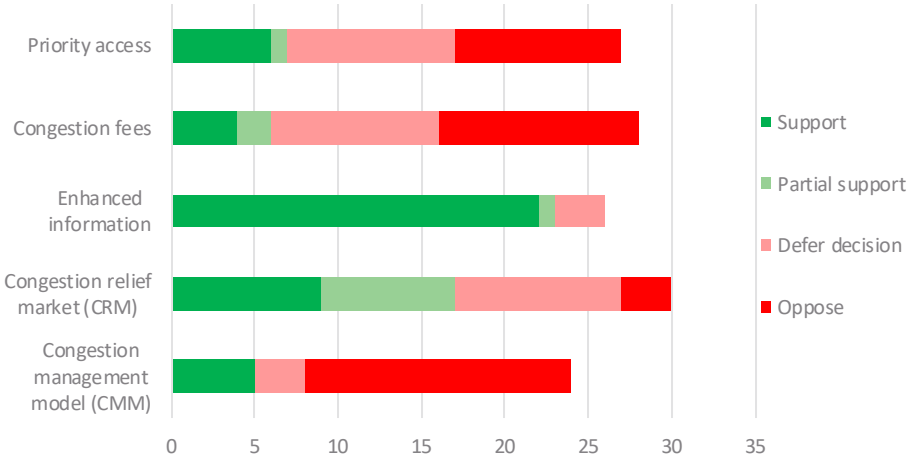
'Other' refers to submissions from the Australian Pipelines and Gas Association and the Australian National University (ANU).

- Stakeholders found the Directions Paper technically dense.
- At least 11 submissions recommended an extension (3-6 months) for the ESB to submit final recommendations on the other reform components to Ministers to allow for stakeholder review of:
  - cost benefit analysis
  - detailed modelling of operational reforms.
- A number of submissions requested targeted education initiatives and worked examples/models, particularly for the CRM. Participants requested more information about pre-dispatch processes and forecasts.

SUBMISSIONS – STAKEHOLDER PREFERENCES

There was no clear preference between priority access and congestion fees.

Figure 2. Stakeholder preferences



Notes:

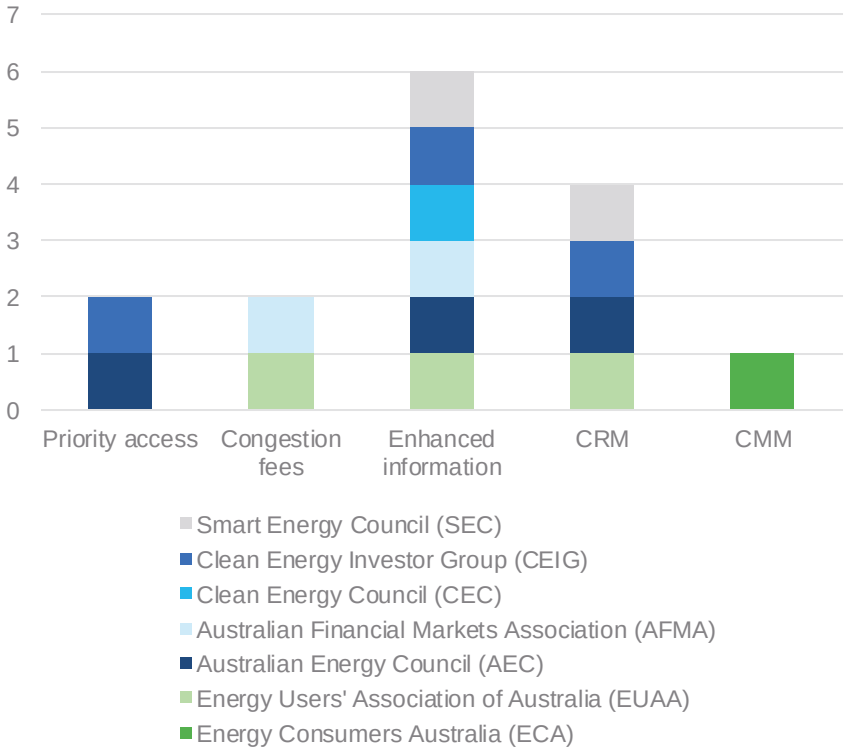
'Partial support for the CRM' typically refers to stakeholders wanting to revert to the Edify Energy proposal and/or CEC's modified version.

'Defer decision' refers to stakeholders (a) not prepared to voice a preference without detailed modelling and/or cost benefit analysis or (b) proposing to defer TAR until the case for change is reassessed after the implementation of other NEM initiatives (e.g. Rewiring the Nation, REZ development)

- Enhanced information is a low regrets policy with broad support.
- The Directions Paper did not seek feedback on the CMM but a number of submissions provided comments. There is a stronger preference for CRM although a number of stakeholders wanted to revert to the Edify Energy proposal or CEC's modified version of the CRM.
- Out of the 24 submissions representing generation and retail interests:
  - 20 supported the development of enhanced information
  - 8 showed support for a hybrid model including operational and investment components (CRM/CMM and priority access/congestion fees)
  - 8 had some level of support for the CRM, but preferred to limit the locational signal in investment timeframes to enhanced information
  - 8 suggested delaying national access reform (apart from enhanced information) until Commonwealth and State initiatives had been implemented.
- Out of the 4 submissions representing customer interests:
  - 2 supported the CMM with enhanced information
  - 1 supported the CRM with enhanced information and congestion fees
  - 1 did not state a model preference but noted its preference for "changes which minimise complexities as far as possible, and which elicit broad stakeholder consensus about their practicality" (Australian Aluminium Council).

SUBMISSIONS – STAKEHOLDER PREFERENCES

Figure 3. Preferences by peak body (support and partial support)



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Operational timeframes

- ECA offers the CMM as “a reasonable middle-ground”. It is concerned with the voluntary nature of the CRM; “If few generators participate – and there is no clear evidence that many will – it may not actually achieve any meaningful reform.”
- EUAA “conditionally supports the CRM” but notes there are a number of detailed issues to resolve including the impact on PPAs, market liquidity and wholesale electricity prices.
- CEC proposes that national access reform should not progress ahead of various Commonwealth and State based reforms and “does not formally endorse the CRM as a mechanism to be implemented on an urgent basis.”

Investment timeframes

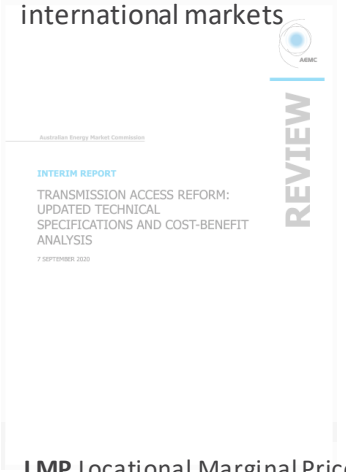
- CEIG supports priority access with or without the CRM; “more effort should be placed on investment timeframe reform [than dispatch efficiency]”.
- EUAA supports congestion fees as part of its long-held view that the “cost of new transmission should be shared more equitably between consumers, new entrant generators and governments.”
- ECA proposes to rely on jurisdictional schemes to provide locational signals. The ECA does not support priority access because it may introduce dispatch inefficiencies into the energy market (that may or may not be resolved depending on the level of CRM participation).

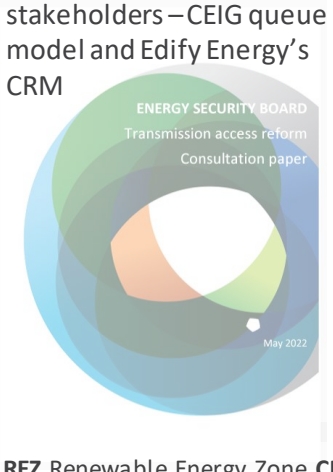
EVOLUTION OF THE CRM DESIGN

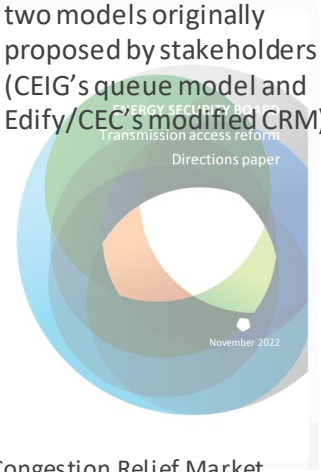
EVOLUTION OF TRANSMISSION ACCESS REFORM

ENERGY SECURITY BOARD

Sep-2020	Jul-2021	Nov-2021	May-2022	Nov-2022
COGATI Interim Report	**Post 2025 advice to Energy Ministers**	**Project initiation paper**	**Consultation paper**	**Directions Paper**
LMPs and FTRs	CMM adapted for REZs	Invite for other models	Four shortlisted models	Hybrid model
leveraging regime applied in international markets	modified approach following stakeholder feedback	ten model options submitted	including two proposed by stakeholders – CEIG queue model and Edify Energy's CRM	including design choices on two models originally proposed by stakeholders (CEIG's queue model and Edify/CEC's modified CRM)







LMP Locational Marginal Price **FTR** Financial Transmission Right **CMM** Congestion management model **REZ** Renewable Energy Zone **CRM** Congestion Relief Market

DEVELOPING THE CRM DESIGN

Stakeholder concerns with evolution of the CRM design

A number of submissions were partially supportive of the CRM design if it re-adopted Edify Energy's original proposal or CEC's modified version.

Specific concerns included:

- referring to the congestion relief price as the locational marginal price (LMP)
- complexity of the design choices
- need for targeted education initiatives, worked examples and user-friendly models.

Clarifying the language of LMPs

- Many stakeholders are concerned with the term of 'LMP' given their familiarity in the context of COGATI.
- The proposed CRM shares underlying mathematical concepts but it has key differences from a classical LMP and FTR regime:
  - Under the CRM design, generators continue to be paid at the RRP for the energy market dispatch
  - CRM participants can profit from dispatch adjustments priced at the LMP (subject to their bids and offers).
- Those differences maintain the intent of the Edify proposal and the ESB version is very similar to the CEC's.
- Importantly the CEC and ECB versions address practical implementation issues arising with the Edify model.

DEVELOPING THE CRM DESIGN

"The Congestion Relief Market"
Submitted by Edify Energy

"The modified CRM model"
Submitted by Clean Energy Council

"The Congestion Relief Market"
Published by the ESB

Similar in concept

Similar in implementation

Introduced key concepts of a voluntary congestion relief market.

Kept intent of Edify proposal but needed to resolve implementation issues. Concept developed for complexity of the NEM (network topology, range of constraints, operating requirements etc)

Adopted the implementation solution proposed by CEC if 'Option 1' design choices were adopted from the Directions Paper. The paper introduced design choices (Options 2+) as potential adaptations to this base.

DEVELOPING THE CRM DESIGN

The ESB is working to develop the detailed design of the CRM in light of stakeholder feedback.

The ESB recognises the need to establish an education workstream to familiarise stakeholders with the changes. This includes presenting technical information in an accessible way so that stakeholders can familiarise themselves with the proposed reforms.

APPENDICES

PRE-READING

Contents

Note the Directions Paper included 44 questions on design choices. Appendix B and C provide more detailed feedback on questions related to the CRM and investment timeframes respectively.

APPENDIX A.

GENERAL THEMES OF FEEDBACK

SUBMISSIONS

As at 13 January 2023, the ESB has received 32 submissions to the Transmission Access Reform Directions Paper from the following stakeholders:

1. Acciona
2. ACEN Australia
3. AGL
4. Alinta Energy
5. Australian Aluminium Council
6. Australian Energy Council (AEC)
7. Australian Financial Market Association (AFMA)
8. Australian National University (Battery Storage & Grid Integration Program)
9. Australian Pipeline & Gas Association (AGPA)
10. Clean Energy Council (CEC)
11. Clean Energy Investor Group (CEIG)
12. CS Energy
13. EDL
14. Enel Green Power
15. Energy Consumers Australia (ECA)
16. Energy Network Association (ENA)
17. Energy Users' Association of Australia (EUAA)
18. EnergyAustralia
19. ENGIE
20. Ergon + Energex
21. Finncorn Consulting (on behalf of ECA)
22. Flow Power
23. Hydro Tasmania
24. Iberdrola
25. NEOEN
26. Origin Energy
27. RES
28. Shell
29. Smart Energy Council (SEC)
30. Snowy Hydro
31. Stanwell
32. Tilt Renewables

SUBMISSIONS - GENERAL

Introductory remarks

- At least 11 submissions recommended an extension (3-6 months) for the ESB to submit final recommendations on the other reform components to Ministers to allow for stakeholder review of:
  - cost benefit analysis
  - detailed modelling of operational reforms
- CEIG proposed a number of additional reform measures:
  - new Statements of Expectation to hold market bodies accountable for the delivery of reforms that enable NEM transformation
  - investigate use of proven, near term, technical solutions to unlock existing VRE capacity
  - provide greater certainty on coal plants' retirement schedule.
- A number of submissions asked for clarification on how the hybrid model would interact with the proposed Operational Security Mechanism (OSM).

Investment timeframes

- Enhanced information could be introduced as soon as possible.
- Some submissions were concerned that the priority access model could put additional pressure on connection applicants to race to complete their connection process.

Operational timeframes

- A number of submissions requested targeted education initiatives and worked examples/models, particularly for the CRM. Participants need more information about pre-dispatch processes and forecasts.
- A number of submissions asked for further information on the impact of model options for inter-regional flows and the interconnectors including:
  - potential transfer of settlement residues from intra to inter-regional
  - potential allocation of a queue position to an interconnector for a share of the access right.
- CEIG and CEC were cautious about the choice of language for the CRM being 'opt out' rather than 'opt in'. Members are concerned that the strictly voluntary nature of the CRM may be eroded; "The ESB must clearly address this concern" (CEC).
- Stakeholders raised concerns about potentially increasing dispatch inefficiency in the energy market as a result of:
  a. priority access
  b. rounding constraint coefficients

  The CRM will only resolve these inefficiencies if there is sufficient CRM participation.

SUBMISSIONS – COST OF CAPITAL

12 submissions explicitly referred to investment risks and cost of capital impacts of the reform options. The ESB is reviewing these comments as part of its assessment.

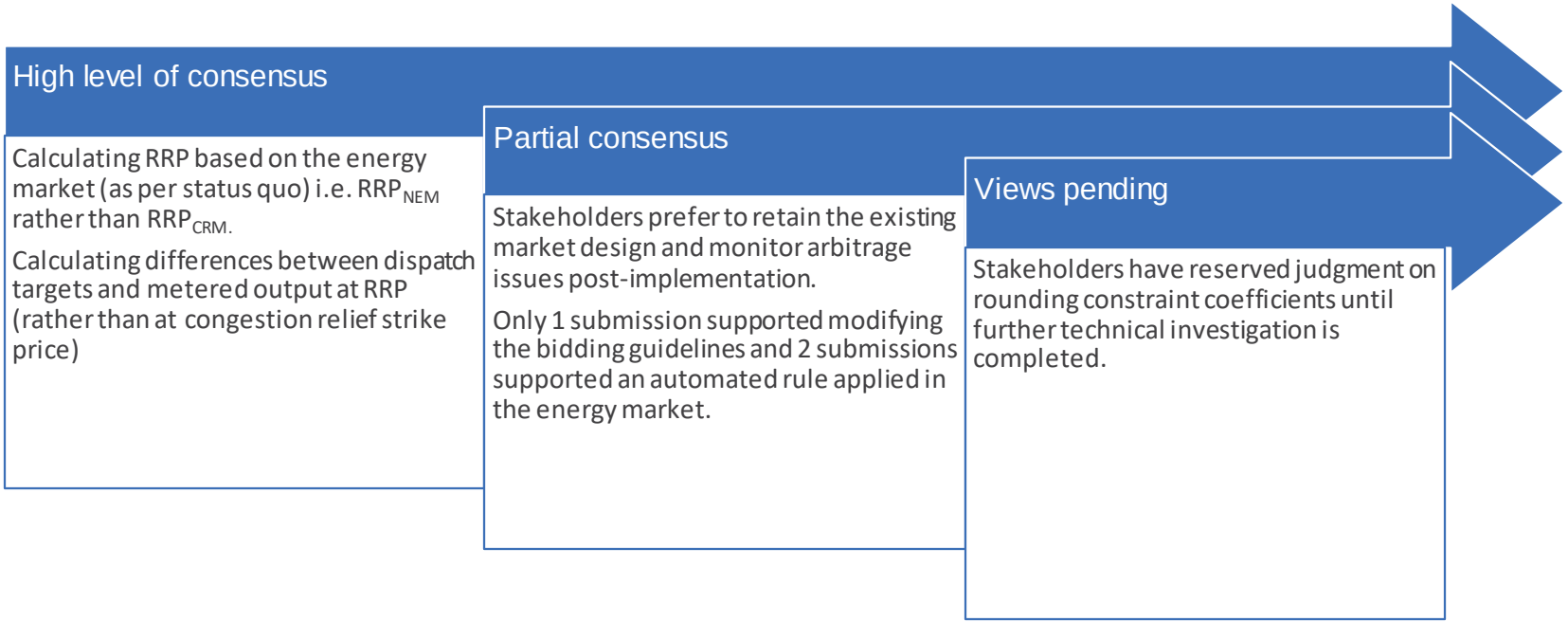
- 8 submissions refer to increased investment risks and reduced contract liquidity as a result of introducing LMPs (CEC, SEC, CEIG, CS Energy, Iberdrola, Shell, Snowy Hydro, Tilt Renewables)
- 4 submissions highlight the difficulty of forecasting CMM rebates and that they are a poor risk management tool (CEIG, Flow Power, Snowy Hydro, SEC)
- The ECA questions why industry stakeholders assume that LMPs lead to higher costs of capital given the international case studies.
- 5 submissions indicate that there is limited benefit of the congestion fees model in mitigating congestion risk (ACCIONA, AFMA, CEC, CEIG, Hydro Tasmania).
- 1 submission suggests that overly pessimistic assumptions and publication of hosting capacities would increase the cost of capital by increasing the perception of risk (RES).
- 1 submission proposes that priority access should result in a lower cost of capital than congestion fees or the status quo (Hydro Tasmania).
- 3 submissions have a counter-argument that priority access will introduce new complexity and risk (ACCIONA, AFMA, CS Energy).

APPENDIX B.

FEEDBACK ON DESIGN CHOICES IN OPERATIONAL TIMEFRAMES

SUBMISSIONS – OPERATIONAL TIMEFRAMES

The diagram below summarises the level of consensus between stakeholders on the detailed design choices for the CRM.



There was a broad consensus to calculate the RRP based on the energy market and avoid unwanted LMP exposure by pricing differences at the RRP (between metered output and dispatch targets).

Calculation of RRP

- 10 submissions supported RRP_{NEM} i.e. calculating RRP based on the energy market (as per status quo) (Shell, CEIG, AFMA, CS Energy, CEC, Snowy Hydro, ENGIE, AEC, ENGIE, Acciona, RES).
- 3 submissions recommended deferring the decision for a better explanation of how RRP may be calculated under the two options and how/why the two RRPs may vary (Hydro Tasmania, EnergyAustralia, Origin Energy).
- RES supported the alternative RRP_{CRM}.

Differences between dispatch targets and metered output

- 9 submissions support pricing differences at RRP (Flow Power, Shell, Snowy Hydro, EnergyAustralia, Origin Energy, ENGIE, AEC, RES, ACEN) given:
  - principle that the CRM is a voluntary market; non-participants want to avoid any LMP exposure
  - settlement deficits arising from Option 2 (if $G_{metered} < G_{NEM}$)
  - potential disincentives arising from Option 2 to participate in FCAS markets including mandatory narrow band primary frequency response.
- No submissions supported the alternative to price differences at LMP.

Stakeholder preference nominated via submissions

Design choice for the calculation of the RRP

RRP_{NEM} - calculate the RRP based on the energy market (as per status quo)	RRP_{CRM} - calculate the RRP based on the final dispatch including CRM adjustments

Design choice for settling differences between metered output and dispatch targets

Differences (metered output vs dispatch targets) are priced at RRP	Differences (metered output vs dispatch targets) are priced at LMP

A review could be initiated after 2-3 years of implementation to assess the choice of RRP and settlements calculation.

Stakeholders prefer to retain the existing market design and monitor arbitrage issues post-implementation.

- 6 submissions recommended keeping the existing market design for generators including storage (Shell, AFMA, EnergyAustralia, Origin Energy, ENGIE, AEC).
- A number of these submissions suggested monitoring post-implementation to determine the materiality of the issue and its ability to self-resolve.
- 2 submissions (RES, ACEN) favoured introducing automated rules into the energy market based on participants bids in the CRM relative to the forecast RRP.
- 2 submissions (Hydro Tasmania, RES) proposed applying energy limits on storage assets in the energy market which might address some of the arbitrage issues for short-duration storage.
- No submissions favoured:
  - introducing a 'strike price' for storage
  - settling storage at the LMP only when acting as load.

Stakeholder preference nominated via submissions

Design choices regarding potential wealth transfers to out of merit generators

- Keep the existing market design
- Modify the bidding guidelines
- Introduce automated rules into the energy market to exclude 'out of merit' bids

Additional design choices for storage

- Apply the same rules to storage as a generator as to other generators (see above)
  - When storage is acting as a generator, exclude 'out of merit' bids i.e. if energy market bid > assigned strike price (+ availability profile).
- Apply the same rules to storage as load as to storage as a generator (see above)
  - When storage is acting as load, only settle storage at the LMP.

Stakeholders have reserved judgment on rounding constraint coefficients until further technical investigation is completed.

- Limited support for rounding (CEIG, Hydro Tasmania, ACEN)
- For most submissions:
  - it is not clear that rounding would have the intended effect on sharing congestion risk (Shell, Tilt Renewables, Origin Energy, AEC, RES)
  - rounding could introduce new inefficiencies into the energy market with new safety margins (NEOEN, EnergyAustralia, AEC, RES)
- Submissions recommended that the ESB investigate whether rounding will require safety margins that introduce material inefficiencies into the energy market and/or whether it will have a meaningful impact on participant outcomes. Origin Energy recommends pursuing this as a separate workstream.

Stakeholder preference nominated via submissions

Design choice for redistributing congestion risk

Keep the existing energy market dispatch.

Round the constraint coefficients in the energy market.

No clear preference nominated by the stakeholders.

APPENDIX C.

FEEDBACK ON DESIGN CHOICES IN INVESTMENT TIMEFRAMES

The diagram below summarises the level of consensus between stakeholders on the detailed design choices for priority queue, congestion fees and enhanced information.

High level of consensus

Preference for a higher number of queue positions but recognition of the need for a tiered approach given implementation challenges.

There is support for providing an indicative queue position/congestion fee and then finalising the number/fee late in the connection process.

Proponents supported the provision of indicative network hosting values and/or standardised methodology, as well as the provision of more detailed data.

Partial consensus

Generators prefer a first-come, first serve basis for queue positions with some exceptions e.g. auctions as part of REZ schemes.

Generators prefer priority access rights for the life of the asset but have suggested pragmatic alternatives.

Views divided

Stakeholders are split between priority access and congestion fees.

Of those that expressed a preference, stakeholders prefer a higher number of queue positions but understand the need for a tiered approach given implementation challenges

- 6 submissions preferred a higher number of queue positions (Shell, EDL, Hydro Tasmania, EnergyAustralia, ENGIE, AEC). Of which:
  - 5 understood the need for a tiered approach given implementation challenges
  - 1 suggested that generators finalising their connection agreements in a similar part of the network at the same time (e.g. same month or quarter) should receive a common queue position creating a tiered approach of sorts (Shell)
  - 2 submissions preferred a tiered approach (Origin Energy, CEIG). CEIG preferred Castalia's original approach to assigning queue positions i.e. with respect to the available hosting capacity.
- 1 submission preferred batches as it would lessen pressure on developers to race for connections and avoids the centralised decision making that arises with tiered access (RES)
- Concern that the RRP may be affected by amending the market floor price to implement priority access (Shell).

Of those that expressed a preference, stakeholder prefer a first-come, first serve basis for queue positions

- 6 submissions in favour of the first-come, first serve basis (Shell, EDL, Hydro Tasmania, EnergyAustralia, ENGIE, AEC)
- Of which 2 submissions support auctions on a limited basis:
  - Jurisdictional auctions in REZs (Hydro Tasmania)
  - Multiple entrants connecting to shared network with interacting impacts (AEC)

Of those that expressed a preference, stakeholders prefer priority access rights for the life of the asset but have suggested pragmatic alternatives.

- 6 submissions in favour of priority access rights for the life of the asset (Shell, EDL, Hydro Tasmania, ENGIE, Origin Energy, AEC). Of which 3 provided a pragmatic alternative:
  - Assign [90]% of capacity with a queue position and remaining [10]% of capacity at the back (Hydro Tasmania)
  - Minimum 10 years with glide path (ENGIE)
  - Minimum 2/3 technical life with glide path where early entrants are progressively brought to the front alongside the original incumbents, Original incumbents retain queue '0'. (AEC)
- Two submissions raised concerns that grandfathering incumbents would limit opportunities for new entry (Tilt Renewables, RES) (note Tilt and RES do not support priority access or congestion fees)
- 2 submissions nominated specified durations:
  - 5-10 years duration aligned to current PPA terms (Ergon Energy/Energex)
  - 10-15 years (EnergyAustralia)

Likewise, stakeholders prefer that incumbents are granted a '0' queue position until retirement with some adaptations based on a glide path or proportion of total capacity.

- 5 submissions prefer Option 1 whereby the queue position awarded to incumbents expires at retirement or a specified date. Variations on this preference include:
  - indefinite priority access, but only for a proportion of their capacity (Hydro Tasmania)
  - glide path whereby early entrants are progressively brought to the front alongside the original incumbents. Original incumbents retain queue '0'. (AEC)
- If a duration is specified, the submissions proposed:
  - a bespoke term to avoid disadvantaging technologies with longer asset lives (Hydro Tasmania)
  - 15 years or 20-30 years based on previous COGATI submissions (Snowy Hydro)
  - 10 years (Alinta Energy)

There is support for providing an indicative queue position/congestion fee and then finalising the number/fee late in the connection process.

- 6 submissions encourage finalising the queue position/congestion fee late in the connection process e.g. at the connection agreement (Shell, Hydro Tasmania, Origin Energy, AEC, ENA, RES).
  - Of which 3 recommended that an indicative queue position and/or congestion fee is provided earlier.
- 2 submissions raised concerns that congestion fees or priority access would increase the risk of the connection process and make it harder to reach financial close (CEC, RES)
- 1 submission raised concerns that congestion fees or priority access would encourage developers to race to develop their projects, with negative consequences for project quality (RES).

There was limited feedback regarding the process for batching to manage multiple simultaneous connection applications.

- There were mixed responses to the instances when batching might be appropriate e.g.
  - generators finalising connection agreements at the same part of the network at the same time (Shell)
  - where there is multiple party interest to a similar part of the network (with EOIs and auctions) (AEC)
  - to allow for a specified quantity of new capacity to access a given congestion fee before any re-forecasting occurs (Finncorn)
  - where there are similarly timed projects in congested areas that overbuild the ISP forecast (RES)
- The relative costs and benefits of a batching process were unclear, and whether it would apply to all connections under Chapter 5. Lessons learned from state REZ batching should be considered before adopting across the NEM (ENA).

There were limited but mixed responses about the metric used to calculate fees.

- 3 submissions recommended that fees should only apply in locations that face congestion in excess of efficient levels (Neoen, Origin Energy, RES)
- 1 submission proposed the fee should represent the cost of alleviating a constraint for all generators located in a congested network pocket when a new generator connects in that part of the network (Shell)
- 1 submission raised concerns about that congestion fees may lead to jurisdictional bias (ENGIE)
- 1 submission proposed an alternative solution whereby a generator pays a very small fee for every MWh it exports where the fee is based on the cost of the transmission assets (similar to TUOS) (AEC).

Stakeholders recognised a balance must be achieved between investor clarity and accuracy in the congestion fee modelling; they recommended a clear and transparent methodology.

- 2 submissions are in favour of a more simple methodology given:
  - additional accuracy will have diminishing returns (AEC)
  - there is limited accuracy anyway in long-term forecasting of congestion (Finncorn)
- 2 submissions favour a relatively bespoke process accounting for location, technology type, other generators in the network and extent to which a generator may agree to be constrained off (Shell, RES – noting RES opposes congestion fees)
- 2 submissions recognise a balance must be achieved and encourage transparency in the methodology (Origin Energy, ENA)

The Directions Paper did not seek feedback on the use of revenue from congestion fees but a number of submissions tackled this question.

- 4 submissions raised the question as to the use of revenue raised from congestion fees. Of which:
  - 1 submission suggested that incumbent participants should be compensated for their loss of access (if priority access was not introduced) (AEC)
  - 1 submission suggested the congestion fees should be received by the TNSP as an offset to regulated opex and/or a source of funding for regulated network investment (Finncorn)
  - 1 submission did not agree with compensating generators affected by congestion or reducing TUOS charges for consumers (Shell).
  - 1 submission noted that stable congestion fees and stable customer bill impacts is desirable so the frequency of changing fee would need to be considered (ENA)

Enhanced information is a low regrets policy. Proponents supported the provision of indicative network hosting values and/or standardised methodology, as well as the provision of more detailed data so that proponents can perform their own modelling and assessments.

- Fairly broad support for indicative network hosting values and/or standardised methodology.
- Varied opinions regarding the level of detail:
  - high-level indicators given complexity of distribution network (Ergon Energy/Energex)
  - high level indicators of network sub-regions with surplus hosting capacity as useful market signals to attract new connections. Use of ISP sub-regions appears practical. (ENGIE)
  - smaller zones than sub-regions developed by AEMO for its capacity outlook for the ISP (ACCIONA)
  - share more granular ISP modelling, or curtailment forecasts to developers (ACCIONA)
- Support in making more detailed data available from prospective developments to model:
  - proponents are responsible for modelling their individual connections (ENGIE)
  - provide underlying data so that developers can perform their own assessments of the congestion impact on potential generation investments in a timelier manner (ACCIONA).
- Neoen provided two additional recommendations for enhanced information:
  - heatmap of the NEM showing average headroom at every connection point
  - headroom time series for a representative year
- RES suggested that "hosting capacity" is a problematic metric and it would be better to publish indicative curtailment percentages for all major nodes across the transmission network.
- NSPs raised concerns regarding:
  - level of effort / resource / cost to TNSPs to satisfy this enhanced information requirement (ENA)
  - whether the enhanced information should be voluntary, rather than mandatory (Ergon Energy/Energex)
  - potential risk to networks from parties relying on this information to make investment decisions (ENA).

Stakeholders encouraged the scope of hosting capacity assessments to include all types of constraints (not just thermal) and to differentiate multiple seasonal scenarios and different tech types.

- 5 submissions suggested that hosting capacity assessments should include all types of constraints (Tilt Renewables, CEIG, Origin Energy, AEC, ACCIONA). Of which 1 submission suggested hosting capacity values with and without non-thermal constraints.
- 1 submission suggested nodal curtailment assessments would be a more useful form of information that would dispense with the need for assumptions regarding operating conditions (RES).
- 4 submissions encouraged more detailed modelling e.g.
  - seasonal scenarios
    - 2-4 different scenarios (rather than just summer peak demand) (Tilt Renewables, CEIG)
    - supplemented with high resource (wind and solar) scenarios (ACCIONA)
  - technology assessments
    - hosting capacity values should be differentiated in terms of technologies (Shell)
    - MW capacity for different technology types – if the benefits of this modelling complexity could be demonstrated (AEC)
    - wind and solar headroom assessments (ACCIONA)

It may be useful to provide hosting capacity values with and without anticipated projects (proponents and/or AEMO/NSPs can take a view on their likelihood of proceeding).

- Even split of responses regarding the calculation of hosting capacity values:
  - 2 submissions recommend including committed projects only (EnergyAustralia, AEC)
  - 2 submissions recommend including anticipated projects (Shell, ACCIONA)
- 1 respondent does not support the publication of hosting capacities and instead prefer nodal curtailment assessments. Information should be made available as part of the ISP. (RES)
- The remaining submissions suggested a combination of the two:
  - 1 submission suggested reporting both i.e. (1) with committed projects only (2) with anticipated projects for investors to take their own view on the likelihood of them proceeding (Origin Energy)
  - 1 submission suggested all existing, committed and likely projects (CEIG)
  - 1 submission recommended AEMO and NSPs taking a view on the likelihood of other projects proceeding to determine an expected available capacity in 2-3 years time (Tilt Renewables).

APPENDIX D.

EVOLUTION OF THE CRM DESIGN

DEVELOPING THE CRM DESIGN – CORE CONCEPTS

The CRM design developed from the concept of local trades between parties affected by the same constraint equation to a broader market solving multiple constraints across the network. Different names were used by different authors for the 'congestion relief price'. The formula for the CRM price was updated from Edify's model to the CEC version and then retained by the ESB.

	Edify Energy	CEC	ESB
Participation in the CRM	Voluntary	Same as Edify	Same as Edify
CRM transactions	Adjustments to the energy market	Same as Edify	Same as Edify
Type of bids	Bids are received from buyers/sellers of congestion relief.	Bids would be similar in requirement and format as per the energy market bids i.e. participants would offer full CRM supply / demand curves for their capacity.	Same as CEC.
Scope of trades	Applies to constrained parts of the network. Trades have to balance at each location i.e. local trading occurs between parties behind a congested node.	Multiple 'constraint relief trades' can occur across the network. It does not isolate individual constraint equations and can involve constrained + unconstrained parties.	Same as CEC.
CRM price – term	Local congestion relief price (CRP)	Nodal CRM price	Locational marginal price (LMP) (different name but same formula)
CRM settlement	CRM adjustments are settled at the difference between the RRP from the energy market and the congestion price from the CRM (applies at the constraint level).	CRM adjustments are settled at the LMP (specific to a DUID level).	Same as CEC.
RRP to settle energy market based on	Energy market	Same as Edify	Same as Edify (referred to as RRP_{NEM} in the Directions Paper although alternative RRP_{CRM} was considered as a design choice)

Key Consistency between model iterations | Differences between model iterations

DEVELOPING THE CRM DESIGN – EDIFY AND CEC

Distinct features – Edify

- The CRM is only triggered after the dispatch run where there are binding constraints i.e. LHS = RHS.
- Each binding constraint is solved to allow the relief providers and relief recipients to vary their dispatch quantity whilst still maintaining the same LHS.
- Congestion relief prices are determined by a clearing process (they are equivalent to congestion prices or the "marginal value" determined by the CRM).
- Congestion relief outcomes are settled as follows:

  Settlement $ = G_{ADJ} x (RRP_{NEM} – congestion price x constraint coefficient).

Terms

G_{ADJ}	CRM adjustment (MWh)
RRP_{NEM}	RRP from the energy market ($/MWh)

Key challenges – Edify

- It assumes that only one constraint will bind at a time and each constraint can be solved one at a time and there is no FCAS co-optimisation to deal with.
- There are challenges for NEMDE to solve each binding constraint and generate a secure dispatch given a generator could be in more than one constraint and in inter and intra-constraints.
- Solving each constraint separately limits the benefits of trade
- It is not clear how participants would bid given they are exposed to an unknown RRP (*congestion relief price = RRP_{NEM} – congestion price x constraint efficient*, but RRP_{NEM} is unknown at the time of bidding).
- Given the uncertainty in bidding, there is a risk that participants lose money on some trades.

Resolution by the CEC

The CEC's modified CRM:

- Adopted a holistic approach to all 'MWs term' constraints - CRM constraints are all those constraints whose costs can be relieved through the changes to the energy dispatch targets of dispatchable generation and loads.
- Participant offers represent the price and volume they would accept for increased or decreased dispatch
- The CRM price at each location is the clearing price from the CRM.
- It maintained the distinction between:
  - energy market transactions settled at the RRP
  - congestion relief transactions settled at the CRM price.

DEVELOPING THE CRM DESIGN - IMPLEMENTATION

CRM design component	CEC	ESB	
Participation in the CRM is voluntary	Yes	Yes	
Transactions in the CRM are adjustments to the energy market transactions	Yes	Yes	
Actual dispatch is the combination of energy and CRM dispatch	Yes	Yes	
The CRM adjustments to the energy market transactions are settled at the market clearing CRM prices	Yes	Yes	
The CRM enables multiple 'constraint relief trades' to occur across the network.	Yes	Yes	
The CRM uses the same network model and security constraints as the NEM energy dispatch	Yes	Yes	
The CRM energy prices represent the value of increasing or decreasing generation or load at each bus (node)	Yes	Yes	
Market participants can decide the extent to which they participate in the CRM by setting their offered maximum dispatch deviations allowed in the CRM	Yes	Yes	
The NEM energy market dispatch is settled at the RRP from the energy market dispatch	Yes	Yes, option 1 RRP_{NEM}	No, option 2 RRP_{CRM}
Differences between metered output and dispatch targets are settled at the RRP adjusted by the marginal loss factor	Yes	Yes, option 1 at RRP	No, option 2 at LMP
NEM energy and CRM dispatch and pricing	Co-optimised	Sequential optimisations	
The CRM FCAS dispatch and prices reflect the changes in FCAS dispatches and the marginal value of these changes in order to facilitate the optimal CRM energy trades whilst ensuring that the dispatch of energy and FCAS is secure.	Not defined	Yes	
The CRM FCAS deviations from the energy dispatch are priced at the CRM FCAS prices.	Not defined	Yes	

Key Consistency between model iterations | Differences between model iterations

DEVELOPING THE CRM DESIGN – CEC AND ESB

Distinct features – CEC

- The energy market and CRM are co-optimised as 'single pass' – energy and CRM bids/offers are concurrently considered, co-optimised, and dispatched.

Key challenges – CEC

- Co-optimised solution would involve more substantial changes to NEMDE and increase solve time.
- Co-optimised approach has the potential to result in disorderly bidding behaviour in the CRM for the units which had chosen no deviations between the energy dispatch and the CRM dispatch in order to get a better outcome in the energy dispatch. In this case, even though these units would not be practically participating in the CRM their behaviour in the CRM could distort the outcomes in the energy dispatch.

Resolution by the ESB

The ESB's Directions Paper proposes a sequential dispatch:

- first run for the energy market dispatch
- second run for the CRM dispatch.

This allows NEMDE to solve and gives confidence that it replicates the same NEMDE structure and algorithms and minimises changes required.

It preserves the optionality of the CRM. For participants that do not participate in the CRM, it is intended that their dispatch outcomes from the energy market would be 'locked' for the purpose of the CRM dispatch immediately after. The technical implementation plan is being developed to give effect to this principle.

Australian Government

Department of Climate Change, Energy, the Environment and Water