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Energy Security Board
Level 15, 60 Castlereagh St
Sydney NSW 2000

Copy: Jess Hunt
Jo Witters
Gabrielle Dominy

By email: info@esb.org.au
jess.hunt@esb.org.au
jo.witters@esb.org.au
gabrielle.dominy@esb.org.au

To whom it may concern,

Post 2025 Market Design Options | consultation response | Transmission and Access reform

Edify Energy (**Edify**) is pleased to make this consultation response to the Energy Security Board (**ESB**) as part of its assessment of Post 2025 Market Design Options. This body of work is ambitious, far-reaching and intended to address the vast, complex, and cross-sectorial range of challenges affecting the National Electricity Market (**NEM**) today and into the future across a broad range of issues. Our submission therefore responds to just one aspect of the consultation paper – Transmission and Access reform contained in Chapter 5.

We recognise this topic has been a long-standing and divisive market design issue, which began as early as the development of the original NEM. We hope that this consultation process achieves its intended outcome of reforming this aspect of the energy market in a way that is fit-for-purpose for the evolving technical and market landscape.

To that end, we would like to focus our consultation response on Question 46 of Part A that was put forward – Are there alternative options that the ESB should consider? – by proposing an alternative mechanism to the Modified Congestion Management Market (**CMM**) and Interim Renewable Energy Zone (**REZ**) mechanisms outlined in the consultation paper. We are terming this alternative mechanism a Congestion Relief Market (**CRM**), which is outlined further below, including with worked examples in Annexure A to illustrate its application.

Operational philosophy of the Congestion Relief Market

The proposed principles for operating the CRM are as follows:

- Congestion relief will be able to be provided by market participants in the NEM within the safe operational envelope of the power system guided by existing constraint equations, limits, studies and processes;
- The CRM is to only become active in network locations (and during periods) that are impacted by congestion (i.e. within areas that are experiencing binding constraints during a specific dispatch interval);

Level 1, 34-35 South Steyne
Manly NSW 2095
hello@edifyenergy.com
+61 2 8790 4000
@edifyenergy
Edify Energy
@edifyenergy
@edify_energy

- The aggregate demand for congestion relief, measured in MW, is limited by the direct change in the left-hand side (**LHS**) or right-hand side (**RHS**) value of a constraint equation, that would cause that constraint to no longer bind (i.e. to have a marginal value of zero);
- The demand for congestion relief otherwise sets the upper limit for the provision of congestion relief, however less may be provided subject to the supply options available;
- If the CRM cannot resolve a local congestion relief price in a given dispatch interval (i.e. the CRM doesn't clear), then no congestion relief will be delivered at that location for that dispatch interval;
- Congestion relief providers should only be remunerated according to the volume of relief realised, not supplied, where differences in these values will reasonably occur on account of differences in constraint equation coefficients;
- As much as practicably possible, the CRM will utilise existing market design and limits that are employed in the current energy and Frequency Control Ancillary Service (**FCAS**) markets (e.g. price bands, market price cap, market price floor, etc.); and
- All market outcomes (participant bidding behaviours, clearing prices, enablements, etc.) relevant to the individual CRMs formed in respect of each constraint are to be made public in a similar way to energy and FCAS market outcomes, to establish price signals for new constraint relief providers to compete within particular CRMs.

Proposed operation of the Congestion Relief Market

The proposed solution is summarised below:

1. The CRM continuously accepts bids and offers from providers (sellers) and receivers (buyers) of congestion relief;
2. After the NEM dispatch engine (**NEMDE**) determines prices and dispatch for energy, the CRM only becomes active for congested nodes (i.e. those that have binding constraints);
3. If the congestion relief market determines a solution, it facilitates transactions where congestion relief buyers pay congestion relief sellers the local congestion relief price for the volume of congestion relief provided; and
4. Congestion relief is dispatched, along with energy dispatch, with no further impact to prices at the Regional Reference Node (**RRN**).

Comparison with the Modified CMM and Interim REZ framework

The CRM aligns with the goals and objectives of the Modified CMM and Interim REZ mechanisms, as presented in the consultation paper, however with a few key comparative benefits as proposed in the table below. This addresses Question 44(b) of Part A of the consultation paper.

Issue / risk with Modified CMM / Interim REZ	How CRM resolves this
The Modified CMM and Interim REZ frameworks require mandatory participation, which does not stimulate competition or innovation amongst congestion relief providers.	The spot market basis of the CRM stimulates innovation and competition amongst congestion relief providers (e.g. between batteries, pumped hydro, synchronous condensers, thermal units, demand response providers, etc.), as the most competitive congestion relief services and technologies can capture the highest revenues.
'Equal sharing' of congestion management costs in the Modified CMM introduces inefficiencies where generators less affected by congestion are forced to over-pay for congestion relief, and generators	The CRM spot market allows participants to individually value congestion relief according to the varying impacts of congestion on them, leading to efficient price discovery and the true marginal value of congestion relief.

more affected by congestion under-pay for this relief.	
The Interim REZ framework introduces 'free-rider' issues as generators located outside but nearby a REZ boundary can benefit from REZ transmission whilst also contributing to congestion for holders of access rights within the REZ.	Direct management of congestion through NEMDE and SCADA / AGC allows precise delivery of congestion relief from providers to sellers.
Mandatory involvement in congestion relief only provides participants with an indirect tool for managing congestion risks.	Although the CRM introduces an element of basis risk between the energy price at the RRN and the local congestion relief price, participants have a comparatively enhanced risk management tool set by opting in / out of the process and directly bidding prices and volumes for congestion relief. CRM design elements such as price caps may also assist in eliminating onerous basis risk scenarios.
The Modified CMM identifies dispatch efficiency and 'disorderly bidding' as the major drivers for congestion and overlooks the impact of power system stability on congestion.	The CRM recognises and rewards contributions of improved power system stability on congestion relief by driving a physical participant response to congestion.
Connection fees introduce an artificial cost for connecting in areas with higher congestion to restrict or prevent participants from connecting to what is deemed an inefficient network location. However, this assumes that all congestion management solutions are already known up front and discourages the discovery of new solutions and innovations.	A congestion relief spot market exposes the true demand / supply balance and pricing for congestion, which incentivises development of new solutions through competitive pressures, enabling the discovery of more efficient utilisation of the transmission network, which can in turn facilitate greater levels of renewable generation than previously determined.

Assessment of the Congestion Relief Market against the consultation paper objectives

Relating the mechanics of the CRM to the initial set of objectives used to assess the Modified CMM, we can make the following assessment:

Objective	Assessment
Efficient congestion management signals in operational timeframes	The inherent design of the CRM is centred around efficient price discovery of the marginal cost / value of congestion relief, implemented within a real-time operational market framework that leverages off existing bidding practices. Therefore, the CRM scores highly against a metric of efficient congestion management signals in operational timeframes.
Efficient locational signals in investment timeframes	The use of constraint equations and coefficients should drive efficient locational signals for the establishment of congestion relief providers and CRMs, where poor locational or technological decisions will either render the congestion relief provider uncompetitive with alternative providers or relieving constraints of low marginal value.

Efficient signals for storage	Storage technologies make for natural congestion relief providers, but the mechanism is technology agnostic, recognising that is has application to not only thermal but voltage and stability constraints too, which may drive alternative technology outcomes (or technologies that can offer a combination of services).
Ability for generators to manage risk	All generators subject to constraints will have the option, but not the obligation, to participate in spot CRMs. This gives generators a physical underlying market to manage congestion related risks directly and specifically. Consequently, this also facilitates the development of financial derivative hedge contracts to manage exposure and outcomes in CRMs, which in turn improves greater long-term certainty and an expanded suite of risk management tools for generators seeking constraint relief protections.

To further illustrate the functioning of the CRM, we have provided two detailed examples in Annexure A of its proposed operation, bidding, dispatch, and settlement, demonstrating how it has application to not only thermal, but stability and voltage constraints too.

We look forward to continuing to work with the ESB and other stakeholders on this important component of broader reform efforts. Should there be questions on any aspect of this consultation response, please contact us on +61 434 630 939 or at manas.choudhury@edifyenergy.com.

Yours sincerely

Andrew Stiel
Head of Energy Markets
Edify Energy Pty Ltd

Manas Choudhury
Energy Markets Manager
Edify Energy Pty Ltd

ANNEXURE A

WORKED EXAMPLES OF THE CRM

Example 1: relief of thermal constraint V>>V_NIL_7

In this example, we assume a new hypothetical constraint relief provider (e.g. battery, pumped hydro, synchronous condenser, coal plant, gas plant, scheduled load, demand response provider, etc.) of 100MW capacity is newly installed and assigned DUIDs for generation and load of CRPG1 and CRPL1 respectively, in a strategic location relevant to the V>>V_NIL_7 constraint. On the LHS of the constraint, CRPG1 is assigned a coefficient of +1 and CRPL1 a coefficient of -1. Both its generation and load Marginal Loss Factor (**MLF**) is assumed to be 1.0 for simplicity. The LHS of this constraint equation as at 08/06/2021 is defined below, with the addition of constraint relief provider CRPG1 and CRPL1, highlighted yellow:

> *0.5194*BROKENH1 + 0.5194*STWF1 + 0.3696*LIMOSF21 + 0.3696*LIMOSF11 + 0.3696*SUNRSF1 + 1*ARWF1 + 0.9637*BULGANA1 + 0.9637*VBGT2B - 0.9637*VBGT3B + 0.9874*CROWLWF1 + 0.8141*KIATAWF1 + 0.7449*KIAMSF1 + 0.8283*MUWAWF1 + 0.8283*VMRT2M + 0.5899*KARSF1 + 0.5899*YATSF1 - 0.5899*V-S-MNSP1 +* ***1*CRPG1*** *-* ***1*CRPL1***

On 10/05/2021, the Ararat Wind Farm (ARWF1) was constrained down by 63MW due to the above constraint binding during the dispatch interval ending 19:55. Relevant market outcomes for this event during this dispatch interval were as follows, which indicates this constrained volume (difference between cleared and available):

Parameter	Value: 10/05/2021 at 19:55
ARWF1	
Bid price (at RRN)	-$174.77/MWh
Local price	-$174.77/MWh
VIC1 RRN price	$55.01/MWh
Bid volume	241MW
Total cleared	160MW
Availability	223MW
V>>V_NIL_7	
Marginal value	-229.78
LHS	570.80193
RHS	570.80193

Were a local CRM to be operating during this time, ARWF1 may have had an opportunity to relieve this 63MW of constrained output, per the following example supply and demand stack:

DUID	Offer / bid price	Volume
CRM supply stack		
CRPL1	$20/MWh offer	50MW
CRPL1	$40/MWh offer	45MW
~~CRPL1~~	~~$54/MWh offer~~	~~5MW~~
CRM demand stack		
ARWF1	$55/MWh bid	50MW
ARWF1	$40/MWh bid	35MW
~~ARWF1~~	~~$35/MWh bid~~	~~15MW~~
~~BULGANA1~~	~~$30/MWh bid~~	~~10MW~~
~~CROWLWF1~~	~~$10/MWh bid~~	~~50MW~~

In this example the bids and offers that have not been struck out are dispatched, with the market clearing ARWF1 receiving its full 63MW of congestion relief from CRPL1 at a price of $40/MWh. Due to the coefficients of ARWF1 (+1) and CRPL1 (-1) being equal and opposing, each MW increase in load of CPRL1 leads to a 1:1 increase in generation and constraint relief for ARWF1.

Had the congestion relief provider CRPG1 / CRPL1 been connected to a less efficient area of the network with regards to relieving the constraint V>>V_NIL_7, it would have received a lower coefficient, and thus would have had to provide a larger load to have the same relieving impact on the constraint. For example, a coefficient of -0.5 would have required +2MW of load increase per +1MW of congestion relief provided. Per the operating principles outlined earlier, congestion relief providers should only be remunerated for the relief realised, not supplied, which means in this case, the congestion relief provider would have been remunerated for the 1MW of relief, not the 2MW of supply. This principle affects the competitiveness of individual providers (and is reflective of the marginal benefit), creating a clear incentive to establish in efficient network locations where the potential impact on relieving constraints will be maximised.

The settlement calculations for ARWF1 and CPRL1 for energy, comparing cases before and after congestion relief are as follows:

Parameter	Value: 10/05/2021 at 19:55
ARWF1: status quo	
VIC1 RRN price	$55.01/MWh
Total cleared	160.07485MW
MLF	0.898
Time duration	5 / 60 hours
Settlement	$658.96

ARWF1: with CRM as cleared above	
VIC1 RRN price	$55.01/MWh
Total cleared	160.07485MW + 62.89866MW
MLF	0.8980
Time duration	5 / 60 hours
Settlement (pre-CRM)	$917.89
CRM price	$40/MWh
CRM settlement	-$40/MWh * 62.89866MW * 5 / 60 h = -$209.66
Net settlement	$917.89 - $209.66 = $708.23
CRPL1: with CRM as cleared above	
VIC1 RRN price	$55.01/MWh
Total cleared	-62.89866MW
MLF	1.0000
Time duration	5 / 60 hours
Settlement (pre-CRM)	-$288.34
CRM settlement	+$209.66
Net settlement	-$78.68

In the absence of the CRM, had CRPL1 decided to place a load on the network in the circumstances described above, this would have relieved congestion for ARWF1. However, despite providing this congestion relief benefit to the wind farm, the congestion relief provider had no incentive to do so beyond the prevailing RRN price signal and so may have preferentially waited until the RRN price was more favourable. With the introduction of the CRM however, the congestion relief provider is incentivised to charge at a lower equivalent cost (in this case $15.01/MWh), being a function of the CRM offer made so should be correctly priced at its marginal cost of charge. Additionally, by allowing NEMDE to determine the dispatch of congestion relief amongst providers and receivers, the CRM eliminates any ‘free-rider’ issues that dilute value in the service, which can occur under the purchased access rights model envisioned in the Interim REZ frameworks.

As the spot price for energy in each region and the spot price for congestion relief are determined separately, recipients of congestion relief are exposed to a basis risk in the event the CRM price clears above the RRN price. However, the presence of a new underlying market may also encourage the development of new bilateral and multilateral financial contracts, between congestion relief providers and congestion relief receivers. Other elements of CRM design, such as placing a cap on the congestion relief price at a level that is equal to the applicable RRN price for that dispatch interval could also be considered.

An underlying physical market for congestion relief, with which to base derivative products on, can provide participants with precise and effective risk management tools. This can in turn help to underwrite investments in new storage projects or other congestion relief technologies. It may also allow coordinated investments between new generators and new relief providers, with pre-established CRM hedge contracts that enable the new generation to connect with a pre-conceived congestion management solution that is not necessarily co-located and sharing the same physical point of connection.

Example 2: relief of stability constraint V^^V_NIL_KGTS_2

In this example we assume a new hypothetical constraint relief provider (e.g. battery, pumped hydro, synchronous condenser, coal plant, gas plant, scheduled load, demand response provider, etc.) of 100MW capacity is newly installed and assigned a DUID of CRPG1. On the LHS of the constraint V^^V_NIL_KGTS_2, CRPG1 is assigned a coefficient of -0.7. In addition to this, through the course of system stability studies, it has been determined that when CRPG1 is synchronised to the system, it boosts voltage stability on the Wemen to Kerang line, adding 70MW to the RHS of this constraint. Its generation MLF is assumed to be 1.0 for simplicity. The constraint description, along with the constraint equation RHS as at 08/06/2021 is defined below, with the addition of constraint relief provider CRPG1, highlighted yellow:

> *Out= Nil, Limit post-contingency flow on Wemen to Kerang 220kV line to be less than 310 MVA for loss of Horsham to Bulgana to Crowlands 220kV line (this trips Bulgana and Murra Warra WF) to avoid voltage collapse*
>
> *1.68*(310 {LIMIT} - MVA flow on Kerang to Wemen 220kV line section at Wemen, line end switched flow + 0.5143*[SMVA flow on Crowlands to Bulgana 220kV line at Crowlands end] + 0.4763*BULGANA1 + 0.4763*[MW output of Bulgana BESS (positive value is gen, neg value is load)] + 0.4832*MUWAWF1 - 20 {Operating_Margin}) +* ***(min(70.0, MW dispatched on CRPG1 by congestion relief market)*[On status of CRPG1])*** *- 0.8887*V-S-MNSP1 + BANN1 + 0.7953*BROKENH1 - 0.375*COHUNSF1 + 0.1028*COLEASF1 + 0.1068*DARLSF1 - 0.375*GANNBG1+ 0.375*GANNBL1 - 0.375*GANNSF1 + 0.8887*KARSF1 + 0.8387*KIAMSF1 + 0.7537*KIATAWF1 + 0.566*LIMOSF11 + 0.566*LIMOSF21 + 0.7953*STWF1 + 0.566*SUNRSF1 + WEMENSF1 + 0.8887*YATSF1 - 0.8887*((((if MW flow west on the Murraylink DC Interconnector <= 0 then 0 else 1)*((Max (Enable status of Victorian Murraylink very fast runback B scheme, Enable status of Victorian Murraylink very fast runback A scheme))))*(MW flow west on the Murraylink DC Interconnector)))*

On 15/05/2021, the Bannerton Solar Farm (BANN1) was constrained down by 42MW due to the above constraint binding during the dispatch interval ending 10:50. Relevant market outcomes for this event during this dispatch interval were as follows, which indicates this constrained volume (difference between cleared and available):

Parameter	Value: 15/05/2021 at 10:50
BANN1	
Bid price (at RRN)	-$1,000/MWh
Local price	-$1,000/MWh
VIC1 RRN price	$22.33/MWh
Bid volume	88MW
Total cleared	19.57408MW

Availability	61.57226MW
V^^V_NIL_KGTS_2	
Marginal value	-689.71899
LHS	412.15758
RHS	412.15758

Were a local CRM to be operating during this time, BANN1 may have had an opportunity to relieve this 42MW of constrained output, per the following example supply and demand stack:

DUID	Offer / bid price	Volume
CRM supply stack		
CPRG1	$14/MWh offer	10MW
CPRG1	$15/MWh offer	45MW
~~CPRG1~~	~~$20/MWh offer~~	~~5MW~~
CRM demand stack		
BANN1	$15/MWh bid	50MW
~~BANN1~~	~~$13/MWh bid~~	~~35MW~~
~~YATSF1~~	~~$10/MWh bid~~	~~10MW~~

In this example the bids and offers that have not been struck out are dispatched, with the market clearing BANN1 receiving its full 42MW of congestion relief from CRPG1 at a price of $15/MWh. Other DUIDs, which either had uncompetitive bids, or did not participate in the CRM, do not receive congestion relief, nor are they affected by the process.

To provide congestion relief, CRPG1 only needs to synchronise to the grid, after which NEMDE increases the RHS of the constraint equation (as shown by the highlighted section in the constraint equation above) by the cleared level of congestion relief provided – in this case 42MW. For this example, the maximum congestion relief CPRG1 can provide on the RHS of this constraint equation is 70MW (a value that would be determined through power system stability modelling from network service providers and AEMO).

This is a particularly important feature of the congestion relief market as it faces into a future NEM with ageing and retiring synchronous generators. As these generators retire, new stability and system strength related constraint equations will need to be developed. Linking congestion relief benefits to improved power system stability attributes that some new participants will be capable of providing enables them to earn additional revenues, facilitating business cases. It also facilitates an efficient process of price discovery and allows new entrant generating technologies to compete with incumbent plants alongside regulated transmission assets such as capacitor banks, SVCs, synchronous condensers, and other future technologies.

The settlement calculations for BANN1 and CPRG1 for energy, comparing cases before and after congestion relief are as follows:

Parameter	Value:
BANN1: status quo	
VIC1 RRN price	$22.33
Total cleared	19.57408MW
MLF	0.8085
Time duration	5 / 60 hours
Settlement	$29.45
BANN1: with CRM as cleared above	
VIC1 RRN price	$22.33
Total cleared	19.57408MW + 41.99818MW
MLF	0.8085
Time duration	5 / 60 hours
Settlement (pre-CRM)	$92.63
CRM price	$15/MWh
CRM settlement	$52.50
Net settlement	$40.14
CRPG1: with CRM as cleared above	
VIC1 RRN price	$22.33
Total cleared	0MW
MLF	1.0000
Time duration	5 / 60 hours
Settlement (pre-CRM)	$0
CRM settlement	$52.50
Net settlement	$52.50

In the absence of the CRM, had CRPG1 synchronised to the grid for the dispatch interval ending 10:50, CRPG1 in the current energy market, would have relieved congestion for both WEMENSF1 and BANN1. However, despite enabling this congestion relief benefit to these solar farms, CRPG1 would have received no revenues or compensation for any costs in providing this service. With the introduction of the CRM however, and by allowing NEMDE to dispatch congestion relief, the market is able to differentiate between participants who paid for the service and those who did not, so will deliver the specific service and volumes efficiently. This is a key point of differentiation between dispatched services when compared to post-settlement / ex-ante calculation mechanisms that are currently being contemplated by both the Modified CMM and Interim REZ frameworks.

This model, by utilising existing processes, harnesses and values power system stability services in a way that is both value accretive for and familiar to all market participants. This is a key advantage of the CRM approach over the Modified CMM and Interim REZ frameworks as it incentivises and enables generators that are facing significant levels of curtailment to unlock lost generation by either purchasing services to store it, or by purchasing proportional levels of power system stability improvements to release it.