NEOEN RESPONSE

ESB’s Transmission Access Reform Consultation Paper

Response Date: 17 June 2022

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About Neoen

Neoen is one of the world's leading and fastest-growing independent producers of exclusively renewable energy. We design and implement the means to produce the most competitive and sustainable renewable electricity on a large scale. Our total capacity in operation or under construction is currently over 5 GW, and we are aiming for more than 10 GW by the end of 2025.

As of January 2022, Neoen has over 2.5 GW of renewable assets in operation or under construction in Australia, spanning across Wind (1072 MW), Solar (918 MW) and Energy Storage (576 MW / 910MWh). This represents over 3.5 billion Australian dollars in investment. Neoen intends to reach 5GW in Australia by 2025.

Preamble

Now is the most potent time to implement radical reform, as it will have the most significant impact on consumers. Confusion, delay, and disruption to new supply coming online will help to maintain prices at record levels for longer.

The new federal government has a policy proposed to actually get to the root of the problem – the lack of adequate transmission.

Given these recent and major changes in circumstance, the need for reform should be reassessed. We recommend postponing transmission access reform until the transmission build-out is completed. It is reasonable to delay reform until at least the actionable ISP projects are completed, which would be by July 2031.

It's not that we disagree that there are problems or that things could be done better. Instead, we think the problems are overblown, and the cure is worse than the disease. We are frustrated at the continued intuition-based policy. The problem statement has changed for the umpteenth time, while the solution is naturally still local marginal pricing (LMP). The ideological crusade for LMP continues to be promoted by those without experience in generator dispatch or generator investment. The industry is still unconvinced that an arbitrary creation of basis risk has any notable benefits.

If we want to solve a problem, we need actually to start by quantifying it – measuring the impact. Congestion is a volume-based problem, and we should stop focusing on artificial price signals. Gather historical data (of which we have a wealth!), identify costs and inefficiencies, and quantify whether it's a big enough problem to solve. If so, create a model for future outcomes and back-test it against real outcomes. Get input from people who know how dispatch works instead of deliberately misrepresenting how participants behave to "prove" that LMP is necessary. We can see from the outputs in the models so far that they haven't been constructed properly. We can see that the congestion relief market (CRM) implementation costs have been exaggerated to make the congestion management mechanism (CMM) look good. We can see that the commercial implications of CMM in the contracts market have been completely ignored.

Let's be honest with ourselves – this reform is supposed to benefit generators. Decreased generator costs mean higher generator profits. However, the generators are all against the imposition of LMP, as are actual consumers (if not the consumer representatives). Neoen's customer's lawyers are anxious about the potential outcomes of an LMP regime as it has effectively a coin flip on whether or not their client gets rinsed. One more missing piece of experience from the LMP proponents is in contracting. We are tired of being told that generators (or their customers) will simply absorb the new business risks without them becoming costs.

Summary

Neoen is pleased to provide this submission on the Energy Security Board's (ESB) Transmission Access Reform Consultation Paper, and thanks to the ESB for giving an opportunity to comment.

We disagree that investors are without locational signals and that fundamental reforms are needed. We think the need for transmission access reform should be reassessed, and any such reform development should be delayed until the transmission build-out of actionable ISP projects is completed.

Nevertheless, if the push for reform continues anyway, we would like to assist the ESB in highlighting critical issues with the existing approach.

We have several critical concerns associated with the ESB's selected model for further consideration and its overall approach to formulating transmission access reform.

1. The congestion zone model with a connection fee will impose an additional cost on generators that will be pushed onto electricity consumers without concrete market benefits.

2. The CMM model with universal rebates is a repackaging of vanilla CMM. It continues to have exposure to LMPs that create excessive investment risks. Industry concerns voiced over many years regarding CMM and LMPs should be listened to now.

3. CMM does not provide any locational signal and does not solve any congestion problem either; it will just redistribute money amongst market participants.

4. Congestion is not efficiently managed by storage. This might feel intuitively right, but consumer value is necessarily destroyed by having batteries in congested areas.

5. ESB has not accounted for gaming in congested locations under the CMM. Generators can exercise market power in nodes through increased concentration.

6. The transmission queue model does not appropriately allocate risks between new entrants and incumbents. It provides some level of congestion protection to incumbents. However, it exposes new entrants to all the access and financial risks and uncertainties. Due to the complexity of the meshed transmission network, it would create curtailment risks for all generators regardless of their position in the queue. The implications of queueing mechanism on the dispatch outcomes would create unhedgeable risks for new entrants and may limit or damage contract market liquidity.

If and when a transmission access reform is developed, we agree with the ESB that it should target the investment and operational timeframes through separate models.

We consider that the enhanced information elements of the congestion zones approach, paired with the CRM, represent the best mix of solutions with several key benefits:

1. Clearer signals through obligations and restrictions will be provided as to where to invest while maintaining as much optionality for market efficiencies to determine good locations.
2. Enhanced information provision through the congestion zones approach will allow for retention of open access principles across the system – with the intention to get as close to the open market while still maintaining economic feasibility for market participants.
3. No connection fee but enhanced information provision and better regulatory processes will allow efficient generation build-up without hurting investment and will not increase the cost of electricity for consumers.
4. Better provision for the flow of information between network service providers (NSPs), generators and the Australian Energy Market Operator (AEMO) will result in a more coordinated investment in transmission, generation and storage.
5. CRM will be an opt-in mechanism for the operational timeframe, which will allow only participants wishing to participate in the congestion relief market to do so, further supporting the open market principles and with no impacts on the contracts market.

Neoen is available at your convenience to discuss these topics further.

Yours sincerely,

Hassan Ali,
Senior Market Analyst,
Neoen Australia

Date: 17 June 2022

Overview

With the transition towards a clean energy grid underway, it is essential to understand that an extraordinary amount of investment will be needed to bring this change. AEMO has already identified the need for 122 GW of additional utility-scale renewable energy generation and 45 GW / 620 GWh of storage in all its forms by 2050 to meet the demand as coal-fired generation withdraws. Moreover, major renewable energy zones (REZs) have already been identified and are underway in Queensland, Victoria, and New South Wales. AEMO has also recognised a need for 10,000 km of new transmission lines to deliver $29 billion of net market benefits ultimately.

Considering the federal government's plan to invest in transmission build-up, we believe that transmission access reform should not be of high priority at present. It should be delayed until the transmission build-up of actionable ISP projects is completed.

Any reform that has the slightest possibility of damaging investment in new generation capacity may result in a delayed transition towards a clean energy grid. And could be catastrophic for the power system considering the likely early closures of thermal generation units.

Issues with ESB's shortlisted models

While Neoen appreciates ESB's approach of considering four different models under two distinct timeframes, there are several issues associated with these models that we would like to highlight through this submission.

Investment timeframe

Congestion zones with connection fees

We appreciate that the ESB has considered certain aspects of our traffic light system for developing this model. However, there are certain characteristics of this model that would drive inefficient market outcomes and hinder investment in new generation capacity:

1. The fee procedure requires a central body to take a view on future market prices, and in effect, they will be responsible for approving investment decisions in new capacity. We have no faith that bureaucrats can do this effectively, given the history of miscalculation in the RIT-T. If the central body consistently overestimates what the fee should be, this will reduce new supply causing a feedback loop where the congestion cost keeps rising, but new entrants cannot reasonably afford to build.
2. This model can discourage investment in new generation build-up by adding a connection fee based on future congestion and transmission investments. Adding a new fee without any firm benefits increases the cost of new generation.
3. The model would have to rely on regulatory processes to set the fee based on available hosting capacity. It may become complicated to develop a fee structure suitable for all technologies. Moreover, the different fee methodologies and continual updating of the valuation process will likely catch generation investment unaware.
4. Even after utilising the revenue recovered from generators in the form of a connection fee to offset the transmission use of service (TUoS) charges, the cost of electricity for consumers will significantly increase because of higher wholesale prices.
5. This model fails to provide any level of revenue certainty over the asset's life at the final investment decision (FID). Even with a connection fee imposed, the incumbents will still be exposed to the risk of future congestion and curtailment from new neighbouring generators. The model fails to assure investors that subsequent inefficient connections will not undermine their project.
6. The model disadvantages newer entrants relative to incumbents insofar as incumbents were not required to pay a fee when they connected. This will create a two-speed access regime that will lead to inefficient market outcomes in the form of higher costs to electricity consumers and windfall gains to incumbents.
7. The risk of setting the fee too high is significant as it will disrupt the market and suffocate investment. If the fee is set too low, the model would be too weak to inhibit inefficient investments.

8. In general, there is no clarity over when, how much a generator will pay, and how they will bring the cost into their investment process.

Transmission queue

There are several issues with this model that would add complexity to the market and stifle investment in new generation capacity:

1. This model does not allocate risks between new entrants and incumbents appropriately. It provides a strong level of congestion protection to incumbents. However, considering that the queuing position may be used as priority rights in dispatch timeframes, it completely exposes new entrants to all the access and financial risks and uncertainties. This is equivalent to closed access, as with FTRs or the WEM.
2. The model does not provide firm access to incumbents and new entrants that gain incumbent positions in the queue. Subsequent connections are still possible, which may cause inefficient levels of future congestion. Due to the complexity of the meshed transmission network, it may create curtailment risks for all generators regardless of their position in the queue.
3. The implications of queueing mechanism on the dispatch outcomes would create unhedgeable risks for new entrants and may limit or damage contract market liquidity.

Operational timeframe

CMM with universal rebates

We welcome the move away from the CMM-REZ model as this was the most harmful model proposed so far. Nevertheless, CMM still contains many undesirable attributes which remain unresolved since COGATI first began years ago.

1. CMM retains the exposure of incumbents and new generators to LMPs. We have previously stated that LMPs will not solve the congestion problem and do not provide locational signals in advance. Creating a settlement residue conflicts with commodity market principles, i.e. the uncongested volume is not paid at the spot price. There has been no rational justification for this artifice.
2. ESB has again failed to provide any practical example by either utilising constraint equations or actually constrained nodes to demonstrate how the model will work in the real market. It is still not clear whether or not non-scheduled generators in a binding constraint will face a congestion charge and receive a congestion rebate.
3. Once again, the latest version of CMM does not reflect on the long-term, forward-looking effects of transmission and generation investment. LMPs are a signal for where to locate in a 5-min interval; they do not incorporate information about future transmission investment.
4. The model encourages gaming, and LMP proponents continue to disregard this harmful aspect. Generators can exercise market power through increased concentration within a constraint. See appendix for examples.
5. Exposure to LMPs (and unpredictable neighbours) will create unhedgeable risks for new entrants and limit or damage contract market liquidity. An LMP-based framework would be counter-productive as it would increase revenue uncertainty, leading to higher capital costs.
6. All pre-existing contracts will need to be renegotiated with legal costs in the hundreds of millions of dollars. The financial position of many buyers and sellers may be jeopardised.
7. For generators (and some buyers), the outcome of their contract position and the randomly assigned LMP-rebate position could result in a default on debt, or a downgrade in credit, impacting their ability to conduct business.
8. Some well-placed and efficient generators currently not exposed to curtailment losses will be under CMM.
9. Some poorly placed and inefficient new entrants will join knowing they can share rebates with incumbents.
10. Approaches that include LMPs should be avoided as they are demonstrated not to be an effective long-term signal – a conclusion that the ESB has itself reached in its paper;

"this model does not provide upfront locational signals to new entrants. Should be implemented in conjunction with an investment timeframe solution."

The model does not solve any congestion problem either; it just redistributes money amongst market participants.

11. ESB has not provided any form of cost-benefit analysis for CMM. Comparing AEMO's implementation cost for CMM and CRM does not present the actual picture. The $300m implementation cost for CRM is an inflated figure for COGATI. It is dishonest to throw such an unsubstantiated number.
12. ESB's detailed design paper highlights that ESB is favouring CMM over CRM. If ESB is engaging stakeholders in consultation for this reform, it is essential to listen to their concerns and develop a suitable model for everyone.
13. ESB continually works with different assumptions to prove that CMM is feasible for the market. Assuming that storage will be located in congested zones is impractical. Relieving congestion is not storage's primary or only job. The storage location within congested areas would signal that CMM has encouraged inefficient investment (see appendix for details).

Preferred Approach

Neoen believes that radical access reforms are counter-productive in the current environment. Transmission build-out is now much more likely to be done in a timely manner, allowing additional generation connection and efficient flow around the network. We would like to see a more effective dispatch of batteries under constraints. However, it is a relatively minor problem, and given the inefficiency of building storage to manage congestion (see appendix), the opportunity is not likely to substantially grow. Neoen would definitely prefer no reforms are made rather than radical ones that undermine our ability to contract new assets.

The issues with the proposals we like the least are:

1. <u>Creation of artificial settlement residues through LMP</u>
   This necessitates an access compensation model on which we cannot find an efficient or fair model for both incumbents and new entrants.
2. <u>The enthusiasm for "generator pays" access</u>
   It is unclear what the collected monies are for, and it is an additional cost that will be passed to consumers. The payment of a fee does not solve the first issue. Where wholesale prices are increased, the net impact on consumers is highly negative and provides a windfall to incumbents.
3. <u>The imposition of all incremental congestion on the new entrant</u>
   When incumbents share a portion of the efficient congestion, new entrants can effectively compete on price; this leads to higher utilisation of transmission infrastructure and lower cost supply for consumers.

In addition, other stakeholders stated that they were uncomfortable with the blocking mechanism (red light) in our original Traffic Light proposal. This is a fair criticism, and we have adapted the proposal to suit.

Congestion relief market

For a reform in the operational timeframe, we prefer the CRM proposal from Edify for the following reasons:

1. The current pricing arrangements are retained, and it does not suffer from basis risk.
2. We support its voluntary nature, which will not disrupt the due diligence processes for a project's investment decision.
3. It will allow generators to manage any residual risk of congestion after implementing the congestion zones model (with enhanced information provision) by participating in the CRM for congestion relief in the operational timeframe.
4. CRM does not create an incentive for high-cost generators to run when RRP is below their operating cost.
5. CRM is conducive to bilateral contracting, which is the mechanism that actually results in locational signals. Contracting helps parties to manage congestion risk, incentivise loads to locate in congested areas or allow bullish investors to locate in congested areas without cannibalising the revenue of others.

6. Relative to LMP, CRM provides greater rewards to loads in congested areas as the new load will frequently cause a constraint to unbind. Under LMP, if the constraint unbinds, the load has no price benefit, and indeed generators will game LMP to get this outcome. Under CRM, they can still get a partial benefit as there are two settlements.

Congestion zones model – enhanced information provision

We believe that a congestion zone model without a connection fee but with better information provision and regulatory enforcement is the best solution to drive efficient investment decisions for the investment timeframe.

Feedback processes will be critical for this model as they allow risk-sharing. Generators will have to continue to bear the cost of congestion which could be reduced through CRM, and customers will continue to get the benefits of low-cost energy as there will be no connection fees that could be passed on to them. The flow of information will be in both directions between NSPs and generators:

1. Recognising the long lead times for transmission builds, AEMO and transmission network service providers (TNSPs) would have to be able to pre-emptively plan and build transmission networks so that this investment could proceed in tandem with generation investment. Better information flows would assist in constructing these investments in time, although we would also need changes to the broader planning and economic regulatory frameworks.
2. Renewable generators will likely continue to connect to the power system based on resource availability. AEMO and NSPs should be able to respond to this private sector investment by making incremental investments to unlock low-cost energy for consumers. This enables risk sharing and reduces stranded asset risk.

We are glad that the ESB has considered our proposal on 'zones' and 'traffic light' models from our submission on the CMM project initiation paper. However, the congestion zone model would be more efficient if adapted to focus on information provision rather than a connection fee for locational signals. 'Heat mapping' of the network is one way to provide parties with better information about current and expected future congestion.

Green Zone:
Positive investment signal

Amber Zone:
Moderate/conditional investment signals

Under the green zone, spare transmission capacity will be available and negligible congestion risks so generators can connect in those locations without any hurdle if enough headroom is still available after connection.

Under the amber zone, there will be limited transmission capacity available, so generators that want to connect in those locations must satisfy certain conditions driven by obligations such as limiting the curtailment caused to neighbours. Generators will have to solve this by:

1. reducing project size, or
2. contributing to transmission augmentation, or
3. using storage to mitigate the impacts, or
4. operating their assets in ways that will not cause congestion for neighbours. This can include a contract to offer capacity into CRM. For example, for a particular connection location, AEMO says the efficient generator size is 100 MW; more would cause inefficient congestion. The generator may want to build 120 MW, knowing that transmission will be improved with scheduled works in 4 years. The generator would then have to agree to offer 20 MW into CRM at $0, so other impacted generators can buy back their capacity for a negligible amount.

For this model to work, several regulatory and information delivery processes will need to be established:

1. More substantial obligations on generators to do more onerous modelling of congestion during connection.
2. Stronger obligations for NSPs and AEMO to provide detailed information on the following:

a. Forecasts on current and expected congestion in their networks
b. Detailed information availablity to enable generators to undertake accurate congestion modelling.
c. Standardised assessment criteria to evaluate the probability that developments will materialise.
d. Feed analysis into the transmission annual planning review and explain why/why not these have been fed into RIT-T processes. Data should also be provided to the AEMO ISP and system strength node declaration processes.

No need for a connection fee: With accurate and firm information available on congestion risks and transmission capacity, there is no need for a connection fee as the model will:

1. facilitate risk and benefit-sharing among generators, TNSPs, and customers,
2. allow the investors to understand where the congestion will occur and make better investment decisions,
3. Let NSPs draw on live generation investment market information to make better network investment decisions.

It is vital to establish that any form of connection fee imposed on generators through this model would simply increase the cost of electricity for consumers as it will be passed down the supply chain. It will also create a monetary imbalance in the energy market through a two-speed access regime. If the marginal cost of a new entrant is increased, this provides a windfall to incumbent generators who have not paid such a fee.

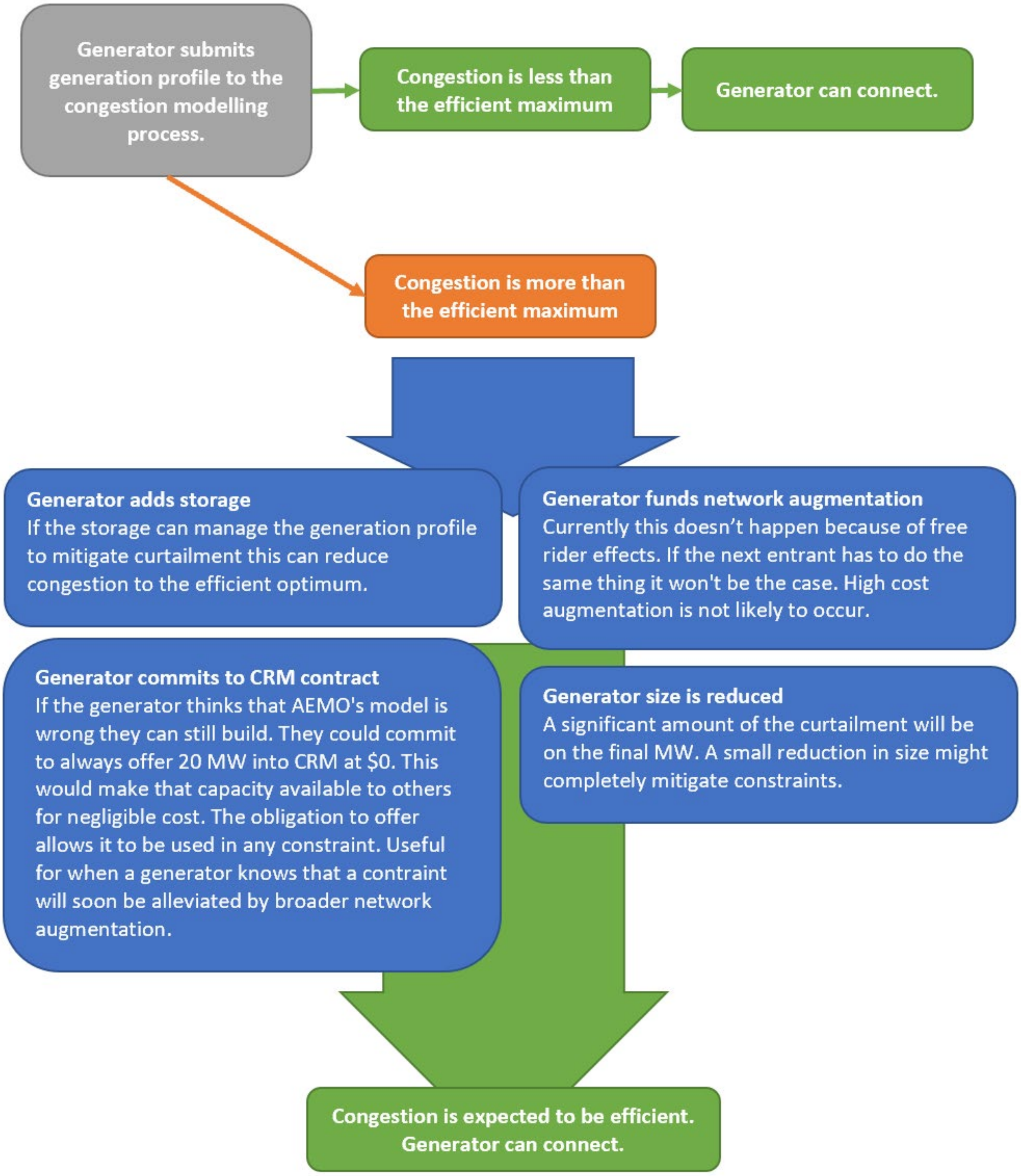

Figure 1: Example Flowchart

Discussion of congestion zone obligations

Our modified proposal aims to meet several goals:

1. Do not burden new entrants with all congestion impacts. Incumbents must share a portion of the efficient congestion. Without this, new entrants will not join (closed access).
2. Prevent congestion from reaching inefficiently high levels.
3. Allow generators to solve the problem in the most effective way they can instead of simply imposing fees.
4. Do not undermine trade in the primary electricity service.

We are satisfied these goals are met, yet it raises further questions which would need to be answered by the industry:

1. What is the efficient level of congestion? How will we assess this over time?
2. Should the congestion assessment include losses?
3. Will inefficient congestion be measured globally (total new congestion/total new generation) or as the maximum impact on an incumbent? Or both?
4. How do we avoid slowing down the development of new capacity and getting stuck in a modelling loop?
5. How do we resolve simultaneous investment decisions?

We would be happy to discuss this proposal in more detail with the ESB and consultation participants.

Appendices

Gaming

The issue with LMP is that it creates the possibility for another generator to determine your revenues for you. This makes the forecasting of revenue inherently less certain, and uncertainty in revenue is a corollary for higher cost of capital.

Here we provide some simple two-generator examples, but further complexity arises with the addition of generation contracts. This provides the ability for generators to divert commercial harm to their offtakers, whether unilaterally or in collusion with their neighbours. This is of course highly circumstantial depending on the contract clauses and price thresholds of the contract and market price.

Here we show four scenarios of two variables: either the high-cost generator has the best coefficient or not, and either the high cost generator is generating more than the rebate amount or less. In each scenario the profit maximising behaviour of the high cost generator is not to bid to SRMC.

Scenario 1: Good Coefficient, Less than Rebate

LMP with rebate

	Wind	Coal
Availability	100	100
SRMC	-$40.00	$50.00
Bid price	-$40.00	-$19.50
Coefficient	1.00	0.50
Constraint RHS	110	
RRP	$80.00	
Dispatch:	100	20
	LHS	110
LMP	-$39.00	-$39.00
Settlement Residue	$14,280.00	
Rebate	$7,140.00	$7,140.00
Net revenue	$7,240.00	$5,360.00
Export value	$9,600.00	

Status Quo

	Wind	Coal
Availability	100	100
SRMC	-$40.00	$50.00
Bid price	-$1,000.00	-$1,000.00
Coefficient	1.00	0.50
Constraint RHS	110	
RRP	$80.00	
Dispatch:	60	100
	LHS	110
LMP	-$1,000.00	-$1,000.00
Settlement Residue	$0.00	
Rebate	$0.00	$0.00
Net revenue	$7,200.00	$3,000.00
Export value	$12,800.00	

In this scenario the coal plant receives a large rebate relative to production, so it can afford to reduce LMP in order to maximise profits. The coal plant bids such that its coefficient adjusted LMP is higher than the wind. This reduces the profit from the wind farm as it also receives a lower LMP and is generating more than the rebate amount. Note that the total exported volume from the constraint is substantially lower due to the dispatch of a unit with a high coefficient. This reduced energy flow needs to be made up with additional dispatch from the wider market, which will occasionally increase wholesale price to consumers. Another way to look at it is that the export value to consumers is reduced. Moreover, the reduced value to consumers is higher in absolute terms than the profit uplift to generators in this example.

Scenario 2: Bad Coefficient, Less than Rebate

LMP with rebate

	Wind	Coal
Availability	100	100
SRMC	-$40.00	$50.00
Bid price	-$40.00	$79.00
Coefficient	0.50	1.00
Constraint RHS	110	
RRP	$80.00	
Dispatch:	100	60
	LHS	110
LMP	$79.00	$79.00
Settlement Residue	$160.00	
Rebate	$80.00	$80.00
Net revenue	$11,980.00	$1,820.00
Export value	$12,800.00	

Status Quo

	Wind	Coal
Availability	100	100
SRMC	-$40.00	$50.00
Bid price	-$1,000.00	-$1,000.00
Coefficient	0.50	1.00
Constraint RHS	110	
RRP	$80.00	
Dispatch:	100	60
	LHS	110
LMP	-$1000.00	-$1000.00
Settlement Residue	$0.00	
Rebate	$0.00	$0.00
Net revenue	$12,000.00	$1,800.00
Export value	$12,800.00	

In this scenario the coal plant can maximise profit by bidding just below the RRP. There is no material difference to status quo, although it is more difficult for the coal plant to manage their position.

Scenario 3: Good Coefficient, More than Rebate

LMP with rebate

	Wind	Coal
Availability	100	200
SRMC	-$40.00	$50.00
Bid price	-$40.00	reduce avail
Coefficient	1.00	0.50
Constraint RHS	180	
RRP	$80.00	
Dispatch:	100	159
	LHS	179.5
LMP	$80.00	$80.00
Settlement Residue	$0.00	
Rebate	$0.00	$0.00
Net revenue	$12,000.00	$4,770.00
Export value	$20,720.00	

Status Quo

	Wind	Coal
Availability	100	200
SRMC	-$40.00	$50.00
Bid price	-$1,000.00	-$1,000.00
Coefficient	1.00	0.50
Constraint RHS	180	
RRP	$80.00	
Dispatch:	80	200
	LHS	180
LMP	-$1,000.00	-$1,000.00
Settlement Residue	$0.00	
Rebate	$0.00	$0.00
Net revenue	$9,600.00	$6,000.00
Export value	$22,400.00	

In this scenario the coal plant can maximise profit by reducing it's availability such that the constraint unbinds. This extinguishes the settlement residue.

This reduces flow out of the constraint (total dispatch MW) which must be made up by generation elsewhere and may result in higher RRP.

Scenario 4: Bad Coefficient, More than Rebate

LMP with rebate

	Wind	Coal
Availability	100	200
SRMC	-$40.00	$50.00
Bid price	-$40.00	reduce avail
Coefficient	0.50	1.00
Constraint RHS	180	
RRP	$80.00	
Dispatch:	100	129
	LHS	179
LMP	$80.00	$80.00
Settlement Residue	$0.00	
Rebate	$0.00	$0.00
Net revenue	$12,000.00	$3,870.00
Export value	$18,320.00	

Status Quo

	Wind	Coal
Availability	100	200
SRMC	-$40.00	$50.00
Bid price	-$1,000.00	-$1,000.00
Coefficient	0.50	1.00
Constraint RHS	180	
RRP	$80.00	
Dispatch:	100	130
	LHS	180
LMP	-$1000.00	-$1000.00
Settlement Residue	$0.00	
Rebate	$0.00	$0.00
Net revenue	$12,000.00	$3,900.00
Export value	$18,400.00	

Similar to scenario 2 in that not much changes relative to status quo. This time coal reduces availability to unbind the constraint.

Discussion of dispatch outcomes

In two of the scenarios no material change in dispatch was observed. There was neither an improvement in dispatch outcomes nor a revenue risk for the generators.

In the other two scenarios the generators are able to influence each other's profits. This is what generators are anxious about – the supposed stability of bidding at SRMC is not a fact, and it is likely that a dynamic, and vindictive practice of rebidding will be incentivised in order to steal revenue from someone else. In these scenarios the operating cost of the units are reduced – but this does not impact price "in the long run", this is a parable people tell themselves. The greater cost efficiency of the coal plant will not incentivise another coal plant to build in this congested area.

We should also not forget that the changes in dispatch have reduced total supply and must be made up with additional dispatch from unconstrained generators. This may only increase price (not decrease), but the impact may be small or zero depending on the bid stack. This price increase impacts the total volume of NEM consumption (not just the congested volume) and so even small price increases should be considered material.

Storage is inefficient for managing congestion

Quite a lot of noise is made in our industry about storage being used to mop up curtailed energy. Intuitively it sounds really neat. Neoen has analysed the opportunity and found that it reduces economic efficiency in all but the most exceptional of circumstances. This is simply due to the fact that curtailed energy only occurs when the generation capacity is greater than the transmission capacity. Adding more generation capacity in the form of storage creates new curtailment at transmission capacities higher than that of the original generation capacity. Furthermore the value of the new congestion is much higher than the value of the absorbed curtailment.

Figure 2: This is not a REZ

Neoen feels partly responsible for the false perception about storage absorbing curtailed energy. Pictures of batteries next to turbines gives the impression that's where they belong. Hornsdale is a good location for a battery precisely because it is rarely constrained and it's on a strong, meshed part of the grid. We might have preferred close to Adelaide, but co-location brought the project connection cost savings. The Victorian Big Battery (VBB) is in an ideal location, very electrically close to Melbourne. Our pipeline storage projects are assessed early on constraint risk – projects with more than occasional risk of constraints are abandoned.

Below is a modelled example of a 100 MW solar farm and 100 MW, 2h battery. The generation mix is kept the same (constant capex), and the transmission capacity is reduced in order to see the change in value. Note that the cost of the transmission is ten times lower than the cost of generation so there are only minor cost savings in reducing the installed amount of transmission.

Solar data is for an actual solar farm in QLD, and the battery behaves relative to QLD price, storing curtailed energy opportunisitically for free.

Results for 100 MW solar and 100 MW battery

Line rating	Generation Value	Avoided Cost of Charging	Proportion of max value
200	$50,180,632	0	100%
180	$50,174,137	0	100%
160	$50,015,902	0	100%
140	$49,703,523	0	99%
120	$49,018,265	0	98%
100	$47,729,957	0	95%
80	$43,106,068	$123,314	86%
60	$36,446,276	$648,231	73%
40	$29,041,826	$1,218,376	58%
20	$22,567,263	$1,974,519	45%

At 200 MW of line capacity there is never congestion and this provides the maximum possible generation value. However, a significant decrease in transmission capacity to 160 MW has minimal effect on the value of the generation mix. This represents the efficient optimum, and at this point there cannot be any solar curtailment.

Between 160 MW and 100 MW line capacity generation value is being destroyed by the congestion that the battery would create upon discharging. There is no benefit from absorbed curtailment.

Reducing to 80 MW transmission capacity creates the potential for solar curtailment. The battery captures a good portion of the curtailed energy, but it's reduced ability to discharge when prices are high means the net benefit is negative.

It is possible to create an optimised system where storage brings larger absorption value that the loss created. This occurs with a very small battery which would incur impractically high connection costs and is not viable.

A wind based (or combined) generation mix is even worse for the battery as the probability it creates inefficient congestion is much higher.

The optimal generation mix to maximise consumer benefit net of transmission costs is wind capacity up to the transmission capacity, a moderate amount of solar to improve utilisation, and locating the battery in another location entirely.