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ESB POST 2025 MARKET DESIGN ISSUES PAPER

Origin Energy Limited (Origin) welcomes the opportunity to provide comments on the Energy Security Board's Post 2025 Issues Paper.

It is well documented the National Electricity market (NEM), is undergoing a significant transformative period. The increasing entry of renewable generation, the retirement of aging plant, and the emergence of new technologies will continue to test the current market settings. Against this backdrop, safeguarding market resilience to ensure the delivery of reliable, secure, and affordable energy remains the paramount objective. Given this, Origin welcomes a comprehensive review of the NEM while also reinforcing that the ESB should be realistic in the expectation of what an exercise such as this can achieve.

The final report from the Finkel Review (which set out a blueprint for the future security of the NEM), was published in 2017. Yet in a little over two years we are already embarking on a similar exercise. This is not to say that such reviews are not warranted or useful, but rather that market reform in a highly uncertain and ever changing environment is inherently incremental. The expectation that it is possible to hand pick the optimal market design that will apply at some point in the future and be resilient over time is unrealistic.

It is also important to establish that an incremental approach does not mean that no significant changes are required. As the market evolves, the regulatory framework must follow suit, and where appropriate even precede the anticipated changes. We should remain mindful that there have been several significant recent (and pending changes) to the market framework. These include the impending implementation of five minute settlement and the wholesale demand response mechanism; the AEMC's consideration of access reform and changes to the marginal loss factor framework; and the introduction of the default market offer, and a raft of operational retail market changes.

In addition to highlighting possible gaps in the current market settings by taking a holistic view, Origin suggests the ESB should:

- Seek to understand the impact of the various current (and pending) regulatory changes that have already been made, when contemplating additional measures; and

- Not necessarily be fixated on setting out a long term blue-print, or discrete alternative market designs for consideration, (if such an approach is found to be impractical). Alternatively, the focus could be on a rolling strategic planning approach with the objective of ensuring the market is able to adapt to various possible futures with additional clarity around what changes will need to be made in order to do so. The timeframe for the delivery of alternative market designs, (for consideration by early next year) appears ambitious and may not even allow for sufficient time to fully understand the challenges the market is facing.

Our thoughts on the key areas covered in the Issues Paper are summarised below:

Assessment Framework

- The ESB should consider the development of a single base case scenario and apply limited sensitivities to examine the spectrum of possible futures. The Integrated System Plan (ISP) scenarios cover multiple paradigms, which may limit comparability.
- More detail (and perhaps consultation) on the plan for incorporating 'real world bidding' should be made available ahead of the modelling exercise. The plan for the modelling of emissions trajectories and plant retirements should also be made clear.

Driving innovation to benefit the customer

- The current design creates some biases in pricing or valuing behind the meter vs in front of meter actions, in particular because of the way market roles are delineated and how network charges apply.
- With the introduction of new products and services it is important that the consumer protection framework remains appropriate. We note that the AEMC is embarking on a review of the customer protection framework that will be crucial in this regard.

Investment signals to ensure reliability

- There are several factors that could challenge system reliability going forward: policy instability and direct govt investment; aging plant/disorderly exit; lower demand/technology uncertainty; failure to co-optimise transmission and generation investment; and revenue adequacy for generation
- Despite the obvious tightening in the market, at this point, it is not conclusive that there is an enduring reliability problem in the NEM, and we should be mindful that a few years ago, it was market over-supply that was the primary concern, highlighting the cyclical nature of markets
- A measured approach is therefore required whereby the ESB should consider the nature of any potential reliability issue, including if it is transient or long term
- Emergency response mechanisms such as the RERT; or strategic reserve for retiring plant, could help address short term issues – but they will need to be carefully designed to minimise cost and distortion, and could only be temporary
- In the case of any possible long term issues, the ESB should determine if these can be resolved through the existing framework. The objective of the market price cap (MPC) is to ensure there is sufficient investment to meet the reliability standard, therefore the appropriateness of the current MPC would need to be examined. The ESB would need to be cognisant of the role of the MPC as safety net against participants' sustained exposure to high prices, which could prove to be a limiting factor in its ability to stimulate investment
- The recently introduced Retailer Reliability Obligation (RRO) which is essentially a type of capacity mechanism, is untested, and is aimed at incentivising investment in dispatchable generation. It might therefore be premature to already be considering new measures
- If it is determined that some additional mechanism is required, then the full suite of capacity mechanisms can be examined, utilising learnings from international jurisdictions, but it is important that capacity markets aren't viewed as a panacea, noting that some are plagued with issues such as in the UK.
- Some of the underlying reasons for jurisdictions turning to capacity mechanisms are informative. Some of these jurisdictions have aggressive climate change policies with mandated coal plant closure thereby resulting in the need for replacement investment within a tight timeframe
- If a new capacity mechanism is to be considered, it should most likely be in the form of a targeted volume based measure which could allow for the procurement of the type of generation the NEM needs – low emissions flexible dispatchable plant that can complement intermittent renewables.

- A model that utilises a one-off payment where the capacity runs in the market as normal without any ongoing assistance is likely to minimise distortion.

Integration of distributed energy resources (DER)

- Given DER can deliver multiple value streams (at the customer, wholesale and network level), co-optimisation across various markets will be crucial to ensure it is made available to where it is valued most.
- The control of DER must reside with the customer. Where other parties such as networks see value in controlling DER they must contract that from the customer (or their chosen energy service provider).
- Dynamic or cost reflective price signals will be important in ensuring the full benefits of DER are realised and that customers that choose not take up DER are not disadvantaged

System security services and resilience

- Some of the difficulties of managing the system in a transitioning market are already evident with the increasing reliance on directions in South Australia to deal with system strength issues.
- Origin considers that a market based approach is the most efficient means of providing the services required by the system and that this is superior to any mandatory mechanism. Market mechanisms allow for price discovery and will encourage innovation and the entry of new suppliers
- Mandating the provision of system security services is likely to result in over-delivery given the blanket requirement for all generators to provide the service.

Integration of renewable energy into the power system

- The ISP is set to play a crucial role in facilitating the development of the transmission network over time which is key to maintaining both a reliable and secure electricity system. It is important that the ISP continues to evolve, to ensure the robustness of the planning framework, and help to instil greater confidence in the plan
- There should be transparency in defining what projects are deemed to be strategic, (and as a result warrant conclusion in the ISP).
- The role of government policy (both Commonwealth and the States) in shaping the ISP should be made explicit, with the governance framework setting out how AEMO is expected to incorporate policy decisions

If you wish to discuss any aspect of this submission further please contact Steve Reid at steve.reid@originenergy.com.au or on 02 9503 5111.

Yours Sincerely

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1. Assessment Framework

1.1 Modelling

Origin agrees the ESB should not seek to rely on a single complex model to determine potential market design options. While modelling is useful to explore the outlook for potential changes in market dynamics, it cannot reasonably be used to form a view on market design options in isolation of other factors. A broader assessment of any underlying issues is ultimately required to understand the rationale for and the type of reforms that might be required. Our general thoughts on the ESB's planned modelling approach include:

- The ESB should consider the development of a single base case scenario and apply limited sensitivities to examine the spectrum of possible futures. The Integrated System Plan (ISP) scenarios cover multiple paradigms, which may limit comparability. It is unclear how consideration of five distinct scenarios will facilitate the ESB's decision making framework. Will policy proposals need to be resilient across most of the scenarios to be deemed feasible?

- More detail (and perhaps consultation) on the plan for incorporating 'real world bidding' should be made available ahead of the modelling exercise. The plan for the modelling of emissions trajectories and plant retirements should also be made clear.

1.2 Principles

Origin is generally supportive of the assessment framework and principles chosen by the ESB for evaluating market design options.

We recommend that the ESB clarifies how it intends to make trade-offs between the principles when they are in conflict. The Issues Paper notes the list is not subject to a hierarchy, but it is not clear exactly how the ESB intends to apply its final assessment. As an overarching objective, we assume any proposed options would only be introduced if the benefits of doing so outweigh the costs.

With respect to the individual principles, Origin makes the following comments:

- **Technological neutrality:** While Origin generally supports a technologically-neutral approach to the NEM, it is worth considering how this is applied in certain situations. For example, some of the issues raised in the Issues Paper relate to problems that may require targeted solutions with specific technical requirements (e.g. flexible plant).

- **Transparency and simplicity:** We suggest splitting these two principles and merging simplicity with 'practicality of implementation'. While simplicity is an appropriate principle, some of the issues under consideration are inherently complex.

2. Driving innovation to benefit the customer

2.1 Market frameworks should support and encourage innovation without picking winners

The trend of progressive decentralisation and the increasing uptake of DER has (and will continue to) change the nature of retailing. But the policy framework should not seek to pick winners. Instead the focus should be on laying the foundations for all technologies and business models to effectively compete, allowing for a dynamic efficient outcome over time where consumers will determine the winners.

2.2 The market design will need to be responsive to distributed, connected energy assets and devices

- Customers are no longer primarily sources of demand but frequently also act as suppliers. The current design will need to accommodate two way flows from customers, which may be critical in unlocking the benefits of emerging models such as peer-to-peer trading.

- The value of energy can vary across different locations within a network and at different times. Some distributed assets are better placed than others to capture this. The current design of pricing at the regional reference node with pre-set loss factors largely ignores this.

- The current design creates some biases in pricing or valuing behind the meter vs in front of meter actions, in particular because of the way market roles are delineated and how network charges apply. For example, the current rules would encourage a retailer to sell 10 small behind the meter batteries to 10 customers in a locality rather than one large battery in front of the meter that the 10 customers share. This isn't necessarily an efficient outcome.

2.3 Customer protection framework is crucial

With the introduction of new products and services it is important that the consumer protection framework remains appropriate. We note that the AEMC is embarking on a review of the customer protection framework that will be crucial in this regard.

3. Investment signals to ensure reliability

There are several issues pertaining to NEM reliability that will need to be addressed under this review, including:

- the current state of reliability in the market;
- the challenges impacting current and future reliability;
- the extent to which the current market framework is likely to be resilient to these challenges; and
- possible options for augmenting the current market design (if required).

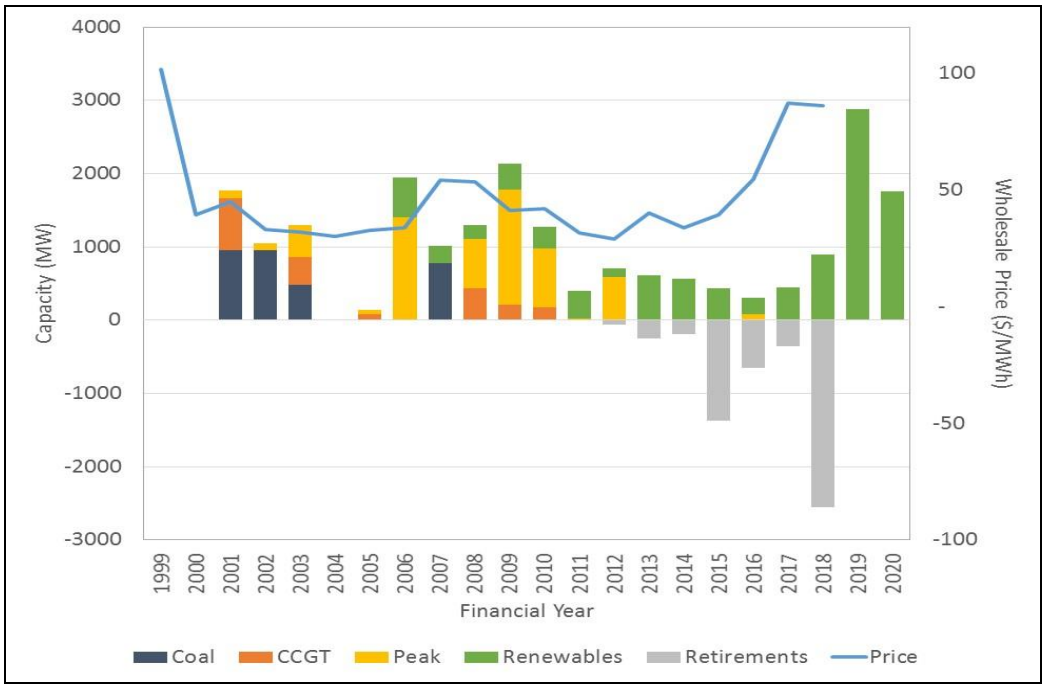
We discuss these issues in greater detail below.

3.1 Current state of reliability in the NEM

The NEM has a strong track record in facilitating reliable supply, with higher prices historically serving as a signal for new generator entry. Chart 1 below, demonstrates that increasing prices from around 2004 led to significant new coal and gas build, resulting in the reliability standard being met every year (except for 2008-09). Only 0.23 per cent of supply interruptions have been due to reliability events between 2007/08 and 2016/17.[1]

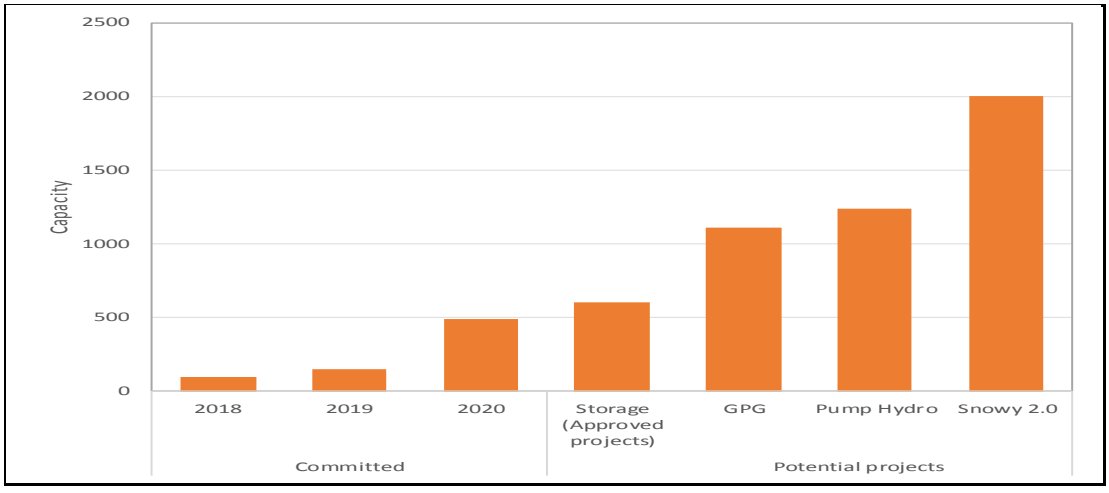
[1] AEMC Reliability Panel, 'Reliability standard and settings review 2018 – Final Report', 30 April 2018.

Chart 1 – NEM Wholesale Pricing and investment



Notwithstanding the above, the NEM's reliability performance has come under scrutiny recently following some major plant retirement. In its 2019 Electricity Statement of Opportunities (ESOO) AEMO highlighted a tightening supply/demand balance and an elevated risk of unserved energy, though, importantly, the reliability standard is still expected to be met. Further, as shown in Chart 2 below, there is almost 500 MW of committed firm generation set to enter the NEM by 2020, with an additional 600 MW having received approvals and over 4,000 MW of potential new projects in the pipeline. It is expected these projects will assist with meeting potential future capacity requirements highlighted in the ESOO.

Chart 2 – Dispatchable generation projects in the NEM[2]



[2] AEMO data.

3.2 Possible challenges to future NEM reliability

Despite the NEM's historical reliability performance, concerns around future supply adequacy have started to emerge as the market transitions. The increasing use of the Reliability and Emergency Reserve Trader (RERT) has renewed debate around the resilience of the NEM framework and the extent to which it will ultimately facilitate the required investment. We discuss some of the potential challenges to future NEM reliability below.

Policy instability/direct government investment

As identified in the Australian Energy Regulator's (AER) recent 2018 Wholesale Market Performance Review, policy uncertainty and government intervention can make investment more challenging. The lack of a long-term cohesive policy approach in the NEM, particularly for emissions reduction, has been a long-standing issue.

Recently, the Commonwealth announced its intention to underwrite new generation investment. The Government's role should be to provide a stable regulatory framework to help shore up investor confidence. Direct government investment in generation is not a long-term solution and runs the risk of increasing uncertainty and disincentivising private sector participation. It would also likely distort bidding and contracting behaviour, with generators that receive assistance facing a reduced incentive to contract with other private entities. This will ultimately exacerbate the problem the Government is looking to solve.

Aging plant and dis-orderly exit

The recent and somewhat unexpected closure of some large generators has resulted in a tighter market and an increase in wholesale prices. The NEM's aging stock of generation has also placed renewed focus on the timing of plant retirement and the market's ability to incentivise replacement investment to ensure reliable supply. While there is a new requirement for generators to provide 42 months notice before closing, the risk of untimely exit is likely to require ongoing management.

Failure to co-optimise transmission and generation investment

The justification for investing in transmission assets (such as interconnectors) is often to enhance reliability and system security. However, to the extent generation and increased interconnection are substitutes, over-investment in transmission could also serve to limit the viability of local generation, discouraging investment. This could ultimately undermine future reliability and/or unduly increase costs.

Lower demand and technology uncertainty

Historically, all electricity was produced by large scale generators and supplied to end use customers through the transmission/distribution grid. Coupled with a stable large manufacturing / industrial customer base, this manifested in relatively predictable demand growth over the period to 2008-09,[3] which was conducive to long term investment. Since that time, grid demand has declined at an average annual rate of 1.7 per cent over the five year period to 30 June 2014 and has remained relatively flat over the subsequent period to 2017-18.[4][5] The closure of some industrial load, improved energy efficiency, and the increasing uptake distributed generation such as solar PV have combined to reduce demand from the centralised system. Uncertainty around the future of major industrial loads such as smelters can also have significant implications for future investment decisions.

[3] Australian Energy Regulator, 'State of the Energy Market 2018', December 2018, pg. 74.
[4] Australian Energy Regulator, 'State of the Energy Market 2015', December 2018, pg. 24.
[5] Australian Energy Regulator, 'State of the Energy Market 2018', December 2018, pg. 74.

There is also scope for further technology disruption that potential investors in long-lived generation assets will need to consider. As the economics of battery storage solutions continue to improve, the extent and timing of future uptake is unclear.

Revenue adequacy

Energy only markets rely on generators being able to earn enough revenue from the selling of energy to provide incentives for future investment, thereby ensuring market equilibrium. Problems with the energy only design can arise where returns in the market are too low to enable generators to recover their fixed (long run) costs. Such an outcome can result in insufficient levels of investment due to uncertainty around future revenue streams, or even premature generator exit.

The increased penetration of zero short run marginal cost generation (i.e. renewables) could test the resilience of the current NEM design in this respect, given such plant can have the effect of suppressing the wholesale price below an efficient level (where generators are unable to recover long run costs). The extent to which batteries will help to mitigate this impact by e.g. enabling charging at low prices and dispatch at higher price intervals is not entirely clear at this point.

3.3 Potential options to address any future reliability issues

Notwithstanding an obvious tightening in the market, it is not yet conclusive that the NEM has an enduring reliability problem. While there have been questions around the entry of new dispatchable generation, it is worth noting that as recently as four years ago, the primary issue in the market was oversupply, and contemplation of whether there were barriers to exit. This situation was resolved without market intervention or the development of new mechanisms. Perhaps the reminder here is that markets are subject to cycles and policy makers must exercise caution in drawing conclusions.

This is not to say there is no need for action, but rather that a staged and measured approach is appropriate. Firstly, understanding the nature of any reliability problem is crucial, including distinguishing between issues that are likely to be transient as opposed to those that could be enduring. As we will discuss later in this submission, transient reliability issues are most effectively addressed through emergency response mechanisms such as the RERT. Issues that are of a more enduring nature could require longer term solutions that may prove more challenging to implement.

Another important consideration is whether the problem can be resolved through enhancements to the current market framework or whether new measures are needed. In this regard, any concerns regarding the adequacy of the long term investment signal in the market could potentially be addressed through changes to the reliability settings such as the market price cap (MPC).

Ideally the MPC should be set at level to ensure the entry of sufficient new generation investment to meet the reliability standard. Any concerns around the ability of the market to attract new investment and maintain reliability must therefore first examine the appropriateness of the current MPC. The ESB will also need to consider the extent to which the MPC and other reliability settings such as the cumulative price threshold (CPT) serve as a safety net against sustained high prices. From a purely theoretical perspective it would be more economically efficient to have no MPC or CPT, allowing market forces to determine the price. However, this must be balanced against the potential for financial hardship due to participants' ongoing exposure to high wholesale prices. A key factor in any contemplated changes to the MPC will be the tolerance for market volatility.

Similarly, the recently introduced Retailer Reliability Obligation (RRO) (which is a type of capacity mechanism) is aimed at improving investment in dispatchable generation. The RRO's effectiveness in driving new investment has yet to be tested, which should give pause for thought in that it may not be prudent to embark on the design of any new reliability mechanisms with the RRO having only been introduced in July of this year.

3.3.1 Emergency response mechanisms can help manage temporary reliability issues

If the ESB identifies a temporary problem in relation to reliability in the short to medium term, emergency response mechanisms could provide a solution. Such mechanisms are often complementary to the main market and are not mutually exclusive with other design changes. They could also provide policy makers and industry stakeholders with the time needed to understand the changing market dynamics and whether any reliability issue is temporary or likely to be permanent.

The NEM's RERT is an example that allows AEMO to procure out-of-market emergency reserves whenever there is an identified shortfall in the market. The AEMC has recently reviewed the RERT and made several changes to the mechanism that will come into effect in March 2020.[6] Notably, as from March, AEMO will be able to procure emergency reserves up to 12 months in advance of an identified shortfall.

It should be noted, however, that emergency mechanisms are inherently expensive and an increased reliance on these measures on an ongoing basis will be costly and is likely indicative of some underlying issue in the market. Though a suitable benchmark of what is deemed to be excessive use of such mechanisms will need to be determined in the context of a market that is in the midst of transition (as is the case with the NEM).

Emergency response mechanisms are also common in other energy markets

Emergency mechanisms are common in both energy-only and capacity-type markets. However, the design features vary across jurisdictions as shown in Table 1.

Table 1 – Emergency response mechanisms across jurisdictions

Design feature	NEM (RERT)	ERCOT	Belgium
Trigger	Only if a shortfall is identified.	No trigger – regular procurement.	Only if a shortfall is identified.
Lead time	Nine months ahead of shortfall (soon to be 12). Shortfall can be at any time.	Ongoing. Procurement occurs three times a year for 4-month contracts. Contracts now focused on specific months.	By 15 November each year for the following winter (i.e. a one-year lead time)
Volume (MW) or price-based ($/MWh)	A quantity (MW) is identified and procurement is through a competitive tender process.	A total budget of US $50 million is allocated every year. Auctions are held three times a year (within the budget cap).	A quantity (MW) is identified and procurement is through a competitive tender process.
Technology	Technologically neutral but out-of-market provisions apply.	Demand response and distributed energy resources only.	Generation: Limited to mothballed or units that have shut down completely. Out-of-market provisions apply. Demand response allowed.

Contemplation of new emergency response mechanisms in the NEM

Enhancements to the NEM's emergency response framework could help to manage any transitory reliability issues, particularly as the market deals with the heightened level of uncertainty brought on by the transition. AEMO has suggested a few options which we discuss below.

[6] AEMC 2019: Enhancement to the Reliability and Emergency Reserve Trader – final determination.

Enhanced RERT / three-year strategic reserve

AEMO has recently called for the implementation of a "three-year strategic reserve", whereby it would be able to procure emergency reserves three years in advance. In considering this option, the ESB should be cognisant of the potential for these mechanisms to distort investment signals in the primary market:

- Incumbents may choose to withdraw capacity from the market to participate in the emergency mechanism instead – worsening any shortfall.
- New investors may choose to participate in the emergency mechanism instead of the market. ERCOT's mechanism limits participation to demand response while Belgium's limits generation to mothballed plant or exited generators only (with a waiting period).
- Similarly, the procurement of reserves three years in advance implies there will be a need for some type of availability payment which will lock in costs, with no guarantee the reserves will be needed. The recent AEMC decision on enhancing the RERT limited the procurement lead time to 12 months as a result.[7]

Strategic reserve (for retiring plant)

Under this approach retiring plant would be placed in reserve if it was deemed they are required for reliability or security purposes. Similar mechanisms have been introduced elsewhere. ERCOT's market design includes a reliability-must-run (RMR) mechanism which provides for bespoke contracts with a generator that is planning to retire, in order to resolve a specific and localised reliability issue.[8] It is seen as a temporary measure to address the lack of coordination of closure of generation and introduction of new capacity.[9] Some US markets including CAISO, NYISO and MISO have similar programs.

These types of mechanisms tend to be out-of-market, similar to the RERT. Contracted units are generally only used in emergencies. In ERCOT, RMR units are required to offer capacity at the market price cap in the day-ahead market but can offer lower offers to alleviate transmission constraints.[10]

The ESB should consider the following if it is to assess the appropriateness of a similar mechanism for the NEM:

- **Qualifying generators**: This would likely apply to generators that have provided notice of closure, perhaps within the last year of their notice period. The ESB may also consider whether it would be appropriate to include mothballed units.
- **In or out of market**: Out-of-market appears to be more appropriate given that contracting with a generator that has announced its intention to close would represent a market intervention. Keeping the contracted unit outside of the market would limit distortions and help preserve the scarcity signal in the market, which is needed to incentivise new investment.
- **Minimising distortions and gaming**: The mechanism would need to be carefully designed so as not to encourage gaming. The three-and-a-half-year notice of closure requirement should help, while other features could be introduced to limit incentives for a generator to announce closure just so it can be given a contract such as:

[7] AEMC 2019: Enhancement to the Reliability and Emergency Reserve Trader – final determination
[8] AEMC 2017: Reliability Frameworks Review – interim report.
[9] AEMC 2017: Reliability Frameworks Review – interim report.
[10] Brattle, Near-term reliability auctions in the NEM, Lessons from international jurisdictions.

- limiting dispatch to emergency situations;
- limiting availability payments to be cost-reflective; and/or
- limiting contract length.

- **Interactions with other mechanisms**: In particular, with RERT and directions. RERT procurement would most likely need to be scaled back if this mechanism was adopted to safeguard against over-procurement of reserve capacity. Clarification would also need to be given on the priority order of dispatch (i.e. amongst RERT; strategic reserve; and directions).

- **Market pricing**: As the dispatch of contracted units would represent a market intervention, it would make sense for intervention pricing to apply. Contracted units could, however, earn a different price based on their contracts.

- **Payment structure**: Unlike other forms of emergency mechanisms, this mechanism would not involve a competitive tender process. As a result, the ESB would need to carefully consider how to structure pricing. Availability payments would need to be cost-reflective but not be set so high that generators have an incentive to announce closure solely for the purpose of earning those payments. Energy payments would likely occur outside of the market – they could be set at the prevailing market price, the market price cap, or somewhere between the market price cap and the value of customer reliability (VCR). Each of these options have cost implications that the ESB would need to consider.

3.3.2 Instruments to sharpen long term investment signal

If a clear, evidence-based problem regarding long-term investment signals in the NEM is identified, and the current market arrangements are proven to be insufficient, then consideration could be given to new approaches. Some jurisdictions have turned to capacity mechanisms. While it is appropriate that capacity markets are considered in the circumstances described above, it is important to move the policy debate away from the notion that the efficiency of wholesale markets is dependent on a binary choice between a capacity framework and an energy only set up. Both have been proven to work, but ultimately it is the specific design features and the measures put in place to safeguard against potential weaknesses that will determine their overall effectiveness.

Learnings from international jurisdictions

Several jurisdictions in Europe and Alberta (Canada) are examining the merits of implementing, or have already implemented, capacity mechanisms. This, however, should not be taken to mean the NEM must necessarily follow suit, or that capacity markets are better able to meet the challenges posed by the energy market transformation. On the contrary, understanding the underlying reasons for the change highlights some of the superior design features of the NEM, including a scarcity and zonal pricing framework that helps to incentivise the timing and location of investment. Additionally, some of these markets have been more aggressive in their climate change policies with mandated coal plant closure and the need for replacement investment (within a tight timeframe) stressing the market further. The rationale for implementing capacity markets across a number of international regions is outlined in Box 1 below.

Box 1 – Rationale for considering capacity mechanisms, international comparison

Alberta

- Commitment to phase out coal plant by 2030. Additionally, policy to retire coal units at 50 years of age is likely to see 12 of 18 coal plants close by 2030, with the remaining six plant to be compensated.
- Coal currently accounts for 50 per cent of the generation mix. By 2030, plan is for the mix to comprise 70 per cent gas and 30 percent renewables.
- Planned phase out of coal within a narrow window has presented an investment challenge which is exacerbated by:
  - low wholesale prices due to falling demand brought on by decline in economic activity with the collapse in oil prices; and
  - policy uncertainty regarding the application of any future carbon price to electricity and lack of clarity around renewables support.
- The relatively low wholesale price cap ($1,000/MWh) is also not expected to allow prices to reach a level that will incentivise investment.
- Note, that earlier this year, the new government announced a reversal in the decision to implement a capacity mechanism and is now considering changes to the energy only market.

Germany

- Commitment to increase the share of renewables to 35 per cent by 2020 and phase out nuclear by 2022. Coal and nuclear still account for about 40 and 13 per cent of the market respectively.
- Renewable subsidies significantly increased new entry, suppressing wholesale prices.
- Given a significant proportion of the existing fleet will be phased out, concerns have been raised around future supply adequacy, particularly if prices remain low.
- Much of the plant to be shut are in the south of the country which is a load centre with poor transmission connectivity to the energy rich north.
- Germany's uniform pricing framework means there is a lack of locational signals to reflect the scarcity in the south, which would otherwise serve to incentivise investment.
- Decision made to implement a strategic reserve mechanism in 2017; additionally, old lignite plant have been put on temporary stand by (to be called on in emergencies) for 4 years before closing permanently.

United Kingdom

- Decline in average wholesale prices primarily due to the increased entry of renewables.
- Mandated closure of coal plant by 2025.
- Three of the UK's largest coal-fired plants (4.3 GW) were decommissioned in 2016. Most of the remaining 9 GW of UK coal thought to be incurring losses, with the carbon price floor and low gas prices having a compounding effect
- Resultant market tightness was highlighted by a low reserve margin (5.5 percent entering winter 2016-17, the lowest since market liberalisation in the 1990s).
- A temporary supplemental balance reserve (SBR), similar to a targeted capacity mechanism, was implemented. 3.5 GW of recently retired coal plant was placed in the SBR in 2016.17, which formed a significant portion of the reserve margin at the time.
- A market wide capacity mechanism was subsequently introduced in 2018, but has been plagued with problems:
- Most of the contracts have been awarded to existing plant with incumbents receiving windfall gains for business as usual activity.

- Despite the penalty regime, the mechanism hasn't guaranteed the delivery of capacity within the specified period, with Ofgem cancelling several contracts due projects being unable to obtain financing.
- Concerns that demand response are disadvantaged given they are unable to qualify for longer contracts.

Observations

- In Germany, Alberta and the UK the aggressive nature of the carbon abatement polices and the tight timeframes for coal withdrawal was bound to stress the aforementioned markets, ultimately leading to concerns around the ability of the market design to deliver replacement investment.

- There are some clear deficiencies in design of the energy only markets in Alberta and Germany. The low price cap in Alberta is unlikely to allow for efficient levels of investment with prices unable to reach a high enough level to ensure the recovery of long run costs.

- In Germany, the lack of locational pricing means the scarcity in the country's south would not be visible through higher prices in that region. In markets such as the NEM and ERCOT, zonal or nodal pricing allows for pricing distinctions between different regions, and therefore a signal for where investment is required.

There is a broad spectrum of capacity mechanisms

There are several approaches to capacity mechanisms, with varying degrees of central planning and market intervention. Most capacity markets include some form of energy component, as well as markets for ancillary services. Capacity mechanisms can be broadly classified as being targeted (apply to only specific participants) or market-wide and take either a volume-based or price-based approach, as shown in Table 2 below.

Table 2 – Capacity mechanisms[11]

	Volume-based		Price-based	Comments/Observations
Targeted Required capacity and the amount expected to be delivered by the market are identified centrally. The capacity mechanism then provides support to the additional capacity expected to be needed beyond what would be delivered by the market	**Tender for new capacity** Tender to finance the construction of a power plant that would bring forward the identified top up capacity. Once the plant is operational, in some models the top up capacity runs in the market as normal (without a guarantee that the electricity will be sold). It would also be possible for the plant to be supported through a power purchase agreement.	**Strategic reserve** Top up capacity is contracted and then held in reserve outside the market. It is only run when specific conditions are met (for instance, when there is no more capacity available, or electricity prices reach a certain level). Typically, strategic reserves aim to keep existing capacity (e.g. capacity slated for retirement) available to the system.	**Targeted capacity payment** Central body sets the price of capacity. This price is then paid to a subset of capacity operating in the market (e.g. only to a particular technology, or only to capacity providers that meet specific criteria).	A tender for new capacity could be considered in the NEM to ensure the delivery of the type of capacity the system needs, (e.g. low emissions flexible plant) if it is conclusive the current market is unable to deliver the investment A model which utilises a one-off payment where the top up capacity runs in the market as normal without an ongoing assistance is likely to minimise distortion Strategic reserves (for retiring plant) with a suitable sunset may be appropriate if a temporary reliability problem is identified. However, issues such as pricing and gaming concerns would need to be overcome. Note the NEM's RERT is a form of strategic reserve. Price based mechanisms should be least preferred option, given they are not subject to a competitive process

[11] European Commission 2016: Final Report of the Sector Inquiry on Capacity Mechanisms, pp. 50-52; European Commission 2016: Commission Staff Working Document Accompanying the Final Report of the Sector Inquiry on Capacity Mechanisms.

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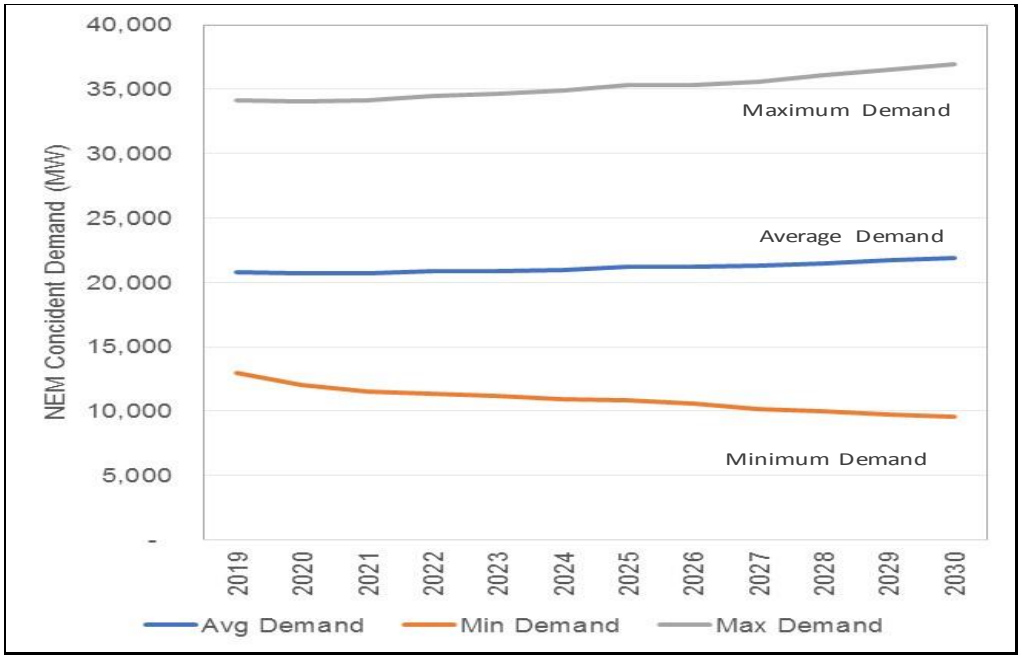
Market Wide Generally, all capacity required to ensure reliability of supply receives payment, including both existing and new providers of capacity	**Central buyer** Total amount of required capacity is set centrally, and then procured through a central bidding process in which potential capacity providers compete so that the market determines the price.	**De-central obligation** An obligation is placed on electricity suppliers / retailers to contract with capacity providers to secure the total capacity they need to meet their consumers' demand. Market forces should still establish the price for the required capacity volume.	**Market-wide capacity payment** The price of capacity is set centrally, based on central estimates of the level of capacity payment needed to bring forward sufficient total capacity and then paid to all capacity providers in the market.	Market wide mechanisms enable existing plant to participate, which may not achieve the desired objective if the aim is to stimulate new investment, which is one of the problems in the UK. Price based market wide capacity mechanisms are particularly susceptible to the over-procurement of capacity. There are significant design differences across market wide mechanisms. PJM provides availability payments through a one year contract (which may not be sufficient to address any concerns around long term revenue certainty). The UK mechanism offers contracts of varying length ranging from one to 15 years. The NEM's RRO is essentially a form of market wide decentral obligation, with France's capacity mechanism a more extreme version of this where suppliers have an ongoing obligation to obtain capacity certificates as a share of their peak demand.

Potential lessons for the NEM

The NEM essentially already has two types of capacity mechanisms in operation namely, the RERT and RRO.

If any additional mechanism is required, this should most likely be in the form of a targeted volume based measure. Such a mechanism should be aligned with the objective of achieving net zero emissions in the electricity sector or any medium term emissions target that might be developed. Additionally, priority should be given to flexible firming capacity that complements intermittent renewables. The NEM today is characterised by the increasing uptake of intermittent generation (including solar PV) and a divergence between maximum and minimum demand accompanied by relatively flat average demand (see Chart 3). This means what is most needed is not necessarily more baseload power (which is best suited when there is less variability in demand levels), but rather flexible plant that are better able to respond to the new market dynamics. As seen in Chart 4 the uptake of solar PV results in a reduction in demand during the day (duck curve effect), which essentially results in the crowding out of baseload generation which is primarily designed to run on an ongoing basis. As solar penetration increases due to lower costs, the NEM's reliability challenge is most effectively met by flexible generators such as storage and gas peaking plant that can switch on relatively quickly and cost effectively to meet the evening peaks, and in response to a decline in output from intermittent generation.

Chart 3 – NEM demand to 2030[12]



[12] AEMO data.

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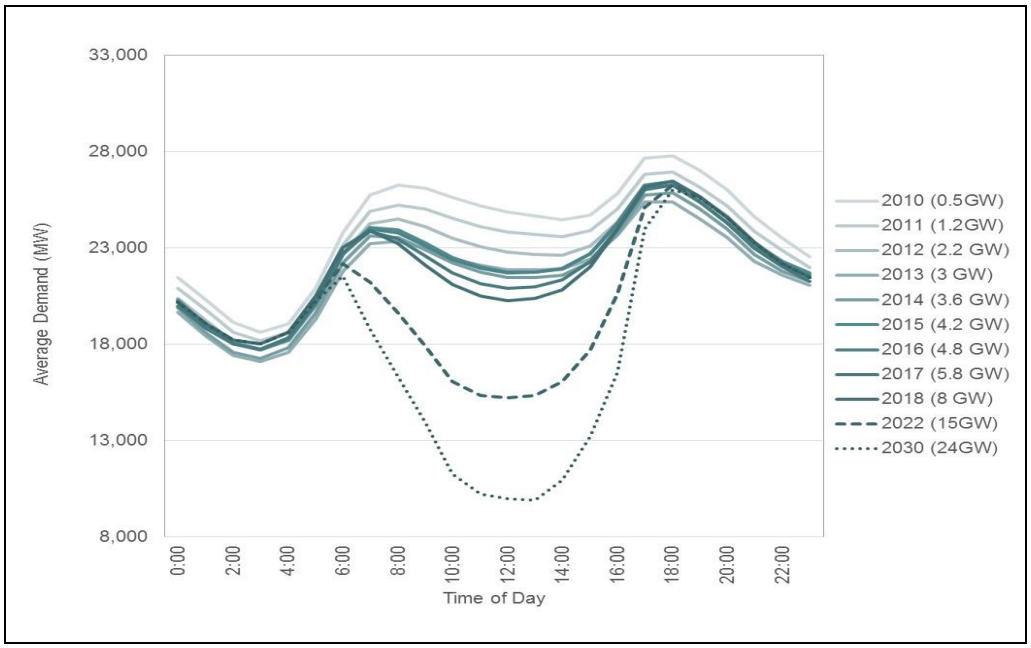
Chart 4 – Solar penetration and the duck curve effect[13]



3.4 Market operations

The operation of the market will have implications for reliability. In this regard we thought it useful to discuss two issues that have been topical of late. The appropriateness and operationalisation of the NEM's reliability standard, and the possible implementation of an ahead market.

3.4.1 Appropriateness of the reliability standard

AEMO has raised concerns about whether the current level and form of the reliability standard remain appropriate. This is based on the view there is a reduced appetite for load shedding and potential for high levels of unserved energy (USE) under certain scenarios due to changing supply/demand conditions. In Origin's view, there is no clear evidence that either the form or level of the reliability standard is no longer appropriate.

Over the period from 2007/08 to 2016/17, only 0.23 per cent and 3.20 per cent of total supply interruptions (in terms of GWh) were the result of reliability and security events respectively.[14] In contrast, the distribution network was responsible for about 96 per cent of supply interruptions over the same period.[15] This breakdown suggests the current focus on the reliability standard is misplaced, with little net benefit likely to be derived from applying a higher standard.

Recent analysis undertaken by the AEMC, which incorporated independent advice from the Reliability Panel and Brattle Group, also found that the expected USE metric remained suitable. Further, there was insufficient justification for changing the level of the standard, which adequately reflects the trade-off between maintaining reliability and minimising costs to consumers based on current estimates of the VCR. Noting the Australian Energy Regulator (AER) is currently updating the VCR, Origin considers a significant change should be demonstrated before further review of the reliability standard occurs.

[13] AEMO data.
[14] AEMC Reliability Panel, 'Reliability standard and settings review 2018 – Final Report', 30 April 2018.
[15] Ibid.

To the extent AEMO remains concerned about changes in the underlying distribution of USE outcomes when modelling expected USE, the AEMC noted the National Electricity Rules (NER) already provide AEMO with the flexibility to evolve and adapt its approach for how it operationalises the reliability standard. However, it should be noted there is already a degree of conservatism built into the existing framework. The medium-term Projected Assessment of System Adequacy (PASA) already gives a higher weighting to lower probability events by excluding 90 per cent probability of exceedance (POE) forecasts from the simulation process. Further, the lack of reserve (LOR) declaration framework used to inform RERT procurement in operational timeframes is not explicitly linked to the expected USE metric, but rather the level of reserves that are necessary to avoid any load-shedding.

3.4.2 The case for ahead markets

While the NEM does not have a formalised day-ahead market, it has many features that play a similar role. These include: a liquid financial derivatives market that strongly incentivises participants to commit generation capacity for dispatch in support of their contractual position; and the provision of transparent operational information to AEMO as part of the pre-dispatch process.

Given these features, it is not clear what issue(s) a US-style day-ahead market would solve in the NEM. Such a change would not improve incentives for generators to commit generation capacity beyond prudent levels.

We therefore agree with the conclusions of the AEMC's Reliability Frameworks Review, which stated that a US-style day-ahead market would not be suitable in the NEM to manage reliability outcomes, since it would impose large costs on the market for little benefit. As discussed above, it would also be prudent to allow other more recent reforms such as the RRO, sufficient time to take effect.

4 Integration of distributed energy resources (DER)

As the volume of DER entering the market increases, the efficient integration of DER into the broader NEM framework is another factor that will have implications for the functioning of the market. Origin's views on some of the key issues are set out below.

Given DER can deliver multiple value streams (at the customer, wholesale and network level), co-optimisation across various markets will be crucial to ensure it is made available to where it is valued most.

In addition to providing benefits to the consumer on whose premises they are located, DER can be used by distribution network service providers (DNSP) to meet their regulatory obligations to provide distribution services (e.g. peak demand management; voltage support). The dual nature of the services DER provides has created ambiguity as to whether NSPs can directly supply and/or own the assets that deliver them on the basis that they contribute to the NSPs provision of these regulatory services. The concern is that when NSPs supply and/or own the assets, competitive neutrality in the provision of these services to customers is compromised. This is because the NSP can in practice access the network support benefits far more easily than other participants in the market, allowing them to offer the customer services at a lower cost. Over time, this could allow NSPs to dominate the market, stifling competition and ultimately leading to higher prices for consumers. NSPs should be allowed these services, but they should be required to procure them from the competitive market, which could include an appropriately ring-fenced affiliate of the NSP.

The control of DER must reside with the customer. Where other parties such as networks see value in controlling DER they must contract that from the customer (or their chosen energy service provider).

Dynamic or cost reflective price signals will be important in ensuring the full benefits of DER are realised and that customers that choose not take up DER are not disadvantaged. Network tariff structures are

still primarily based on the volume of energy consumed as opposed to the time at which usage occurs. This approach does not provide appropriate signals for consumer investment and usage or allow for equitable cost recovery. As more consumers take up DER such as solar PV, network charges are recovered from a smaller base.

Notwithstanding the need for more cost reflective tariff offerings, we note that customers value simplicity, and so if these price signals are passed through to customers this could create confusion. We do not think this is necessary, so long as retailers are exposed to the price signal and able to manage the risks of differences in the network and retail tariff structures.

5 System security services and resilience

5.1 Challenges in maintaining system security in the NEM

As the stock of synchronous generation declines, and the entry of non-synchronous plant increases, the management of the power system will become more challenging. Synchronous plant are the primary suppliers of ancillary services that help to address frequency imbalances. They are also a vital source of inertia which helps to limit the rate of change of frequency (RoCoF) when there are significant deviations in supply and demand.

Some of the difficulties of managing the system in a transitioning market are already evident with the increasing reliance on directions in South Australia to deal with system strength issues. AEMO has flagged a degradation in the level of primary frequency control (PFC) (the initial response to frequency disturbances) and is now calling for the mandatory delivery of this service. The AEMC has also made two recent rule changes aimed at addressing some of these emerging system security issues – an obligation on transmission companies to maintain a minimum level of inertia; and a requirement for new generators to 'do no harm' to the minimum level of strength when connecting to the network.

The current situation in South Australia should serve as a lesson for the rest of the NEM, and going forward it will be important to ensure the delivery of the services the market needs in a timely and efficient manner. There are two approaches, (which are not necessarily mutually exclusive) that have been considered – mandatory provision; and market based mechanisms.

5.2 Options for the delivery of new system security services

Market based approaches are the most efficient means of delivering new system security services

A mandatory approach could be considered in dealing with a pressing issue, where there might not be enough time to develop a market based solution. As noted above, AEMO now considers there is an immediate need for additional frequency response and is proposing the mandatory provision of PFC. However, Origin considers that a market based approach is the most efficient means of providing the services required by the system and that this is superior to any mandatory mechanism. Market mechanisms allow for price discovery and will encourage innovation and the entry of new suppliers. By pricing services such as inertia and system strength, generators that currently provide these for free (or through AEMO directions) will be able to recover costs, providing an incentive to supply. Additionally, a market approach is expected to allow for the co-optimisation of services such as fast frequency response (FFR) and inertia.

Mandating the provision of system security services is likely to result in over-delivery given the blanket requirement for all generators to provide the service. This will ultimately increase costs and does not allow for a dynamic efficient outcome. While it may be too early to assess the effectiveness and efficiency of the 'do no harm' provisions for system strength, one possible outcome is that each connecting generator in looking to ensure compliance would simply build synchronous condensers which does not allow for system-wide optimisation. So, while a mandatory approach could guarantee

delivery of a service in the immediate term, it is unlikely to be the most efficient option in the long term. Even if there is a perception that the development of market solutions, may take relatively longer, we note there are various options, some of which (such as contracting) allow for an expedited process and more immediate delivery of the required service. We discuss some of the strengths and weaknesses of both approaches in Table 3 below.

Table 3 – Market based vs mandatory provision of system security services

Approach	Options for system security services	Strengths	Weaknesses
MARKET BASED	Contracting Market operator could enter into fixed term contracts with providers	- Allows for long term price certainty which is likely to be attractive for potential providers of the service - Contracting arrangements can be developed relatively quickly. - Allows for transparency of the total cost for services in question - Could facilitate innovation and the development of new technologies, increasing supply - Resilient to government intervention/market design changes	- Potential for over or under procurement of service
	Spot Market Similar design to the energy and existing FCAS markets where provision of the service is enabled through least cost merit order dispatch	- Transparent pricing mechanism allows for price discovery. - Builds on familiarity with current ancillary services market model. - Responsive to short term market changes. - A bid stack will ensure lowest priced service is procured first. - Could allow for the co-optimisation of various services including those provided under current FCAS markets; FFR; and PFC. - Could facilitate innovation and development of new technologies, increasing supply	- Lack of long term financial certainty for prospective suppliers with no historical prices available - Might be complex to design
	Generator trading Platform (e.g. listing service, or exchange) that could bring together suppliers of system security services and potential buyers (e.g. renewables complying with do no harm provision)	- Could allow for system wide optimisation for the delivery of the services - Allows for price discovery - Could facilitate innovation and development of new technologies	- Success will be dependent on liquidity, particularly at the start.
MANDATORY	Generator Obligation	- Facilitates a causer pays approach by requiring non-synchronous generation to cover their system security obligations.	- Could result in over-procurement of the service.

	E.g. do no harm system strength provisions	- Allows for immediate delivery of the required service - Relatively easy to implement	- Does not allow for system wide optimisation in the delivery of service and higher costs
	TNSP obligation E.g. current TNSP requirement for minimum inertia level	- Initial rationale was that this could allow for the provision of the service, relatively quickly, but we note that the condensers have not yet been completed in South Australia, and AEMO is reliant on directions.	- Non-market based approach, which may not result in a least cost outcome. - Does not support innovation and development of new sources of supply

6 Integration of renewable energy into the power system

The integration of renewable energy is critical to the efficient operation of the market, and there are several issues that will need to be resolved including: the operation of AEMO's Integrated System Plan (ISP); the connection of remote renewables; the variability in marginal loss factors (MLFs); and the AEMC's plans for access reform. We discuss our views on each of these below.

6.1 The Integrated System Plan must continue to evolve

The ISP is set to play a crucial role in facilitating the development of the transmission network over time which is key to maintaining both a reliable and secure electricity system. It is important that the ISP continues to evolve, to ensure the robustness of the planning framework, and help to instil greater confidence in the plan.

Transparency: There should be transparency in defining what projects are deemed to be strategic, (and as a result warrant conclusion in the ISP). For example, the inclusion of large government sponsored generation projects in the plan has significant implications. By being included in the ISP, the economics of these projects is likely to significantly improve, particularly if this results in not having to fully fund any required transmission works. This runs the risks of crowding out private investment.

The role of government policy (both Commonwealth and the States) in shaping the ISP should be made explicit, with the governance framework setting out how AEMO is expected to incorporate policy decisions.

Co-optimisation of transmission and generation investment: The ISP should also explicitly consider and comment on the trade-off between transmission and generation, and the optimal level of investment in both. To the extent transmission and generation are substitutes, investment in transmission (that is facilitated by a centrally planned regulatory framework), can crowd out private generation investment exacerbating reliability concerns.

Modelling approach: The least cost optimisation approach can sometimes result in modelling outcomes that are not intuitive. It is important the modelling considers revenue adequacy for generation to ensure more realistic outcomes.

6.2 Effectiveness of the NEM's locational signals

Traditionally the NEM's locational signals have generally worked well in incentivising efficient decision making. There are now indicators, however, that this is being tested by the changing pattern and nature

of new generation entering the market. The variable and somewhat unpredictable nature of marginal loss factors is sometimes seen as being symptomatic of this.

New entrant generators typically balance multiple factors when deciding on where to locate. These include loss factors, network congestion, and fuel availably. It is possible that the rapid influx of new generation, and the nature of these plant has upended this balance with fuel availability (i.e. access to wind, sun) now seemingly have a greater bearing on location decisions. One critical consideration is the extent to which a lack of transparency around new connections has contributed to any poor or irrational locational decisions; and whether this can be addressed by the recent proposed changes in this area[16].

If the AEMC concludes that the NEM's locational signals do require strengthening, any proposed solution should focus on generators looking to enter the market, to ensure their location decisions are aligned with the efficient development of the network. Therefore, if the plan for the introduction of locational marginal pricing progresses, grandfathering arrangements would need to be put in place for existing generators given they are unable to change their location.

[16] The AEMC published a draft determination on 1 August aimed at increasing the transparency of new projects entering the market