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18 May 2018

Mr. John Pierce
Chair
Australian Energy Market Commission
PO Box A2449
Sydney South NSW 1235

Dear Mr. Pierce

Coordination of Generation and Transmission Investment Discussion Paper – AEMO Submission

Thank you for the opportunity to respond to the discussion paper on Coordination of Generation and Transmission Investment in the National Electricity Market (NEM).

AEMO welcomes the discussion on the issues raised in the paper. The changes occurring in energy markets require active, ongoing reassessment of regulatory and market arrangements to ensure they can deliver the outcomes required for the transforming NEM.

The regulatory and market frameworks must enable the coordinated whole-of-system development of a modernised power system in line with the National Electricity Objective (NEO). AEMO supports a well-managed transition to deliver cost-effective outcomes for the NEM. The transition must incorporate:

- Efficient integration of new supply sources and technological advancements;
- Economic retention of existing supply sources;
- Development of a resilient and secure system with appropriate risk management.

The coordination of generation and transmission is a key element of the change needed to the planning processes that will enable the transition and therefore drive efficient investment for the NEM. AEMO will be publishing a longer-term system plan (the Integrated System Plan (ISP)) in mid-2018 which will inform policy choices and support more coordinated investment decisions for both transmission as well as commercial decision-making by generators.

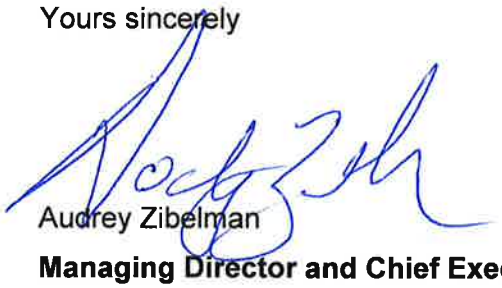
With the linkages between this review, the ISP as well as the AER's Review on the Regulatory Investment Tests which is due to be completed in September 2018, AEMO believes there would be benefits from extending publication of recommendations from this review. For example, AEMO's ISP will provide additional information and analysis on the development of renewable energy zones (REZs) which will allow stakeholders to provide more informed feedback to the Commission's review. This will ensure recommendations do not misalign so that inefficient and ineffective investments for consumers going forward can be avoided.

It is AEMO's view that to achieve greater coordination and implementation of the longer-term strategic plan, a broader range of changes to the planning and regulatory regimes are required. These changes should be determined through the work assigned to the Energy Security Board (ESB) on planning and regulation of the transmission system and interconnection, requested by the Council of Australian Governments Energy Council (COAG

EC). AEMO understands the ESB is to report to Ministers on its progress by August 2018 and we look forward to collaborating with the AEMC, AER and the ESB to continue this important work.

Should you have any questions on the matters raised in our submission, please contact David Swift, Executive General Manager Planning and Forecasting on (08) 8201 7371.

Yours sincerely



Audrey Zibelman

Managing Director and Chief Executive Officer

Executive Summary

AEMO is required to maintain a secure and reliable power system for the benefit of all Australians. The Australian energy industry continues to transform from a power system with conventional demand patterns predominantly supplied by coal-fired generation to one that needs to accommodate innovation in technology and greater consumer involvement in energy supply and usage. These trends are coupled with government policies incentivising growth in renewable generation and a reduction in carbon emissions.

The current regulatory framework was designed to deliver incremental growth to meet demand. However the current drivers for network investment have completely changed. Demand growth has stalled but the retirement of ageing coal fired plant, the growth in utility scale renewable generation, distributed energy resources and storage is placing new pressures on the network and new opportunities for the networks to provide consumer benefit. Development of the transmission system is required to access existing and new sources of supply to maintain system security and reliability at affordable prices through more competitive markets.

From a reliability and security basis, transmission can help ensure the system can rely on existing and new resources and take advantage of the natural effects of geographic diversity to meet system requirements at the lowest cost to consumers. For existing resources, transmission expansion also can relieve uneconomic congestion on the system and yield lower prices to consumers by providing generators access to larger load and customers access to more resources and greater competition. The scale and cost of transmission development required for new investment will also be related to the location of the sources of supply while the value of those resources will often relate to their location. The efficient solution which leads to the lowest overall cost to consumers will depend upon co-optimising the cost and performance of generation and storage with the cost of the transmission system.

The expected growth in battery storage raises further challenges and opportunities to the existing regime. Battery storage can be located very flexibly and with generally lower economies of scale than conventional generators. Given the right signals, well located battery storage could manage the loading of the transmission system and provide other essential system services.

The reform of the regulatory frameworks for planning for the NEM is an essential part of managing the transition to a modernised power system. The regulatory framework must be underpinned by objectives that allow delivery of coordinated investment through independent longer-term planning developed on a whole-of-system basis, and delivery of cost-effective energy for consumers.

While markets are adept at responding to investment signals in order to deliver efficient outcomes, the higher levels of uncertainty associated with the energy transformation means that the market currently lacks clear investment signals. This means that the risk of the power system evolving in an uncoordinated and inefficient manner must be managed to avoid poor outcomes.

The Finkel review recognised the critical importance of integrated system planning as a foundational component of an orderly transition. A coordinated system plan provides the investment certainty required by generators who want to ensure they can receive a return on

their investment. Planning and developing the power system in a manner that takes into account consumer costs and benefits and embrace technological change helps ensure the power system and markets can deliver secure and reliable electricity at an efficient cost. In the absence of a system plan, the transmission system will develop in a haphazard fashion which in turn will lead to inefficient connection and overall system costs. It was in this context that the COAG Energy Council approved the Finkel review recommendation that a strategic and comprehensive approach to coordinating generation and transmission investment in the NEM be developed and implemented.

AEMO observes that the use of independent and coordinated planning is the established practice in both Europe and the United States. As recognised in those jurisdictions, independent system wide planning and system development supports improved integration of resources, reduces congestion costs, and is necessary to develop robust markets.

That said, a strategic plan can only be delivered by network service providers that are able to validate the development proposals and progress with the detailed design of the proposals. This means that the right investment signals must be provided to the market by a regulatory framework that enables the overarching plan to be implemented. To deliver efficient outcomes, market participants also need to be provided with appropriate signals for investment of the right nature, timing and location.

Before recommendations on the changes required to the regulatory framework can be made, AEMO believes the outcomes from the strategic plan, that is the ISP, should first be observed. This would provide guidance on establishing the right frameworks so that the market is able to facilitate the plan.

Congestion on the transmission system represents a lost opportunity for suppliers to reach markets and for consumers to access lower cost generation. Ernst and Young's estimate of the cost of congestion ($17 million) understates by several multiples the current level of congestion and its impact on prices. AEMO's analysis of historic congestion is around $58 million and we are concerned that may be too low. Further, while current levels are more significant than represented, in the current environment where the energy transformation is occurring rapidly, historically measured congestion should not be used as the sole basis for decision making on the need for new transmission investment. Future congestion modelling can also aid in ensuring that the market and regulatory frameworks support obtaining the best economic outcome for consumers,

Visible congestion is also an inadequate indicator of the impacts of the transmission access regime. It is therefore not the sole measure to consider when assessing the appropriateness of transmission frameworks. Market participants invest and operate within the capability of the network. Participants' market offers will therefore not necessarily reveal the full cost of current congestion. Intending participants also consider the limitations of the current network when choosing locations for investment; especially in an environment where there is no real way to secure a level of access. In an environment where the most efficient location of new generation is changing as a result of changes in the supply mix, the current access regime may induce participants to choose sub-optimal locations in order to avoid congestion. In these circumstances, prudent augmentation of the network can lower costs, support government policies and provide a smooth transition of the industry.

AEMO recommends that decisions with respect to renewable energy zones should be considered in the context of the ISP. AEMO's preliminary analysis suggests that the optimal development paths are likely to lie along the path of interconnectors, rather than requiring the network to be extended to locations that are remote from the rest of the grid, and thereby lowering overall system costs. Subsequently, stakeholders are likely to be more informed to provide input into this review on REZs, and likewise AEMO expects to update and expand our views, following the finalisation of the ISP.

It is for these reasons and others discussed below that AEMO suggests a strategic plan must be in place that coordinates investment required for the efficient delivery of system services. This will ensure the long-term reliability needs of consumers are met most economically.

AEMO welcomes the opportunity to work with the AEMC, AER and ESB to explore these issues as part of the upcoming ESB review of NEM transmission planning and interconnection.

1. Introduction

The terms of reference for this review, which were issued in February 2016, ask the AEMC to examine whether Optional Firm Access (OFA) should be introduced.[1] The AEMC is using this review as an opportunity to explore a related set of issues. The AEMC's paper released on 13 April presents initial views on three key developments which may necessitate changes to the current transmission framework. These include:

- Likely future congestion on transmission networks as more generators seek to connect to the grid in places where there is not substantial spare capacity
- New types of generation capability – such as large-scale battery storage – connecting directly to the transmission network
- Increasing entry of lower-emissions generation such as wind and solar farms to the market, which may need to locate in areas that are at the edges of the existing network, potentially in new renewable energy zones (REZs).[2]

This work by the AEMC is part of a series of major reviews being undertaken on the NEM transmission access regime, requested by the COAG EC.[3]

Today's power system displays very different characteristics to the power system of the previous decades and those under which the current regulatory and market frameworks were established. The pace of change in the industry has accelerated over recent years and these regimes now need to adapt.

In particular, there has been an 80% increase in new generation proposals[4] across the NEM over the last three years, the vast majority of which have been renewable resources. On the other hand, the transmission development required to fully accommodate this increase in supply has not yet been established. Given the longer lead times required for transmission investment to occur, particularly where major new transmission lines are required, there is a risk that these generation proposals will not be able to operate to their full capacity when expected. Therefore, the maximum value of these diverse resources cannot be realised and delivered to NEM consumers. This is one indication that there is a clear need for generation and transmission investments to be coordinated.

As such, AEMO's submission below focusses on the aspects of the energy market transformation that validate the need to change the NEM's regulatory framework to support the coordinated and efficient development of the power system so that affordable, secure and reliable energy is delivered to consumers.

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[1] https://www.aemc.gov.au/sites/default/files/content/97164a7b-09bf-49fb-9f2e-f6b996f5a96b/Reporting-on-drivers-of-change-Terms-of-Reference.PDF

[2] AEMC Discussion Paper – Coordination of Generation and Transmission Investment, Available at https://www.aemc.gov.au/sites/default/files/2018-04/EPR0052%20-%20Discussion%20Paper%20for%20publication%20180413.pdf

[3] AEMO notes however that since the COAG EC request, the Finkel Review has identified a number of concerns raised with the coordination of transmission planning, Pg 127 of the Independent Review of Future Security of the National Electricity Market Report.

[4] Data extracted from AEMO's Generator Information Page and includes committed and publicly announced projects between 2014 and 2017.

2. Transmission frameworks in the NEM

The Commission's report describes the existing transmission access regime and the design principles that underpin it. It highlights the inter-related nature of the issues and the complexity of changing any individual element. AEMO's view is that there are structural reasons why the existing framework is not well placed to the meet the challenges associated with the energy transformation.

2.1. Existing Framework

AEMO agrees with the Commission that the transmission access reform is complex and has proved intractable over numerous previous reviews. Given the complexity of the issues involved, AEMO's top priority is the need to implement a strategic development path.

The current regulatory framework needs to change to keep pace with the transforming market. It was designed to deliver incremental growth in transmission to meet growing demand, whereas the current drivers for network investment are the retirement of coal fired plant, the need to better access existing and new sources of supply and the need to maintain system security, including during more extreme weather events.

The current demand-led regulatory model exposes customers to the risk of supply shortfall should it remain unchanged. Over the next two decades the capability and resilience of the existing system will be tested as the current coal fleet reaches the end of their technical lives and as the level of utility and small-scale renewable generation increases.

Assuming that coal-fired generators will retire as per public announcements and by their 50th year of operational life, it is expected that generation capacity which currently meets approximately 35% of NEM scheduled demand will have retired by 2035. The retired generation is broadly equivalent to the scheduled demand of NSW. Therefore, it is important that a framework is in place that enables implementation of a longer-term strategic plan.

Preliminary analysis by AEMO suggests that almost 70% of renewable projects in the NEM (solar, wind and battery storage) are located within 5 km of pre-existing network assets. Once the existing network reaches capacity, the current framework does not provide clarity as to which location is likely to optimal given future network development. This investment uncertainty has potential to create inefficiencies in the market. There is a risk that less efficient generation sites will prevail over more efficient sites on account of their proximity to the grid, leading to higher costs to consumers.

While markets are adept at responding to signals in order to deliver efficient outcomes, the higher levels of uncertainty associated with the energy transformation means that the market currently lacks clear investment signals. Market participants are competitors with diverse, and sometimes conflicting, commercial interests. It is problematic to expect market participants to coordinate in order to initiate major developments that shape future markets.

If the transmission network required to develop a renewable energy zone (REZ) is built to only account for known generation projects, then the capacity of this network is unlikely to be adequate to handle future generation projects for the REZ. Additional transmission network will then be required to further exploit the renewable resources in the REZ, likely leading to an overall higher costs. For example, it is generally less expensive to build one high capacity transmission line than to build one lower capacity transmission line which is later duplicated.

Transmission augmentations need to be assessed with an eye towards future network expansion requirements, guided by a nationally coordinated plan, to maximise market efficiencies arising as a result of the energy transformation.

This view is widely accepted internationally. For instance, the IEA's report on *Getting Wind and Solar onto the Grid* argues that "a holistic, long-term view of energy strategy helps market participants and system operators to anticipate changes, which will ease VRE integration in a secure and least-cost fashion".[5]

Similarly, the European Union has seen a series of reforms designed to increase coordination and integration of the European electricity network.[6] New regulations introduced in November 2017 creates incentives for transmission system operators (TSOs) to reduce congestion by requiring TSOs to develop a methodology for sharing congestion income associated with cross-zonal capacity.[7]

In the US, FERC Order 1000 establishes a framework whereby transmission investments can be justified based on public policy, as well as on reliability or economic grounds. This decision also recognises and seeks to address the risk of coordination failure that arises when transmission networks plan investments from a local perspective.

As these regulatory bodies have recognised, the design and implementation of a coordinated plan is not a substitute for markets. Instead, it is a recognition that transmission is in essence, the superhighway for the power system that is an essential, but regulated component of ensuring that markets can flourish.

2.2. Transmission investment under the current regulatory framework

Over the last 57 years, eight transmission links have been built across state borders that define the NEM's five regions.

There has been comparatively little investment in interconnectors since the RIT-T was introduced in 2009. The Heywood interconnector was augmented based on RIT-T conducted in 2013, with VIC-SA transfer capacity notionally increased by 190 MW. In addition, a QNI upgrade was assessed under a RIT-T, but the "do nothing" option was preferred.

Another observation arising from the history of interconnectors in the NEM is that the results of building inter-regional links are not predictable. For instance, QNI was built based on the economic benefits of exporting power from NSW to QLD, but in practice power has predominantly flowed in the opposite direction. On the other hand, the cost of the interconnector was returned in a few years through reduced ancillary service costs – a benefit which was not assessed in studies to justify the link.

[5] https://www.iea.org/publications/insights/insightpublications/Getting_Wind_and_Sun.pdf
[6] See, for instance the EU's Third Energy Package (2009), Guidelines for Trans-European Energy Infrastructure (2013) and the Guideline on Capacity Allocation and Congestion Management (2015).
[7] Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing.

Table 1 Australia's inter-regional transmission links

Date	Interconnector	Regions	Nominal capacity (present level)	Type
1959	VNI (Murray- Dederang line)	NSW-VIC	700 to 1600 MW/-400 to -1350 MW	330 KV AC
1979	VNI (Wodonga-Jindera line)	NSW-VIC		330kV
1988	VNI (Buronga-Red Cliffs line)	NSW-VIC		220kV
1990	Heywood	VIC-SA	+600/ -500 MW MW	275kV AC
2000	Directlink	NSW-QLD	180MW	±80kV DC
2001	QNI	NSW-QLD	+300 to 600 / -1078 MW	330/275kV AC
2002	Murraylink	VIC-SA	+220 / -200 MW	±150kV DC
2006	Basslink	VIC-TAS	+478 / -594 MW	400kV DC

A shift in the nature of transmission investment has been observed since 2009, moving away from augmentation to increase network capacity, and towards replacement of ageing assets. This shift coincides with a period of declining consumption drawn from the grid.

In the last ten years, with the exception of Queensland, very few major transmission lines were built across the NEM. Queensland experienced high load growth, which drove a need for new major transmission augmentations. In all regions, a number of smaller augmentations were carried out at local level to meet pockets of local load growth and to provide connection access to new generators and direct connect customers.

To date renewable generators have been accommodated within the existing transmission network without major network augmentation. TNSPs have implemented dynamic line ratings and/or generator run-back control schemes to ensure secure and reliable operation by getting the most out of existing assets. This approach has avoided or delayed additional new transmission lines.

Going forward, new renewable generation connection interest in some areas of the NEM far exceeds existing transmission network capacity. ElectraNet, Powerlink and AEMO, as the Victorian TNSP, are currently undertaking RIT-Ts for augmentations that deliver market benefits by increasing power system capability to get the renewable generation to the load centres, reducing the need for generation from costlier fuel sources. As the cost benefit analysis for each investment is mutually interdependent, there is a strong need for an overarching plan to ensure that the optimal system-wide solution is selected.

3. Issues with the current framework

The Commission's discussion paper discusses the absence/presence of congestion and the lack of a clear framework for treatment of storage. AEMO considers that there is a much

broader range of issues at play. The presence of congestion is not the sole determinant of the need to change the regulatory framework. The changing generation mix, need to address emerging system security challenges, and need to build climate risk resilience into future plans are also important drivers for reform.

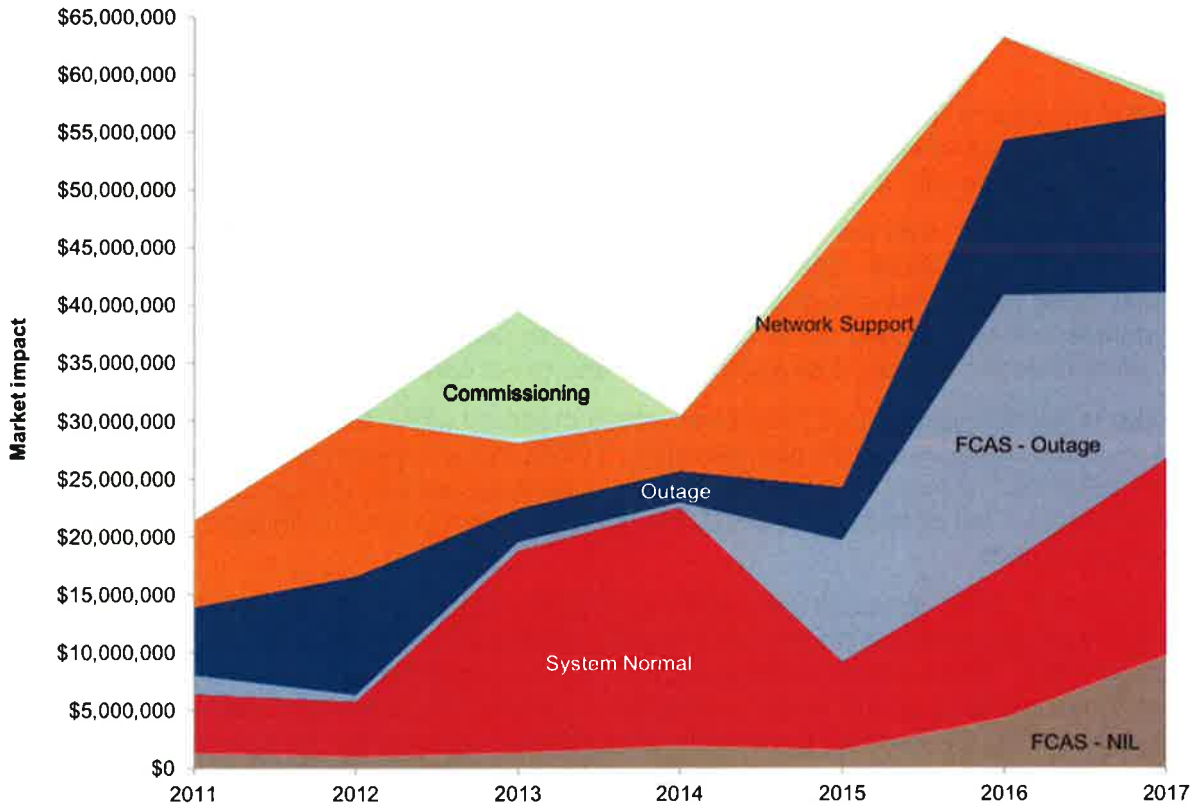
3.1. Congestion

AEMO considers that the analysis undertaken by Ernst and Young (EY) understates the true value of congestion in the NEM because

- It excludes the costs of congestion associated with system normal constraints (it only includes N-1 constraints).
- EY's analysis identifies that most congestion occurs on interconnectors, but does not remove the interconnector limits when modelling the unconstrained networks, with the result that the benefits of removing congestion are suppressed.

AEMO considers that that the market impacts of congestion in the NEM are significantly higher. Figures 1 below shows the market impact of congestion by constraint type. Further information on congestion in the NEM is available at AEMO's Congestion Information Resource.[8]

Figure 1 Market impact of congestion by constraint type



[8] https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Congestion-information/Statistical-Reporting-Streams

These estimates of the costs of congestion, whilst significantly higher than the EY analysis, are still likely to understate the true costs of congestion. Current frameworks for assessing congestion costs in the NEM are narrowly construed since measuring the underlying short run operating costs understates the reliability value. During extreme events or under peak demand conditions, congestion can merge with reliability and the scarcity value is much higher than the short run cost difference.

European policy makers recognise that there are other benefits of relieving congestion beyond reducing the marginal cost of generation.

Box 1 – European view of the costs of congestion

While the costs of building interconnectors are significant – ENTSO-E estimates €150 billion in total for its proposed additional grid infrastructure – they are small compared to the costs of congestion. ENTSO-E estimates the costs of not building the additional interconnectors at €40bn *per annum* by 2040.[9]

Congestion increases the marginal cost of electricity generation by limiting access to least cost resources. ENTSO-E's Ten Year Development plan estimates that removing congestion would reduce the marginal cost of electricity generation by between €3-14/MWh, depending on the region.[10]

ENTSO-E's plan recognises that removing congestion can also give rise to environmental and reliability benefits. Reducing congestion leads to lower CO_2 emissions insofar as there is less need to curtail renewables. It also reduces the risk of unserved energy, particularly in weaker parts of the grid that are exposed to system security risks.

European Commission policy is that "energy should flow freely across the EU - without any technical or regulatory barriers".[11]

The analysis above, and the analysis undertaken by EY, examines historic congestion. However, market design should be forward looking, not based on the view from the rear view mirror. Forward looking indicators (such as generator connection applications and transmission marginal loss factors) suggest that congestion is imminent. Areas of potential congestion are expected to be identified in this year's Annual Planning Reports. Generators that are currently going through the development process may be exposed to prolonged transmission congestion, with potential adverse consequences both commercially and in terms of reliability.

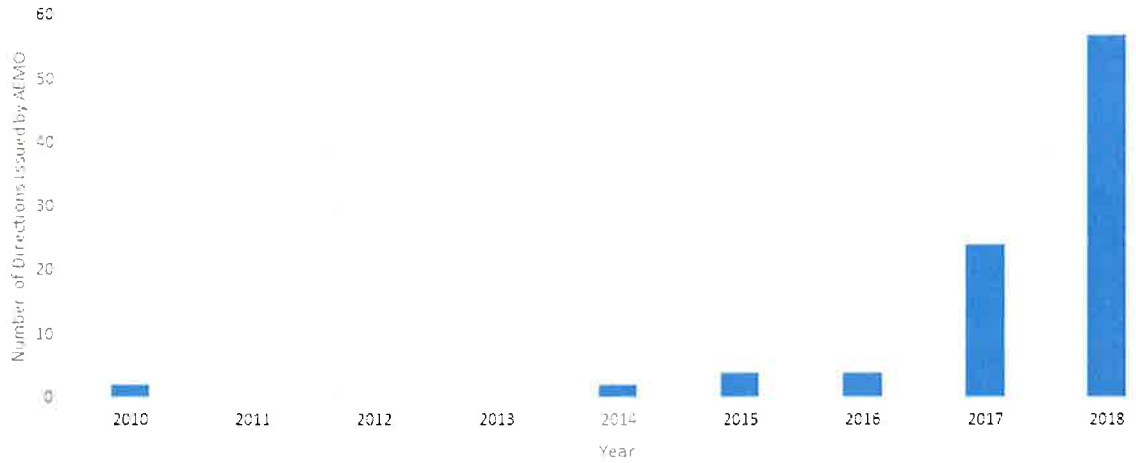
Further, congestion is not the only indicator of the need for reform. As a result of the energy transformation, there is now a more complex range of factors to take into account when planning the strategic development of the power system. Rather than focussing on reliability and the potential for transmission congestion, it is also necessary to consider other issues, such as risks to system security.

Figure 2 shows how the need for AEMO to intervene in the market in order to maintain system security has increased dramatically in recent years, particularly since the 2018 figure covers only the year to 13 May.

[9] http://tyndp.entsoe.eu/tyndp2018/power-system-2040/
[10] http://tyndp.entsoe.eu/tyndp2018/power-system-2040/
[11] https://ec.europa.eu/commission/priorities/energy-union-and-climate/fully-integrated-internal-energy-market_en

It is not clear that current market frameworks are best placed to identify future power system needs in the timeframes required to avoid expensive short term solutions. These issues highlight the need for a strategic approach to the coordination of transmission and generation investment.

Figure 2 Annual number of directions in NEM*



* The figure for 2018 includes directions during the period 1 January to 13 May. It is not extrapolated.

3.2. Treatment of storage

As the AEMC notes, there are currently a number of large-scale energy storage projects under construction or seeking to connect in the NEM. These are stand-alone batteries or incorporated within existing or new generating systems (commonly referred to as hybrid arrangements). Additionally, there are emerging business models that aggregate small-scale resources (e.g. Virtual Power Plants). AEMO has interim arrangements in place to register proponents of stand-alone batteries and hybrid arrangements under the existing NEM regulatory framework and existing systems and processes. For batteries connected to the grid and purchasing electricity (charging) and selling electricity (discharging), in these circumstances, a proponent with a battery 5MW and above need to register as a Market Generator (scheduled generating unit) and Market Customer (scheduled load) and participate in central dispatch.

AEMO agrees that it is necessary to review whether the regulatory framework is appropriate for emerging business models and this is underway. As noted by the AEMC, AEMO is currently working with stakeholders to clarify the NEM arrangements (including the NER and AEMO processes and systems) for participation of emerging generation and energy storage. We have conducted two workshops to seek to understand stakeholder perspectives on future operational and financial arrangements. AEMO is currently considering stakeholder issues and ideas together with the operational learnings from registering proponents of stand-alone batteries and hybrid arrangements. These are being used to develop key policy and IT options to be discussed and consulted on with stakeholders. Further information about AEMO's work is available on our website.[12]

[12] AEMO website Future arrangements for emerging generation and energy storage, https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Participant-information/Future-arrangements-for-Emerging-Generation-and-Energy-Storage

AEMO understands that one of the consequences of its Interim Arrangements is that a proponent registering as a Market Customer may be charged use of system charges by a Network Service Provider (NSP). AEMO agrees with the AEMC that resolving whether a new registration classification or category is needed may help resolve the issues related to transmission use of service (TUOS) payments. It should also allow the full potential of batteries to be used by being able to seamlessly move from charging to discharging or vice versa.

AEMO considers that where energy storage performs functions that make it part of the electricity supply chain, they should be treated in a technology neutral manner. Such functions include frequency control ancillary services and renewables firming. As with a generator, the energy storage facility would not receive firm transmission access and would be constrained in the event of network congestion. However battery storage can be very flexibly located and could supply valuable services to the network by managing flows and transient stability. The transmission pricing regime and payments for services should provide incentives to batteries to locate in advantageous locations.

4. Renewable Energy Zones

The purpose of Renewable Energy Zones (REZs) is to reshape the transmission network in a way that enables the efficient connection of new sources of generation and maintains a reliable supply to customers, notwithstanding the need to replace a significant proportion of the generation fleet.

AEMO acknowledges the indicative options the Commission has set out for REZs. Additionally, the Commission have also proposed another option to REZs, the 'clustering' model, where TNSPs coordinate generator connections and process them as a 'cluster' based on the option that delivers the most efficient outcome. The options presented by the Commission range from requiring no or minimal changes, to requiring significant changes to the existing framework. The Commission has requested stakeholder feedback on the definition of a REZ.

It is AEMO's view that renewable generation and transmission investment can only be coordinated and efficient through the development of REZs that form part of a longer-term strategic plan for the NEM, as recommended by Finkel. For that plan to be enabled, changes are required to the existing framework.

As presented in Section 2.2, the current market-led model has not delivered the required level of investment in the required timeframe. A strategic plan that takes a holistic and comprehensive view of the investment development required will provide the appropriate signals to the market so that electricity can be delivered more efficiently. This longer-term strategic plan is the Integrated System Plan.

4.1. Integrated System Plan

Finkel concluded that system planning was one of the three pillars required to deliver secure, reliable and affordable energy to consumers. The Finkel review further explained that system planning incorporates an integrated grid plan to inform investment decisions and ensure security is preserved in each region as the generation mix evolves[13]. Finkel Recommendation 5.1 was one of the 49 recommendations endorsed by the COAG EC and outlined that AEMO, in consultation with stakeholders, particularly TNSPs, develop an

[13] Finkel et al., Independent Review into the future security of the National Electricity Market. Available at: https://www.energy.gov.au/publications/independent-review-future-security-national-electricity-market-blueprint-future.

integrated grid plan to facilitate the efficient development and connection of renewable energy zones across the National Electricity Market.

The inaugural ISP will be published by AEMO in mid-2018. By considering a range of scenarios, it will present a long-term strategic development plan that can deliver continued reliability and security, at least-cost for consumers, while meeting NEM emissions reduction targets. The ISP is designed to be regularly updated so that the dynamically changing nature of the power system can be reflected. This will also encourage continuous innovation and allow effective strategies to evolve going forward.

In line with Finkel's recommendation, one of the key outcomes of the 2018 ISP will be proposals for the most viable REZs.

4.1.1. Renewable Energy Zone developments

Currently in the NEM, coordination of large-scale renewable generation and transmission development is challenging. As mentioned previously, one of the main factors causing this are the very short lead times of renewable development compared with the longer lead times required for transmission development to facilitate the renewable connections.

Another factor is the inappropriate locational investment signals for developers. As noted previously, the current framework incentivises investors to stay close to existing transmission paths, whereas there may be lower overall system costs associated with unlocking new renewable energy zones and considering transmission access reform.

AEMO believes the ISP will assist in reducing overall system costs to consumers by incorporating renewable generation through REZs developed on a whole-of-system basis rather than on a regional basis. This approach is likely to result in REZ development as part of the integrated shared network; i.e. along the path of interconnectors or co-located with large loads. This contrasts with recent generation development proposals which have applied closer to weaker parts of the existing network.

Flexibility and adaptation of REZ development is also important for providing appropriate investment signals in the energy transition. These characteristics can facilitate the required level of coordinated and cost-effective investment at the right time under the relevant circumstances. The ISP is developed under a range of scenarios and will recommend the most viable REZs based on those scenarios. This will ensure investment outcomes are not locked in and instead encourage coordinated investments that incorporate a level of flexibility and ability to adapt to the market environment that transpires.

This said, it is difficult to achieve coordinated and efficient outcomes in the presence of disparate commercial interests, particularly given the lack of firm access under the current regime. Unless there is change to the transmission access regime, the current market-based approach risks an impasse leaving the NEM insufficiently prepared for the retirement of coal fired generators and increase in levels of utility and small-scale renewable generation.

4.2. Regulatory treatment of REZs

AEMO notes the Commission's views on a preference for market-based approaches rather than centralised planning as the risk of inefficient investment is placed on consumers. While the consideration of risks associated with unnecessary investment are important, consumers are also exposed to risk associated with a disorderly transition.

There is a risk of stranded investment under the current framework if transmission investment does not occur in a timely fashion. There is also a risk of inefficient expenditure if transmission upgrades are driven by generator location decisions which do not reflect the optimal development of the system as a whole. The market is also less capable of making

major strategic decisions that shape the power system in the longer-term interests of consumers as they lack a holistic perspective, and face commercial imperatives that prevent co-ordination with other parties.

This said, market participants are very effective at responding to signals within the framework that applies at the time. With an appropriately designed regulatory framework that gives effect to the system plan, the market can deliver the benefits of more coordinated and efficient outcomes of the plan to consumers that considers the longer-term whole-of-system needs. This may require reconsideration of the connection arrangements, transmission pricing and the granularity of market prices.

AEMO notes that there is an absence of international examples of market-driven power system development. AEMO's ISP Consultation Paper released in December 2017[14] highlighted a number of international jurisdictions including New Zealand, Germany, the United Kingdom and various states in the United States of America[15] who have successfully coordinated large-scale renewable generation and transmission development through strategic planning at a jurisdictional and policy level.

4.2.1. Funding of REZs

The Commission appears to believe that REZs are more likely to be connection assets and should not be subject to the RIT-T process. AEMO would like to refer to the Finkel Review that explicitly contemplates that developments proposed through the ISP, and thereby REZs, would be funded, at least in part, via the regulatory framework and justified under a cost-benefit assessment.

Finkel's views are in line with AEMO's preliminary ISP modelling results that suggest that the optimal development paths for REZs are not distinct from the shared network. There is scope for REZs to lie along the path of interconnectors rather than requiring the network to be extended to locations that are remote from the rest of the grid.

Another option for REZ funding that merits further exploration is a *subscription model*. This approach requires generators to make a financial contribution in support of their preferred REZ. If applied in the NEM context, to the extent that TNSPs would incur additional costs in order to access new REZs, a minimum financial commitment from market participants would need to be achieved as a pre-requisite for the additional expenditure. This would remove the risk of REZs becoming stranded and inefficient investments and would also lower overall costs to consumers due to more coordinated development.

AEMO believes there are benefits to examining these issues further as part of the broader ESB Review on planning and regulation of the transmission system and interconnection. AEMO has also engaged FTI Consulting to review best practice options utilised internationally for centralised investment planning and the relevant roles and responsibilities in the context of the energy transition and how best to facilitate Finkel Recommendations.

We would welcome the opportunity to share these findings and explore these options further with the Commission and other stakeholders.

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[14] AEMO's Integrated System Plan Consultation Paper available at http://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/ISP/2017/Integrated-System-Plan-Consultation.pdf

[15] Namely Texas and the states served by the Mid-Continent Independent System Operator (MISO)

5. Conclusion

The current regulatory framework needs to change to keep pace with the transforming market. It is designed to deliver incremental growth based on meeting demand, whereas the current drivers for network investment are the retirement of coal fired plant, the need to access diverse new sources of supply and the need to maintain system security. The current demand-led regulatory model exposes customers to the risk of supply shortfall as the current coal fleet reaches retirement age.

In the absence of a strategic development plan, there is a risk that the transmission system will develop in a distorted fashion. Transmission connection costs will make it necessary for investors to stay close to existing transmission paths, whereas there may be lower overall system costs associated with unlocking new renewable energy zones. The efficient solution which leads to the lowest overall cost to consumers will depend upon co-optimising the cost and performance of generation and storage with the cost of the transmission system.

EY's analysis understates the costs of congestion in the NEM. Further, the presence or absence of congestion is only one of a number of factors that should be considered when assessing whether transmission frameworks are appropriate.

Decisions on the regulatory framework to support the coordination of transmission and generation investment would benefit from being informed by the ISP. AEMO welcomes the opportunity to work with the AEMC, AER and ESB to explore these issues as part of the upcoming ESB review of NEM transmission planning and interconnection.