ABN 70 250 995 390
180 Thomas Street, Sydney
PO Box A1000 Sydney South
NSW 1235 Australia
T (02) 9284 3000
F (02) 9284 3456

20/03/2019

Ms Nicola Falcon
General Manager, Forecasting
Australian Energy Market Operator
GPO Box 2008
Melbourne VIC 3001

Submitted by email to: forecasting.planning@aemo.com.au

Dear Nicola,

Consultation on 2019 Planning and Forecasting Paper - Scenarios, Inputs, Assumptions, Methodology, Timeline, and Consultation Process

TransGrid welcomes the opportunity to respond to the Australian Energy Market Operator's (AEMO's) consultation paper on the proposed engagement process, scenarios, inputs and assumptions, and the material issues and modelling improvements for 2019 Planning and Forecasting documents.

TransGrid is the operator and manager of the high voltage transmission network connecting electricity generators, distributors and major end users in New South Wales and the Australian Capital Territory. TransGrid's network is also interconnected to Queensland and Victoria, and is instrumental to an electricity system that allows for interstate energy trading.

Australia is in the midst of an energy transformation. This is characterised by:

- Changing consumer expectations and greater demand-side participation;
- The requirement to reduce greenhouse gas emissions in accordance with Australia's international commitments;
- Significant technological advancement; and
- The progressive retirement of existing thermal generators.

These changes raise complex issues in relation to the design of the National Electricity Market (NEM), which must adapt to these changes and provide the basis for low emissions, reliable supply at the lowest cost to consumers over the long run. In NSW alone, almost 9 GW of ageing coal generation is likely to exit the market over the next two decades. Significant new energy resources will therefore need to be developed in a timely way, ahead of anticipated retirements, to maintain reliable and secure energy supply during the transition.

TransGrid supports the development of the Integrated System Plan (ISP) by AEMO and considers there should be a clear link from the ISP to the transmission planning and investment decisions by transmission network service providers. The ISP has the potential to facilitate the efficient and timely development of nationally strategic transmission infrastructure, resulting in significant market benefits and lower price outcomes for consumers.

Renewable energy will deliver lower unit costs

Large scale wind and solar can supply energy with a lower levelised cost than new coal and gas fired power stations, in the timeframe required by the anticipated retirement of existing coal fired generation. CSIRO analysis finds that neither system costs nor firming requirements rise significantly until renewables are providing over 60% of power generated in the NEM, suggesting that even a

majority renewable-based system will deliver lower costs in future than a system powered by new thermal generation.[1]

Distributed Energy Resources (DER) will play a growing role in Australian energy markets. Australia already has some of the highest rates of rooftop solar PV penetration globally, and as technology costs continue to decline, uptake of solar, energy storage and other behind-the-meter technologies will continue to grow.

Coordinated transmission development will be required to facilitate timely generation investment

The transmission network provides a platform for the lowest cost electricity generation to be connected and dispatched, enhancing energy market competition.

TransGrid currently has an unprecedented volume of generation connection enquiries, with over 45 GW of potential solar, wind and hydro projects at various stages of development within our network. Unfortunately, most regions with strong renewable resources are already facing network congestion, with new and existing renewable generators at risk of constraints. A summary of these enquiries by region is shown in Figure 1. The 2018 ISP forecast that as much as 15 to 20 GW of new large scale generation will need to be developed within NSW over the outlook period, and only a fraction of this capacity can be accommodated in the existing network configuration. Additional network capacity will be needed to facilitate this next wave of generation development.

TransGrid supports the strategically planned connection of large scale energy zones, supported by greater interconnection, to facilitate the timely development of new generation capacity.

In 2018, TransGrid commissioned Aurecon to determine the conditions under which large scale energy zones are the most cost effective option for replacing retiring coal capacity. The analysis indicates that the establishment of large scale energy zones will lower system costs by 8% compared to the 'business as usual' uncoordinated approach, which will deliver a saving of $0.9 billion for NSW consumers over 20 years. The study found that while the energy zone development scenario incurred higher transmission costs, these were more than offset by reductions in generation capital and operating costs, and the reduction in generation curtailment that would occur under the status quo arrangements.

The delivery of transmission connections to these zones should be staged over time so that lowest cost connections for new capacity in priority energy zones are completed first, new generation connection is enabled ahead of expected thermal retirements, risk of asset stranding is minimised and future optionality is preserved.

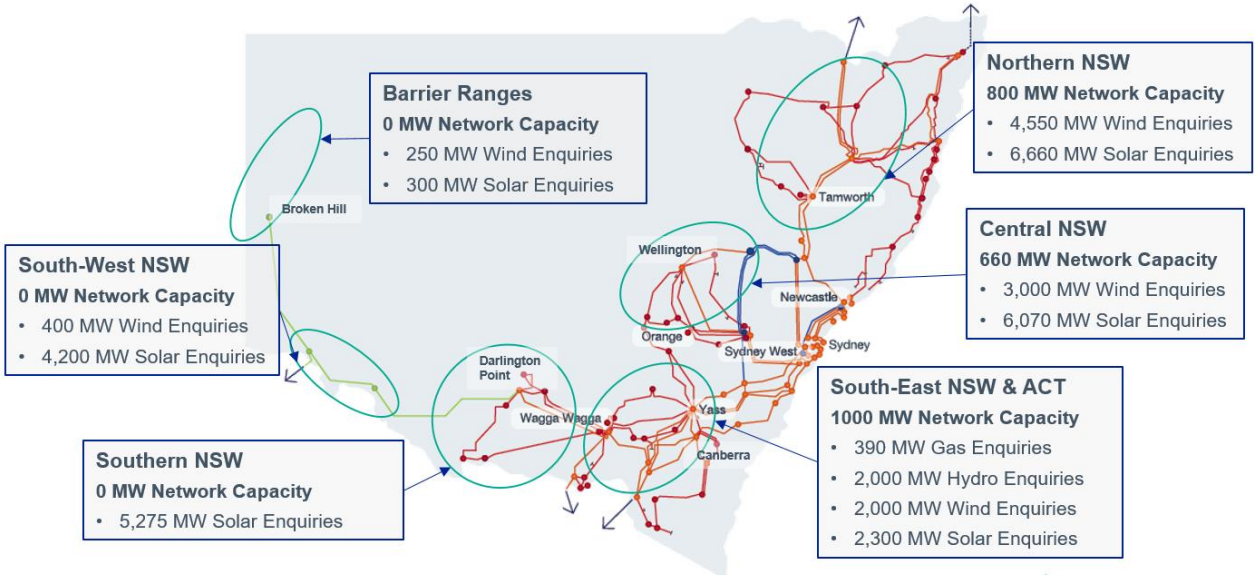
The benefits of strategic development of these zones include:

- Connection of the lowest-cost generation in regions with the best quality renewable resources. These large scale generators can operate at higher capacity factors and are able to supply electricity to consumers at lower unit costs than generation in lower quality renewable resource areas.
- Efficient transmission connection through economies of scale.
- Geographic diversity of renewables across the NEM to provide lowest cost intermittency firming.
- Sharing of energy and ancillary services across regions to provide system security and resilience.

Where possible, energy zones should be located to enable reuse of existing transmission infrastructure (as existing generation retires) to minimise transmission costs and maximise optionality, while facilitating low cost renewable generation.

[1] Analysis based on data sourced from: Bloomberg New Energy Finance, 2017; CSIRO Low Emissions Technology Roadmap, 2017; CSIRO Future Energy Trends, 2015

Figure 1: Current connection enquiries to TransGrid network



Within NSW, TransGrid has identified several priority renewable energy zones, including:

- Northern NSW;
- South-East NSW and ACT;
- Southern NSW;
- South-West NSW; and
- Central NSW

These priority energy zones are closely aligned with those identified by the NSW Government, and have high quality solar and wind resources, compatible land use with low opportunity cost and low transmission augmentation costs. They are located on corridors between major population centres and maximise the use of the existing network.

Proposed pathway for efficient delivery of the Integrated System Plan

The ISP should set out an energy system for the NEM that maximises benefits for consumers over the long term. It is essential that the Plan is implemented effectively, and that the priority projects identified are delivered in a timely manner. TransGrid notes that policy and regulatory certainty is an important factor in the consideration of investors. Therefore, TransGrid urges policymakers and regulators to consider the broader context of their decisions, including the cumulative effect of policy and regulatory interventions (such as the removal of merits review, lowering the rate of return and the potential for stranded asset risk) on transmission investment. Such interventions have the potential to undermine efficient transmission investment and the benefits it brings to consumers.

To deliver the ISP, TransGrid considers there should be a clear link between the ISP and transmission planning and investment decisions by TNSPs. This can most effectively be achieved by adopting an approach whereby:

- The ISP identifies priority projects across the NEM in accordance with an assessment framework that is least regrets and benefits maximising for customers.
- The ISP provides an agreed set of inputs, assumptions and scenarios as well as precise and actionable recommendations that can be used by a TNSP.
- The TNSP adopts the inputs, assumptions, scenarios and future NEM pathway in the ISP to undertake more detailed assessments of priority projects identified in the ISP.

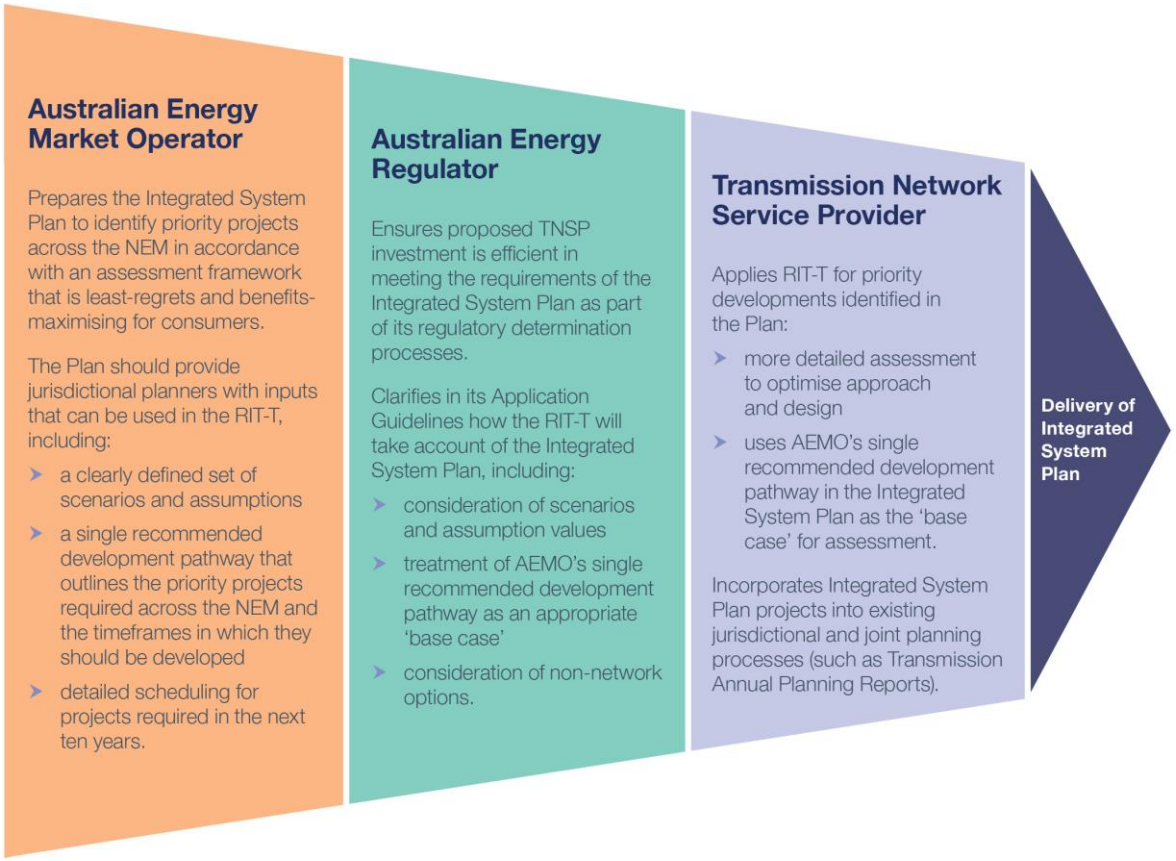
This approach for making the ISP an actionable strategic plan is set out in Figure 2.

Under this approach, the consideration of needs and options by AEMO in the development of the ISP should be appropriate to satisfy the requirements of the Project Specification Consultation Report (PSCR) of the RIT-T. TNSPs should be able to rely on the consultation carried out by AEMO to satisfy the PSCR consultation and commence the RIT-T process at the Project Assessment Draft Report stage (following which there is a further round of consultation on the results of the investment test).

In addition, to increase its effectiveness, the ISP must have standing in the regulatory framework and be subject to sufficient consultation. This will ensure that all stakeholders have confidence that the investments identified have been appropriately tested and will deliver net benefits to the market.

We understand that the Energy Security Board is to provide to the COAG Energy Council any changes required to the National Electricity Law and Rules to embed the ISP into the regulatory framework and enable the ISP to identify the need and set of credible options to meet that need in place of the current PSCR in the RIT-T.

Figure 2: TransGrid's proposed approach for making the Integrated System Plan an actionable strategic plan



Group 1 and 2 project rule changes

The ISP released by AEMO in July 2018 recommended two transmission investments (Group 1 projects) in relation to expanding transfer capacity between NSW and Queensland (QNI – minor upgrade), and between NSW and Victoria (VNI – minor upgrade) by 2020, or as soon as they can be built. AEMO identified that these investments would support the long-term interests of consumers for safe, secure, reliable electricity at least cost across a range of plausible futures.

As a result, TransGrid has jointly worked with Powerlink and AEMO respectively to initiate two Regulatory Investment Tests for Transmission (RIT-T) to progress the 2018 ISP's recommendations. These RIT-Ts were commenced in November 2018. Following the closure of submissions on PSCRs in late February 2019, TransGrid and Powerlink/AEMO are performing full quantitative market impact analysis of both network and non-network options in the preparation of the Project Assessment Draft Reports (PADRs).

TransGrid supports the two rule change requests from Dr Kerry Schott AO to streamline certain regulatory processes for QNI, VNI and the SA Energy Transformation project (now known as Project Energy Connect) in AEMO's 2018 ISP as we consider it would:

- Provide the potential for a reduction in the overall timeframe for regulatory approval processes that occur after RIT-Ts for these projects, and
- Provide certainty to the market about the status of these projects sooner.

However, we note that the time taken for these regulatory processes may be longer if a dispute were to be raised to the current RIT-T processes.

We understand that the AEMC is consulting on another rule change request from Dr Kerry Schott AO relating to the application period for contingent project revenue. This rule change request seeks to remove NER clause 6A.8.2(b)(1) (the requirement that a Transmission Network Service Provider cannot submit a contingent project application during 90 business days ahead of the end of the regulatory year), as well as the equivalent clause in distribution. We are supportive of this proposed rule change as it would help reduce the potential for any unnecessary delay to the commencement of a revenue determination process for contingent projects, including for the QNI and VNI projects.

TransGrid understands that AEMO is seeking stakeholder feedback on the modelling scenarios, inputs, assumptions, methodology for 2019 Planning and Forecasting documents. TransGrid generally supports the principles behind the modelling scenarios, inputs, assumptions and methodologies proposed by AEMO, and has proposed an additional scenario and provided responses to specific questions (attached). We do not propose any additional questions to be addressed.

TransGrid appreciates the opportunity to comment and look forward to working with AEMO further on the process. If you would like to discuss this submission, please contact Andrew Kingsmill, Manager of Network Planning, on 02 9620 0850.

Yours sincerely

Gerard Reiter
Executive Manager/Network Planning & Operations

Appendix A – Response to Consultation Questions

ENGAGEMENT

1. How could AEMO further improve stakeholder engagement and confidence in the results of the 2019-20 ISP and 2019 ESOO?

TransGrid supports the role of AEMO as the National Transmission Planner and has welcomed AEMO's collaborative approach in the development of the 2018 ISP. TransGrid will continue to engage with AEMO in its preparation of the 2019-20 ISP and 2019 ESOO.

TransGrid also supports AEMO's initiatives to improve stakeholder engagement and confidence in the results of the 2019-20 ISP and 2019 ESOO. Considering the scale of the power system transformation that will be required over the coming decades, a coordinated jurisdictional planning process that will provide a platform for the most efficient development of the power system, underpinned by economic analysis, is imperative to achieving the National Electricity Objective and emission reduction targets. It will play an essential role in aligning market signals with long-term system requirements, facilitating future investment, and achieving an affordable, reliable and decarbonised energy supply.

TransGrid considers that the existing regional and joint planning arrangements are appropriate. However, a coordinated plan is required to identify, prioritise and stage transmission projects and a clear implementation pathway for the ISP is required to ensure developments are delivered in a timely manner.

SCENARIOS

2. Do you agree that the proposed scenarios outlined in this section provide plausible and internally consistent future worlds for use in network planning and forecasting publications? Do they provide sufficient stretch for forecasting and planning purpose?

Transmission assets are long-lived and may remain operational beyond forty years. Hence, it is important to consider a range of scenarios so that the derived conclusions for transmission investment are robust and 'least regrets'.

TransGrid supports the use of a central case or cases, in conjunction with 'bookend' scenarios representing the upper and lower bounds of credible outcomes for large-scale generation and transmission planning. In finalising these scenarios, TransGrid recommends the following:

> TransGrid supports AEMO testing a range of DER and demand-response scenarios, and in cases where these technologies offer a cost-effective alternative, they should be included in the ISP.

> Feedback from TransGrid's stakeholder consultation on modelling assumptions in late 2018 is being incorporated into our planning. Specifically, TransGrid and Powerlink are including an additional scenario in the RIT-T for expanding NSW – QLD transmission transfer capacity. The newly added scenario is described as "Neutral scenario with stronger emission reduction target".

  This scenario explores an alternate approach to meet Australia's Conference of Parties (COP21) commitment in which the electricity sector delivers more than its proportionate share of emissions reduction (52% by 2030). Generation retirements are likely to be influenced by this higher emission reduction policy targets, with capacity retiring prior to end of technical life. It also assumes the Queensland and Victorian renewable energy policies will be delivered as planned, and the NSW Transmission Infrastructure Strategy will be pursued. This scenario reflects a medium outlook for economic activity and development and assumes neutral underlying electricity consumption and fuel prices. A neutral uptake of small-scale distributed energy resources and systems, including small-scale batteries, is expected.

TransGrid recommends AEMO adopt a similar scenario as a fifth scenario. Refer to TransGrid and Powerlink's Input and Methodology Consultation Paper – Expanding NSW – QLD Transmission Transfer Capacity for further details.

3. What additional sensitivities should be explored in the 2019-20 ISP or 2019 ESOO that could materially impact power system planning?

TransGrid supports AEMO's proposed sensitivities beyond the core scenario. Modelling outcomes are likely to be particularly sensitive to assumptions made around the retirement of existing thermal generators, pumped hydro storage potential and costs, and choice of weighted average cost of capital and/or social discount rate. Due to the importance of coal fired generator retirement timing, TransGrid urges AEMO to specify the exact retirement timing for each generator under the fast change scenario.

INPUTS AND ASSUMPTIONS

4. Do the proposed inputs and assumptions provide a reasonable basis for assessing the value and direction of the future energy market transition? If not, please provide suggestions for improvement, particularly with regard to consumer embedded investments, large scale generation technologies, and network and non-network options to support Australia's future energy system?

TransGrid considers the proposed inputs and assumptions provide a reasonable basis for assessing the value and direction of the energy market transition. TransGrid also recommends the following:

> For 2019 planning and forecasting, the consultation paper proposes a focus on changes in generation mix that may impact the power system, with emission reductions being an output of the simulation rather than a driver. Table 6 of the consultation paper indicates the policy settings will reflect policies of the day at commencement of modelling.

TransGrid considers that certainty on emission policy is very important part in gaining investor confidence. Emissions policy is also a major driver of system development. Under international climate change agreements, the Australian Government has committed to reducing national greenhouse gas emissions by 26-28% by 2030 and to working towards limiting global warming to no more than 2^{o}C above pre-industrial levels. The UNFCCC Paris Climate Agreement therefore includes a mechanism for countries to 'ratchet up' the ambition of their national targets over time. In Australia, electricity generation is the largest source of greenhouse gas emissions, and will therefore play a significant role in delivering abatement.

TransGrid recommends AEMO clearly define policy settings in the core scenarios and consider potential alternative mainstream emission policies. TransGrid and Powerlink have done this through the inclusion of an additional scenario of "Neutral scenario with stronger emission reduction target" in the RIT-T for expanding NSW – QLD transmission transfer capacity, as noted above.

> The extent to which distributed energy resources will be deployed and coordinated in the future is a significant area of uncertainty, with many organisations currently assessing the potential of these technologies to deliver benefits to consumers, networks and wholesale market. A virtual power plant (VPP) in the current Australian context means using software to remotely coordinate fleets of batteries and rooftop PV located behind the meter. VPPs being installed across Australia, are largely driven by subsidy schemes incentivising thousands of units.

TransGrid supports AEMO testing a range of DER and demand-response scenarios and recommends AEMO test a range of VPP levels across scenarios.

> To avoid inconsistencies between the ISP and RIT-T, TransGrid urges AEMO to use the same discount rate that is set out in the Australian Energy Regulator's (AER's) RIT-T application guideline.

5. Do you have any other feedback on AEMO's proposed input and assumptions?

TransGrid recommends AEMO consider a wide range of technologies, including the development of a hydrogen industry over the medium to long term. There has been significant activity in Australia in recent months to investigate and demonstrate the potential role of hydrogen as a clean fuel and export commodity. In 2018, three major Australian reports about the potential future role for hydrogen were published:

> CSIRO published its National Hydrogen Roadmap.
> The Hydrogen Strategy Group (led by Alan Finkel) prepared Hydrogen for Australia's future for the COAG Energy Council.
> ACIL Allen Consulting prepared Opportunities for Australia from hydrogen export for ARENA.

ARENA has since allocated $22.1 million to 16 research teams nationally, and COAG Energy Council ministers have agreed to develop a national hydrogen strategy by the end of 2019. Consistent with this analysis, TransGrid recommends that AEMO consider the implications of a range of hydrogen industry developments within their scenario definitions.

SPECIFIC CONSULTATION REQUESTS

6. Do you have specific feedback and data to support AEMO on:
    a. The list of candidate generation technologies for assessment?
    b. The current and future generation technology costs assumed?
    c. Generator fixed O&M costs, noting the inclusions of fixed costs associated with mines?
    d. The appropriateness of AEMO's assumptions around various storage technologies?
    e. The approach on generator retirements, including appropriate costs to convert existing CCGTs to OCGTs providing a peaking, rather than major energy production role?

As Australia's coal fired generators age, AEMO data demonstrates that they are becoming less reliable. Like all complex machines, generator reliability is subject to a "bathtub curve", where forced outages are initially frequent due to teething issues, fall rapidly and stay flat for many years until finally gradually increasing towards the end of plant's life. At some point, the maintenance and equipment replacement required to retain reliability at a reasonable level becomes uneconomic. In some cases, these generators may have to reduce production to operate within safe limits.

With traditional thermal generation, the unpredictable sudden failure of large unit size could pose a significant threat to energy security particularly during summer heat, when demand is high and reserve generation capacity is low. Stakeholders have expressed to TransGrid a concern that large coal-fired generators may suffer technical failures ahead of their 50 year operating lives, or announced closure dates, leaving a supply gap in the energy market that would be difficult to address in the short-term. Similarly, increased forced outage rates, or plant de-rating could challenge energy system reliability, security and resilience.

TransGrid recommends AEMO consider a scenario or sensitivity in which some coal generation capacity retires sooner than expected, or withdraws from the market suddenly. Increased outage rates and/or maintenance costs should also be considered across all scenarios, reflecting recent performance trends.

MATERIAL ISSUES FOR 2019

7. For 2019 planning and forecasting activities, what, if any, material issues should be prioritised ahead of the issues proposed by AEMO?

TransGrid supports the material issues proposed by AEMO to be considered as part of the 2019 forecasting and planning activities. Other material issues should be considered include:

> Improving understanding of the value of REZs

Transmission systems in many areas are becoming increasingly congested, and as new connections occur, new and existing renewable generators face growing risks of being constrained at certain times.

However the regulatory frameworks that currently facilitate investment in transmission typically require new generation to lead network expansion, creating a 'chicken and the egg' dilemma: new generation projects in high-quality renewable energy zones cannot be committed without transmission access, but proactive transmission expansion is not supported. That is, investors will only commit to generation once they have assurance of a network they can reasonably connect to, and which will provide sufficient capacity for them to deliver their generations.

There is a misalignment of incentives between generation and transmission. Generators are currently incentivised to develop renewable projects near existing transmission lines, where connection costs are lowest, despite often not being in areas with highest-quality resources. Connecting into lower-voltage systems is lower cost for generators, yet these systems are less able to support intermittent generation. Major transmission investment can actually be achieved at lowest cost due to economies of scale. For example, the cost of installing a 500kV transmission line to connect a new renewable energy zone is around double the cost of a 330kV line, but delivers around three times the capacity.

> Producing an actionable ISP

TransGrid has proposed a pathway to deliver timely development of the priority projects in the ISP. Refer to Figure 2 for further details.

8. What other material HILP events should be considered in assessing resilience?

Power system resilience refers to the ability of the system – which includes generating sources, transmission, and distribution to withstand high-impact, low frequency events. This could include natural disasters such as cyclones, storms, bush fires, floods and droughts, as well as man-made events, such as cyber or physical attacks on grid infrastructure.

Resilience metrics can help determine the resilience of the system, however they are not easy to formalise. Because they are focused on individual, low-frequency events, it is often not possible to base metrics on historical data. Many metrics will likely be based on extensive simulations of 'what-if scenarios. In addition, many of the technologies and strategies for increasing the resilience of the electricity system are expensive, particularly when implemented on a large scale.

TransGrid supports AEMO conducting resilience modelling to understand the implications of HILP events for different infrastructure configurations. It is important to develop frameworks for assessing how best to manage the risk of new and emerging threats to the system. The Electric Power Research Institute (EPRI) included a list of possible events that could harm the power system and lead to life-threatening outcomes, including natural and manmade events. Other threats include unanticipated severe shortages of fuel or water for power generation and extreme weather that impacts a variety of generating sources (especially wind and solar).

9. What mitigation options could be considered to increase grid resilience, and how should these options be evaluated? Is AEMO's proposed approach reasonable?

Advancing resilience must begin with the characterisation of the most important threats, which often vary by region. TransGrid recommends AEMO:

> Build a greater understanding of HILP events and capability to incorporate HILP threats into risk assessment. Scenario based planning to explore multiple contingencies can be used to stress test the system and identify gaps in resilience.

> Institute policies and practices that can help to streamline assessment and decision-making while enhancing coordination and communication can be just as important to resilience as the development of robust infrastructure and assets.

> Hardening the grid using the solutions including selecting route diverse paths for new transmission assets will help the grid integrity.

> Diversifying generation resources by increasing the number of generation sources and fuel types, and their locations in the NEM at both the distributed and utility-scale, will both limit the risk of outages and allow faster restoration of service.

SYSTEM STRENGTH AND INERTIA REQUIREMENTS METHODOLOGIES

10. What other factors should be considered in the methodologies or proposed 2019 improvements to determine future inertia or system strength requirements?

TransGrid supports AEMO's Inertia Requirements Methodology and System Strength Requirements Methodology documents to determine future inertia and system strength requirements.