6 September 2019

Mr John Pierce

Chair

Australian Energy Market Commission

PO Box A2449

Sydney NSW 1235

Lodged online via: EPR0057

# Discussion paper - Mechanisms to enhance resilience in the power system - Review of South Australia Black System Event

Dear John,

Energy Networks Australia welcomes the opportunity to respond to the Australian Energy Market Commission's (AEMC) discussion paper on Mechanisms to enhance resilience in the power system – Review of South Australia Black System Event.

Energy Networks Australia is the national industry body representing Australia's electricity transmission and distribution and gas distribution networks. Our members provide more than 16 million electricity and gas connections to almost every home and business across Australia.

This response is on behalf of Energy Networks Australia's transmission members.

Australia has experienced a notable change in its focus on the reliability of the energy system. In particular, reliability has become a bigger focus, driven by changing community expectations and choices, advances in renewable energy technologies, retirement of existing and dispatchable generation, and the adjustments required in Australia's economy to meet our international climate change commitments. These changes raise complex issues in relation to the design of the National Electricity Market (NEM) and have led to a greater focus on ensuring reliability of supply and how that is achieved.

The South Australian Black System Event demonstrated that the type and severity of risks to power system security are rapidly changing, with new and ever-evolving challenges that need to be addressed. At the same time, the strength and pliancy in the power system of the past, which provide a measure of resilience and which are vital to addressing these challenges, are continuing to decrease over time.

Energy Networks Australia supports the AEMC's exploration of ways to address issues in the current design of the NEM and we agree that there is an increasing need to build and maintain a secure and resilient grid to address new risks and challenges facing the power system. Any enhancement to the system security and resilience framework needs to be evaluated in a manner that is nationally consistent, transparent and rigorous and mindful of any cost increases that will ultimately be borne by end consumers.

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Given the interconnection in the power system, as well as an increasingly interconnected and energised society, Energy Networks Australia recommends robust consultation of any changes prior to enhancing resilience frameworks. In summary, Energy Networks Australia recommends that:

- The AEMC avoid increasing the complexity of the framework – a level of flexibility and simplicity is required to deal with risks as they emerge in operational timeframes;
- The AEMC in collaboration with stakeholders, undertakes robust analysis such as scenario modelling and gap analysis to stress test current frameworks and procedures;
- The costs and benefits of potential changes (or new mechanisms) to rectify identified gaps in system security frameworks needs to be assessed. This will ensure that the benefits of any reform outweigh the costs, ensuring the lowest cost for consumers over the longer term. These changes should also be tested against a range of potential future scenarios or events to ensure they are effective in managing system risks, as well as cost-efficient;
- Any potential changes to existing system security frameworks need to adequately address the changing risk profile of the power system, including the emergence of indistinct, credible system security risks;
- A resilience framework that facilitates strategic planning decisions and incorporates design phase resilience measures is likely to reduce vulnerabilities, lower the extent of impacts, and provide quicker recovery following a power system disturbance. A resilience framework which also support Australian Energy Market Operator's (AEMO) development of its Integrated System Plan (ISP) and Network Service Providers (NSPs) planning processes, while retaining a robust and transparent cost-benefit framework should be considered.

Energy Networks Australia provides more detail in the Attachment.

Energy Networks Australia appreciates the opportunity to comment on this discussion paper and looks forward to engaging with the AEMC and other stakeholders further on this important project.

If you would like to discuss this submission, please feel free to contact Verity Watson, vwatson@energynetworks.com.au.

Yours faithfully

Andrew Dillion

**Chief Executive Officer**

# Attachment

***The assessment framework***

Energy Networks Australia is generally supportive of the assessment framework set out in the AEMC's discussion paper. While all the principles identified are reasonable for this review, it is likely that certain principles bear a higher level of relevance in relation to system security frameworks and procedures. More specifically:

- Flexibility – both in definitions within and application of frameworks and procedures.
- Simplicity (or avoiding increased complexity) in the application of frameworks and procedures.

It is important that system security frameworks and procedures and risk management tools are flexible in their approach. This allows market participants – including the AEMO and NSPs – to adequately and effectively respond to power system needs as new and existing risks change and evolve.

It is also important that any changes or clarifications made by the AEMC avoid increasing the complexity of system security frameworks and procedures which are already complex. Market participants need to be able to respond to system security risks in a timely manner, especially when these risks emerge in the operational timeframe (i.e. during the survival and recovery phase following a system event or disturbance).

Increased complexity and procedural timeframes will increase risk as it reduces the ability of operational measures to efficiently withstand a disturbance or prevent a cascading power system failure within the NEM. This in turn increases the likelihood that emergency management arrangements are needed, likely resulting in sub-optimal price, reliability and security outcomes for consumers.

***Scenario modelling and gap analysis required prior to changes being made***

Prior to changes being made, it is important that work is undertaken to identify the boundaries of 'events' considered within the scope, as well as the gaps in which the current regulatory framework fails to address current and emerging security risks.

Energy Networks Australia recommends the AEMC, in collaboration with other regulatory bodies, including AEMO and the Australian Energy Regulator (AER), consumers, market participants and NSPs, undertake robust analysis such as scenario modelling and gap analysis to stress test current frameworks and procedures. This will help identify:

- The boundaries of 'events' and risks considered within scope of system security frameworks. This will help to provide clarity over the interpretation of definitions with system security frameworks, such as contingency classifications.
- Gaps in current system security frameworks whereby current or emerging security risks, issues or concerns are not being addressed effectively, or at all.
- Potential changes to current frameworks and procedures (or the introduction of new mechanisms) to rectify identified gaps.
- The costs and benefits of potential changes (or new mechanisms) to rectify identified gaps in system security frameworks. This will ensure that the benefits of any reform outweigh the costs, ensuring the lowest cost for consumers over the longer term.

Continued collaboration across the industry on these issues will help to ensure understanding and interpretations of the National Electricity Law (NEL) and Rules (NER) are consistent, as well as help to avoid sub-optimal outcomes for consumers over the longer term.

### *Managing credible indistinct risks – reclassification of contingent events*

Energy Networks Australia agrees with the AEMC that clarity of contingency definition is required if it is to capture diffuse events.

We support potential changes to existing system security frameworks to ensure they adequately address the changing risk profile of the power system, including the emergence of indistinct, credible system security risks. In particular, adjusting the criteria for a secure state to account for and manage against the consequences of different forms of short-term supply-side variability, such as but not limited to increased generation variability due to distributed weather conditions.

Greater flexibility in AEMO's ability to respond to heightened risks will help to support its role in maintaining the system in a secure state as security risks arise and evolve. However, this flexibility would need to be balanced against any additional complexities it introduces and ultimately any additional costs ultimately borne by consumers

Decisions by AEMO and NSPs to protect against system security risks need to be made efficiently and in a timely manner. This is especially true for mechanisms that are undertaken during the operational timeframe, and as such, are time sensitive. Any proposed changes should avoid increasing complexities and be cautious about introducing complex statistical models to calculate supply variability that are open to different interpretations of the appropriate response. Changes need to be practical and reasonable given the timeframe available to respond to these emerging risks.

As these sorts of heightened risk circumstances are not everyday occurrences, but can develop quite rapidly, it is likely that relatively simple, deterministic criteria and actions, that can be assessed and implemented quickly, will provide significant benefit at relatively modest cost.

As mentioned above, to ensure any changes are in the long term interests of consumers, these changes should also be tested against a range of potential future scenarios or events to ensure they are effective in managing system risks, as well as cost-efficient.

### *Enhancing network resilience is needed to protect the power system into the future*

Increasing the resilience of critical power infrastructures to high impact, low-probability (HILP) events, such as extreme weather conditions, is becoming increasingly important for maintaining a reliable and secure power system. Changes in weather patterns, shifts in the generation mix, and evolving consumer expectations have meant that further consideration beyond the traditional reliability principles of adequacy of supply is needed.

Planning the network into the future requires power infrastructure that can maintain high levels of performance under the most "common" outage reliability event, but is also resilient to less frequent, severe and prolonged events[1]. Resilience in power system infrastructure is likely to reduce vulnerabilities, lower the extent of impacts, and provide

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[1] Blockley, D., Agarwal, J., Godfrey, P. 2012, *Infrastructure Resilience for High-Impact Low Chance Risks*, ICE Proceedings Civil Engineering, 165(CE6), 13-19, November, available at: https://www.researchgate.net/publication/259363879_Infrastructure_Resilience_for_High-Impact_Low_Chance_Risks

quicker recovery following an HILP event.[2] It also includes the flexibility to adapt to present and future conditions.

The electricity power system plays a vital role to the performance a range of other critical infrastructure that underpin the essential services needed to maintain the social wellbeing and economic prosperity of the community, including transportation systems, water and wastewater systems, and communication services.

### *AEMC's proposed measures to increase resilience*

Energy Networks Australia supports the AEMC's consideration of mechanisms to provide increased power system resilience.

We understand that the AEMC is considering the term resilience in reference to the ability of the power system to contain and manage the risk of a cascading (uncontrolled) failure following a disturbance event, particularly a HILP event. That is, resilience in relation to the system security of the power system whereas other uses of the term resilience, such as in reference to the reliability of the power system, are considered out of scope.[3]

It is also important to note that power system resilience mechanisms can be categorised into three distinct categories which correlate to where in the investment lifecycle they are made:

1. Proactively investing for resilience during the planning and design phase, which is currently more difficult under the current framework given the simplistic $probability \times consequence$ approach that is applied when attributing the benefits of mitigating HILP events, particularly those classified as emergent risks[4]. As noted by the AEMC, an example of this is transmission line route diversity which protects the network against extreme weather events that may affect a specific geographic location. Other examples include amendments to transmission tower standards to strengthen them to better withstand higher wind speeds or increasing the standard rating of equipment to withstand higher temperatures.
2. Those that can be done in the Operational timeframe, for example scheduling more Frequency Control Ancillary Services (FCAS) and contingency reclassification. Other mechanisms include enhancements to coordination and communication during the response and recovery phase of an outage event.
3. Investing in resilience retrospectively, that is changes made or additions added following infrastructure being built. These are likely to be limited to smaller, incremental investment decisions. For example, control schemes investments such as sensing equipment and control operations that allow transmission network service operators to identify and isolate damaged parts of the network and re-route power flows to non-damaged areas, providing for a more effective and timely response to a system disturbance.

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[2] Panteli, M., Mancarella, P. 2015, *A Stronger, Bigger or Smarter Grid? Conceptualizing the Resilience of Future Power Infrastructure*, May, IEEE Power and Energy Magazine, Manchester, United Kingdom, available at: https://www.research.manchester.ac.uk/portal/files/21327680/POST-PEER-REVIEW-NON-PUBLISHERS.PDF
[3] AEMC, *Mechanisms to enhance resilience in the power system - Review of South Australia Black System Event*, Discussion paper, 15 August 2019
[4] Hillson, D 2014, *How to manage the risks you didn't know you were taking*, 2014 PMI Global Congress Proceedings, available at: http://www.risk-doctor.com/index.php?content=publications-papers_general&include=yes&ddResourceType=&pstart=10#bs

While measures used to improve infrastructure resilience at any stage of the lifecycle will improve the power systems overall ability to resist, respond and recover to a system security event, the optimal time to maximise overall infrastructure resilience is likely to be during the planning and designing phase.[5]

The AEMC proposed measures to building power system resilience is narrow and focused only on those measures within the operation phase and forgoes significant opportunities for resilience in the planning and design phase. While these measures may have some benefit, they are limited in their effectiveness and ability to protect against or effectively recover from a power system event. For example, the proposed framework for monitoring the interconnector flow against a standard will increase the transparency of emerging risks, however this does not directly manage the risk itself.

Energy Networks Australia recommends that the AEMC broadens its focus to consider proactive resilience measures, that is; measures that occur within the design phase of the network. This will improve the level of resilience and system security capabilities through the facilitation of strategic planning decision and improved grid integrity to limit the downside risk of an outage and provide for faster restoration of the system. As acknowledged by the AEMC, these measures are also likely to improve the level of reliability within the power system[6], reducing the reliance on emergency management tools and better ensuring that the most optimal price, reliability and security outcomes for consumers is achieved.

A resilience framework that facilitates strategic planning decision, including consideration of measures to improve infrastructure resilience at the design phase, would also support AEMO's development of its Integrated System Plan and NSP's planning processes, whilst retaining the robustness and transparency of the RIT process should be considered.

***Approaches to calculating the value of resilience in the power system***

Energy Networks Australia supports a rigorous cost-benefit framework, however we note the RIT framework is limited in its ability to evaluate benefits which are difficult to quantify including reputational, system security benefits and the insurance value of avoiding (or reducing the impact) of HILP events.

There remains a gap in the current regulatory framework to economically justify incremental investments in power system networks for greater power system resilience during the planning and design phase. This includes difficulties in assessing these HILP style events and appropriately measuring the value of resilience mechanisms which are vital inputs into current regulatory planning and approval processes, including regulatory investment tests.

More specifically, the simplistic probability × consequence approach that is applied when attributing the benefits of mitigating indistinct or HILP events is not considered an appropriate approach for measuring resilience as it does not allow for consideration of customer's risk aversion. That is, customer's willingness to pay above what is economically justified to avoid or better protect against large and catastrophic outcomes.

[5] NSW Government 2018, *NSW Critical Infrastructure Resilience Strategy*, NSW Department of Justice, 18 September 2018
[6] AEMC, *Mechanisms to enhance resilience in the power system - Review of South Australia Black System Event*, Discussion paper, 15 August 2019

Energy Networks Australia recommends that the AEMC considers alternative approaches for valuing and facilitating power system resilience mechanisms, for example an insurance value approach which is applied in other jurisdictions such as the United States of America[7,8]. This is expected to better reflect the wider economic costs, as well as consumers' willingness to accept or avoid certain extreme risks.

Further, the severe consequences of HILP events largely fall outside of the boundary of the economic evaluation framework in the NEM. For example, network businesses are unable to value the wider economic costs, such as travel and transport disruptions associated with a system disturbance following a HILP event.

Given the interconnection in the power system, as well as an increasingly interconnected and energised society, Energy Networks Australia recommends robust consultation of any changes to enhance resilience frameworks.

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[7] FERC 2018, *Grid Resilience in Regional Transmission Organizations and Independent System Operators*, 8 January, Media Release
https://www.ferc.gov/CalendarFiles/20180108161614-RM18-1-000.pdf
Definition is "The ability to withstand and reduce the magnitude and/or duration of disruptive events, which includes the capability to anticipate, absorb, adapt to, and/or rapidly recover from such an event." (Clause 23, page 12).
[8] The Brattle Group 2018, *Recognizing the Role of Transmission in Electric System Resilience*, 9 May