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Thursday, 5 September 2024

Ms Merryn York
Executive General Manager System Design
Australian Energy Market Operator
Lodged via email: futureenergy@aemo.com.au

Dear Ms York

Consultation on AEMO's Transition Plan for System Security

Transgrid welcomes the opportunity to respond to the Australian Energy Market Operator's (AEMO) consultation on the Transition Plan for System Security (within the Engineering Roadmap FY2025 Priority Actions Report).

Transgrid operates and manages the high-voltage electricity transmission network in NSW and the ACT, connecting generators, distributors and major end users. We have an important role in managing one of the key parts of Australia's National Electricity Market (NEM) as it transitions to increasing levels of renewables generation.

As the share of renewables grows, the power system is becoming more distributed, dynamic and unpredictable, and increasingly complex. In light of this changing landscape, Transgrid requires an uplift in its capabilities and capacity to plan, manage and operate the NSW power system into the future. Transgrid articulated the need to uplift tools, systems, people and process within the 'operability' pillar of its System Security Roadmap.

Through Transgrid's 2023-2028 Revenue Proposal, Transgrid requested additional capex and opex to uplift its Operational Technology tools and systems in the control room and across Network Planning, Operations and Asset Management. Transgrid also requested additional opex for increased additional headcount and training to undertake more complicated and time-consuming planning, operations and asset management studies required to plan, operate and manage future power system stability and security. The Australian Energy Regulator (AER) did not accept Transgrid's opex request (for headcount and training) and deferred its decision on Operational Technology tools and systems to a contingent project application process (currently ongoing).

Transgrid supports increased collaboration between AEMO, TNSPs and DNSPs. Transgrid values AEMOs recognition throughout multiple public documents (Integrated System Plan, Electricity Statement of Opportunities, Engineering Roadmap) that TNSPs and DNSPs will need to invest in additional capacity and capability to plan and operate the power system into the future. In the FY2025 Priority Actions Report, AEMO states that *"While ARENA's funding is helping achieve the resourcing levels required to support AEMO's Engineering Roadmap implementation efforts, a similar uplift in effort will be required by transmission and distribution NSPs to manage the increasing engineering efforts needed from their businesses…. the resourcing and efforts required for key stakeholders to progress through upcoming*

transition milestones is new, different, and in addition to current activities." (AEMO, 2024, Engineering Roadmap, FY2025 Priority Actions Report p13)

Transgrid sees limited options for cost recovery to undertake key supporting activities for transition milestones, which AEMO identifies as *"new, different, and in addition to current activities"*. Transgrid identifies a key role that AEMO could play in supporting TNSPs to access funding to undertake studies necessary to ensure a successful implementation of the Transition Plan for System Security. Transgrid looks forward to working with AEMO to identify what types of studies are essential for TNSPs to undertake and how AEMO could trigger the necessary cost recovery for TNSPs. Example of studies Transgrid recommend that AEMO and Network Service Providers (NSPs) collaborate on are shown in Appendix A.

Transgrid has identified an urgent need to uplift tools and systems in our control room and across Network Planning, Operations and Asset Management. Transgrid is undertaking a comprehensive, and independent review by EPRI and GHD, with input from AEMO and other NSPs, to determine the changes required in Transgrid's control room and operational planning tools. The review supports the need for staged uplifts to Energy management systems (EMS) and SCADA, outage management, operational forecasting, situational awareness and decision-making related systems, and training simulation to list a few areas. We believe that further collaboration and support from AEMO will help facilitate the delivery of these essential enhancements within Transgrid.

We look forward to further engagement throughout the Engineering Roadmap and Transition Plan for System Security processes. If you have any questions, please feel free to contact me or Jenna Connellan at Jenna.Connellan@transgrid.com.au.

Yours faithfully,

Robbie Aherne

Robbie Aherne

General Manager, System Resilience
Transgrid

Appendix A – Additional studies to facilitate the energy transition

Several areas of study that Transgrid sees as important to progress, in collaboration with AEMO and other TNSPs, include (in no particular order):

- Establishing an improved and consolidated platform for planning and operational data, including model exchange between all the key stakeholders in NEM planning and operations, including AEMO, NSPs and EnergyCo to improve the efficiency and accuracy of network modelling by all NEM parties. This may be in the form of a step change to the AEMO modelling platform (AMP).
- Detailed PSCAD studies on the performance of grid-forming batteries for stable voltage waveform, fault current and synthetic inertia.
- Wide area PSSE, PSCAD and small signal stability modelling (SSAT, Dynspack or Mudpack) of interactions between multiple regions with renewable generators, batteries, synchronous machines and their impact on the interconnector modes of stability.
- System stability challenges as each coal unit exits the system and the replacement of these units with batteries and synchronous condensers, which have much less frequency control capability, concurrently in all the states.
- Generator response during faults resulting in system over-voltages up on fault recovery that could lead to repetitive fault ride through behaviour of inverter-based generators causing system instability.
- Investigation of protection system operation in the absence of large amount of fault current contribution from conventional synchronous generators and the functioning of different types of protection equipment with grid-forming batteries.
- Minimum demand studies, including, voltage control strategies to manage through low demand periods, including system impact when switching large static reactive plant.
- System restart as synchronous generators leave the system, including the challenges produced by the reduction in synchronous generation such as the energisation of long transmission lines and large transformers, and the role of synchronous condensers and batteries for system restart in the system of the future.
- Ability of the network to withstand or avoid cascade failure in the event of non-credible events, including double circuit line trips and multiple generator trip events.
- The challenges of developing effective under frequency response due to Consumer Energy Resources (CER).
- Continued refinement of Load Models to effectively determine the impact on inter-regional and intra-regional transmission capability due to stability limits. Particularly, accurate modelling of Consumer Energy Resources (CER), Inverter-based Resource (IBR) including loads (including large data centres) and other power electronic devices (including rectifiers, switched mode power supply and cyclo-converters) and Distributed Photovoltaics (DPV) shake-off in the event of frequency and voltage disturbances.

- Development of phasor measurement unit (PMU) based techniques to perform timely, efficient, and non-invasive inter-network testing, to replace the existing techniques.