

Evolving Transgrid's Operational Technology (OT) Capability

Addendum to April 2025 EPRI Report

June 2025

The Evolving Transgrid's Operational Technology (OT) Capability (ETOTC) – was originally produced by EPRI, primarily in 2024, following extensive engagement with Transgrid subject matter experts and impartial capability analysis. Since the report was compiled, 2025 has been a challenging year for global transmission system owner/operators. In 2025 there have been system blackouts in Chile, Spain, Portugal, North Macedonia and Honduras, among others, causing major socio-economic disruption. Spain/Portugal and Chile are countries with similar operational characteristics to Australia. Both are integrating high levels of solar generation on relatively well developed, but weakly interconnected transmission networks. While the exact causes of the blackouts are not yet reported officially, nor definitively attributable to renewable energy or weak networks, the salient point is that global electricity networks are facing increasing challenges to their reliability requirements, due to the previously unforeseen risks. Networks being pushed to the boundaries of their operating envelope is having very significant, unforeseen consequences for nation states.

For transmission system operators facing similar reliability challenges (such as the Australian TNSPs and system operator), the only way to mitigate the risks is to improve real time network data visibility, decision making and controllability. These capabilities rely exclusively on resource-intensive, high-reliability, operational technology software systems such as SCADA/EMS and other ancillary control room applications.

Given the long lead time for approvals, funding and procurement, it is essential that all transmission owner/operators invest and develop continuously in their OT system capability, with a forward time horizon of 5-7 years. To have systems capable of managing the 2030 network in place by 2030, it is essential to start the approvals, procurement, and design process as early as possible. To address 2030 network risks, technology needs to be updated some years in advance. In the April 2025 report that assesses the Transgrid operational capabilities, EPRI recommended:

- A generalized uplift in operational technology capability to address operability gaps, categorised in 10 different technology solutions
- The need for continuous investment in operational technology capability given the long lead times and uncertainty associated with long term electricity system operation.

Since the EPRI assessment and publication of the report there has been no major material changes to Transgrid's operational capability, except for an ongoing alarm data management improvement project and regular system maintenance. The alarm management project is an enabling capability uplift, structuring the data in the systems to reduce alarm volumes and prepare for future intelligent alarm processing solutions. There have been no operability improvements that require the conclusions drawn in the report to be updated at this point, except for an increase in urgency driven by global power system events.

The EPRI report recommended 10 technology solution initiatives with potentially three stages of capability enhancement to maturities that align broadly to the AEMO ISP scenarios. The broad recommendation was to aim to achieve Level 2 capability in the technologies before 2030 to meet the ISP step change scenario (deemed most likely).

Transgrid produced the System Security Roadmap Operational Technology Upgrades RIT-T Project Assessment Draft Report in May 2025 with a recommendation to proceed with a capability uplift program called - **Option 2 Proactive capability**.

Option 3 was ruled out after a market analysis, due to inherent uncertainty in the needs. Option 1, while offering a modicum level of capability uplift, would limit Transgrid's capability in two ways:

1. It would not go far enough to fully mitigate the potential reliability risks given likely growth patterns.
2. Given the nature of the systems and investment required, further additional investment in OT capability uplift would undoubtedly be required in the short-medium term, which would require additional rounds of consents, approvals, procurement, design development and deployment efforts which would potentially double the costs, introduce delays and uncertainty.

The Transgrid recommended Option 2 program aligns broadly with the EPRI ETOTC recommended technology capability uplift to Level 2 to meet the Step Change scenario.

Option 3 in PADR aligns with Level 3 in ETOTC. Option 3 is very ambitious and visionary proposals with nascent technology that will likely be required to operate the future network, but on a longer time horizon than 2030.

Option 1 in PADR and Level 1 in ETOTC has basic capability uplift but has in-built constraints and limitations in scope and investment that would almost certainly require inefficiently allocating additional piecemeal investment to address gaps in operability in the medium term.

The goal for all system operators is move to proactive management from reactive, addressing controlling and mitigating risks before they manifest. The technology proposals (such as upgrading SCADA/EMS, look ahead forecast, alarm management, wide area monitoring, outage management) are already proven globally and mature in multiple contexts, with multiple vendor options. This should de-risk investment decisions and ensure reasonable implementation timelines. The technology and the monitoring, decision making and controllability capability uplift Option 2 will bring to Transgrid, will dovetail well with AEMO's and interconnected TNSP and DNSPs functional obligations to manage the transmission network.

Based on information at hand at time of writing and the best forecasts available for future growth rates for electricity in NSW/ACT: EPRI can endorse Transgrid's recommended approach, to proceed with Option 2 for operational technology capability uplift as it is judicious and aligns well with the recommendations from the original Evolving Transgrid's Operational Technology (OT) Capability report.