



## TRR 2027-32

### Transmission Stakeholder Advisory Panel (TSAP)

Summary Notes for Deep Dive on Resilience

| Details                                                                                                                                                                                                                   | Members                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | AusNet Staff                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>1:30pm to 4:30pm Tuesday 20 May 2025</b></p> <p><b>In-person &amp; Online (MS Teams)</b></p> <p><b>Chair:</b> Tom Hallam</p> <p><b>Secretariat:</b> AusNet prepared draft, finalised by TSAP Chair Glenn Orgias</p> | <p><b>TSAP:</b></p> <ul style="list-style-type: none"> <li>Glenn Orgias, <i>TSAP Chair (joined online)</i></li> <li>Alex Crosby, <i>Multiworks</i></li> <li>Al Mills, <i>Squadron Energy</i></li> <li>Andrew Richards, <i>Energy Users Association Australia</i></li> <li>Gavin Dufty, <i>St Vincent De Paul</i></li> <li>Harshal Patel, <i>Beca</i></li> <li>Rebecca Xuereb, <i>Independent Customer advocate</i></li> <li>Richard Robson, <i>Citipower / Powercor / United Energy (joined online)</i></li> <li>Roy Unny, <i>Independent Customer advocate</i></li> <li>Tennant Reed, <i>AI Group (joined online)</i></li> <li>Thedora Karastergiou, <i>Jemena</i></li> </ul> <p><b>Other attendees:</b></p> <ul style="list-style-type: none"> <li>Paul Alexander, <i>Squadron Energy</i></li> <li>Tim Sheridan, <i>DEECA</i></li> <li>Jo Brownlee, <i>DEECA</i></li> <li>Diwaker Basnet, <i>DEECA</i></li> <li>Asif Choudhary, <i>VicGrid</i></li> <li>Sridhar Pulikanti, <i>VicGrid</i></li> </ul> <p><b>Apologies:</b></p> <ul style="list-style-type: none"> <li>David Markham, <i>Australian Energy Council (TSAP)</i></li> </ul> | <p><b>AusNet Staff:</b></p> <ul style="list-style-type: none"> <li>Tom Hallam, <i>GM Strategy &amp; Regulation (Transmission) – Acting Chair</i></li> <li>Martin Cavanagh, <i>GM Security &amp; Network Operations</i></li> <li>Laura Walsh, <i>GM Network Management (Transmission)</i></li> <li>Mario Ellaz, <i>GM Cyber Security</i></li> <li>Ross Dunbar, <i>Head of Strategy &amp; Partner Management</i></li> <li>Stuart Dick, <i>Manager Asset Management (Transmission)</i></li> <li>Michael Larkin, <i>Price Review Manager</i></li> <li>Lucy Holder, <i>Customer Engagement Manager</i></li> <li>Tushar Mehta, <i>Senior Planning Engineer</i></li> <li>Khai Ling Chan, <i>Strategy Lead</i></li> <li>Charlie Qin, <i>Regulatory Economist</i></li> <li>Emma Ferrie, <i>Engagement Specialist</i></li> <li>Nicholas Gathercole, <i>Business Graduate</i></li> </ul> <p><b>Observers:</b></p> <p>Australian Energy Regulator (AER)</p> <ul style="list-style-type: none"> <li>Pat Devlin</li> <li>Michelle Shi</li> <li>Kirk Zammit</li> <li>Dale Johansen</li> </ul> <p>AER Consumer Challenge Panel:</p> <ul style="list-style-type: none"> <li>Mike Swanston</li> <li>David Prins</li> </ul> |

## Key outcomes

The group was presented with a detailed overview of AusNet's resilience related capex proposal. This included AusNet's proposed investments in the following areas that will help AusNet's network withstand and recover from extreme events:

- Tower resilience program
- South Morang Terminal Station transformer replacement
- Digital investments

Attendees indicated that they were comfortable with AusNet's approach for its resilience investment.

## Purpose & Agenda

| AGENDA ITEM |                                                                                                                                                                                                                                                                                              | KEY QUESTIONS TSAP WERE ASKED | TIMING                                                                                                                                                                                                                             |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0           | <b>TRANSMISSION CONTROL ROOM TOUR</b> <ul style="list-style-type: none"><li>• Visit the Transmission Operations Centre (TOC)</li><li>• Learn about AusNet's role in maintaining network security</li></ul>                                                                                   |                               | 11:30am   75 mins                                                                                                                                                                                                                  |
|             | Lunch                                                                                                                                                                                                                                                                                        |                               | 12:45pm   45 mins                                                                                                                                                                                                                  |
| 1           | <b>WELCOME AND PROGRESS UPDATE</b>                                                                                                                                                                                                                                                           |                               | 1:30pm   10 mins                                                                                                                                                                                                                   |
| 2           | <b>INTRODUCTION TO RESILIENCE</b> <ul style="list-style-type: none"><li>• The different aspects of resilience</li><li>• Resilience challenges faced by AusNet and other networks</li><li>• Case study on the February 2024 storms</li><li>• In-progress work to improve resilience</li></ul> |                               | <ul style="list-style-type: none"><li>• Are there any other aspects of resilience we could be thinking about?</li><li>• Are we prioritising the right challenges to address in 2027-32?</li></ul> 1:40pm   40 mins                 |
|             | <b>RESILIENCE IN OUR TRR 2027-32 PROPOSAL</b>                                                                                                                                                                                                                                                |                               |                                                                                                                                                                                                                                    |
| 3           | <b>Tower resilience</b> <ul style="list-style-type: none"><li>• Recent experiences of tower failure</li><li>• Approach and proposed investment</li></ul>                                                                                                                                     |                               | <ul style="list-style-type: none"><li>• What level of investment in tower strengthening do you think most appropriate to include in our TRR proposal?</li></ul> 2:20pm   45 mins                                                   |
|             | Break                                                                                                                                                                                                                                                                                        |                               | 3:05pm   15 mins                                                                                                                                                                                                                   |
|             | <b>South Morang Terminal Station transformer replacement</b> <ul style="list-style-type: none"><li>• Identified need at South Morang Terminal Station</li></ul>                                                                                                                              |                               | <ul style="list-style-type: none"><li>• Do you support investing in resilience via the SMTS project?</li><li>• Do you support Option 1 (AusNet's proposed option), or do you think another option would</li></ul> 3:20pm   30 mins |

|                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                    |                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| <ul style="list-style-type: none"> <li>Approach and proposed investment</li> </ul>                                                                                     | <b>deliver better overall outcomes for customers?</b>                                                                                                                                                                                                                                                                              |                   |
| <b>Digital investments</b> <ul style="list-style-type: none"> <li>Overview of proposed investments</li> <li>Benefits of investment and impact on resilience</li> </ul> | <ul style="list-style-type: none"> <li>Do you understand how and agree that these digital investments support network resilience?</li> <li>Do you support us fully or partially justifying some of our digital expenditure with resilience benefits?</li> <li>What further engagement would you like to see on digital?</li> </ul> | 3:50 pm   30 mins |
| <b>4 WRAP-UP AND NEXT STEPS</b>                                                                                                                                        | <ul style="list-style-type: none"> <li>Anything else you'd like to raise?</li> </ul>                                                                                                                                                                                                                                               | 4:20pm   10 mins  |
|                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                    | 4:30pm end        |

## Summary of discussion

| Topics                            | Discussion points                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Welcome &amp; introduction</b> | <p>Tom Hallam, General Manager Strategy &amp; Regulation at AusNet, introduced himself as Acting Chair for today's meeting, with Glenn Orgias (TSAP Chair) joining online. Tom introduced the speakers from AusNet who would be presenting in the meeting.</p> <p>Tom highlighted that AusNet is working through the projects that have been outlined in the draft Victorian Transmission Plan (VTP) and are looking for areas where the VTP might impact AusNet's draft TRR 2027-2032 proposal.</p> <p><b>Discussion</b></p> <ul style="list-style-type: none"> <li>Nil</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Introduction to resilience</b> | <p>Laura Walsh, General Manager Network Management (Transmission) at AusNet provided an overview of the resilience challenges faced by AusNet and other networks. Laura started this by defining network resilience, as the network's ability to withstand and recover from an extreme hazard event that is likely to lead to a prolonged outage, and highlighted how this differs from network reliability, which is out of scope for this deep dive workshop.</p> <p>Laura shared that at a high level, AusNet is proposing to increase it spend for resilience because:</p> <ul style="list-style-type: none"> <li>The Victorian network is facing increasing external threats, including climate change-driven weather events.</li> <li>The network is becoming weaker and less able to respond to instability with the shift towards renewable energy.</li> <li>Regulators are placing greater importance on resilience.</li> </ul> <p>Martin Cavanagh, General Manager Security &amp; Network Operations at AusNet spoke through recent events on the AusNet and other transmission networks, including the 13 February 2024 storm that resulted in towers collapsing, line faults, loss of reserve and islanding on AusNet's transmission network. Martin noted that the network is increasingly experiencing extreme events that are impacting the network, and the increasing risk of a widespread 'system black' outage event.</p> |

Michael Larkin, Price Review Manager at AusNet spoke on how the Australian Energy Regulator (AER) has regulated other Transmission Network Service Providers (TNSPs) investment in resilience to date.

Tom spoke through AusNet's Prevent > Detect > Respond > Recover framework and how the areas AusNet is planning to invest in resilience align to the framework.

## Discussion

- **Network vulnerability and the transition to renewables:** An attendee asked for clarification around the network becoming weaker and more vulnerable as it shifts towards renewables, noting that there could be a dual component to the vulnerability in resilience and reliability. AusNet responded agreeing that in the past it would have looked at the network becoming weaker based on reliability associated with condition. AusNet furthered by sharing that extreme events could impact the network even when it's in good condition, which is what the resilience spend is focused on.
- **Distinguishing resilience and reliability spending:** An attendee asked how AusNet differentiates between spending on reliability versus resilience. AusNet responded by sharing that reliability spending typically involves replacing or repairing assets due to poor condition, while resilience spending is aimed at addressing external threats - such as cyberattacks or severe weather events that can damage the network regardless of its condition. AusNet confirmed resilience spend is still measured through value of load at risk and is still an economic analysis.
- **Clarifying definitions and standards for resilience:** An attendee raised the importance in the language around defining resilience. The attendee suggested that AusNet should specify what constitutes a "major" or "extreme" outage event, including the parameters that determine when such thresholds are met. The attendee noted the existence of a reliability standard and proposed that developing a similar standard for resilience could be valuable. AusNet clarified that the resilience projects it will be discussing are either:
  - replacing assets that are fine from a condition point of view, but need to be made stronger
  - an investment in its ability to respond quicker after an event that impacts the network
  - an added benefit added over an existing replacement of an aging asset.
- **Inclusion of lost generation in economic analysis:** An attendee asked if AusNet includes the value of lost generation in its cost benefit analysis when valuing energy at risk. AusNet responded by saying that the economic analysis for most of its projects will consider the market benefits but noted that it will differ depending on project circumstances.
- **Resilience investment metrics and risk assessment:** There was discussion around the metrics AusNet will use to standardise its investment in resilience, as well as AusNet's risk assessment when investing in resilience for the transmission network. AusNet shared that it is using the Value of Customer Reliability (VCR) and the standard valuations of risk in the cost benefit analysis. A panel member asked if AusNet could go through its risk assessment in a future TSAP meeting to help the panel understand the value of energy at risk and how that will change moving forward. AusNet shared that it will take the TSAP through its risk assessment in an upcoming meeting.
- **Customer impact and future risk considerations from extreme weather events:** An attendee provided feedback on AusNet's slide outlining major tower incidents across Australian transmission networks since 2020, along with their primary causes (e.g. bushfire, wind, landslide). The attendee recommended including two additional columns to provide:
  1. The impact of each incident on customers, including the cost and timeframe.

2. Anticipated changes in response to evolving environmental conditions, noting that what wasn't a problem previously could become one in the future.

- **Impact of household energy storage on resilience modelling:** An attendee asked whether the increasing use of household energy storage, such as batteries linked to solar systems, electric vehicles, and appliances impacts AusNet's resilience modelling. The attendee furthered asking if this reduces the impact of power outages in the models, or if it's treated as a separate way people are improving their own resilience, noting that such developments may be uneven and difficult to observe. AusNet responded that AEMO is forecasting the uptake of such technologies, and AusNet uses these forecasts to support its project planning. AusNet also noted that the Value of Customer Reliability (VCR) reflects the current mix of technologies.
- **Highlighting benefits of resilience investments for all customers:** An attendee suggested that AusNet clearly demonstrate how small end consumers will benefit from resilience investments such as experiencing fewer and less disruptive load shedding events. The attendee emphasised the importance of highlighting these kinds of consumer-focused metrics.
- **AEMO's 2024 Tower Failure Report Recommendations:** An attendee asked if any of the 19 recommendations that came out of the 2024 AEMO report on tower failures impacted AusNet. AusNet responded sharing that two of the recommendations were targeted towards TNSPs, requiring them to assess resilience risk and incorporate those findings into its asset management plans, both of which AusNet is presenting on in this meeting.
- **Clarifying resilience investment across transmission and distribution networks:** An attendee noted that AusNet's role in both transmission and distribution networks offers a unique opportunity for coordination and asked how duplication of resilience investments is avoided. The attendee furthered asking if AusNet sees greater value in resilience investment for transmission or distribution. AusNet responded that most widespread customer outages stem from the distribution network, which tends to have more localised impacts. In contrast, transmission network resilience relates to broader, system-wide events like system blackouts. AusNet clarified that there is minimal overlap between the two, ensuring customers are not being charged twice for the same resilience outcomes.

## Tower strengthening program

Stuart Dick, Manager Asset Management (Transmission) at AusNet introduced AusNet's proposal for tower strengthening on the transmission network. He highlighted that tower collapses are not uncommon, with 12 tower collapse events since the 1950s, noting that in the last 25 years, there has been a tower collapse event every 6 years. Stuart shared that thunderstorm cells and convective downdrafts are the main causes of tower collapse.

Stuart noted two studies:

- a) A weather study completed recently by the Bureau of Meteorology, modelling the likelihood of future convective downdrafts. It showed a strong correlation between tower collapse and extreme weather events for all but one event, making for good modelling, but noted AusNet doesn't have enough data yet to calibrate the model or give detailed resolution (so are likely missing localised events), or to make accurate predictions.
- b) A tower strength assessment, modelling likelihood of an event exceeding a tower's design life.

Stuart provided an overview of AusNet's economic analysis it uses to justify tower strengthening. Stuart shared AusNet's proposal to take a 'weakest link' approach where AusNet progressively strengthens the weakest towers first, (as far as overall economic risk reduction will allow) in order to raise overall line resilience.

Stuart presented 3 options for AusNet's tower strengthening program to include in its draft TRR proposal for attendees to consider what would be most appropriate:

- Option 1: involved upgrading towers to an economic level to withstand 1 in 100 year events, with some shorter lines able to withstand 1 in 1000 year events, which would involve strengthening 179 towers.
- Option 2: involved upgrading towers to current standard to withstand 1 in 400 year events, which would involve upgrading 674 towers.
- Option 3: involved upgrading towers to a higher standard to withstand 1 in 1000 year events, which would involve upgrading 784 towers.

## Discussion

- **Tower strengthening and structural weak points:** An attendee asked what is involved in strengthening a tower. AusNet responded by saying it involved adding additional members either in thickness or size, or additional bracing. The attendee furthered by asking if there is a consistent weak point across all towers. AusNet responded clarifying that all towers have a weak point, but it depends on the design of the tower as to where the weak point is. AusNet shared that when a tower fails, it is due to being overstressed.
- **Causes of tower failures:** An attendee asked if condition has been a contributing factor in the tower collapse events. AusNet responded by confirming that condition hadn't played a part in the tower collapses. AusNet furthered sharing that most tower collapses have been caused by extreme overstress, as verified by the independent safety regulator. AusNet shared that design standards have changed and since 2010, new towers are being designed to withstand thunderstorm downdraft events.
- **Current tower design standards and future-proofing infrastructure:** An attendee asked whether the towers that collapsed during those events might have withstood the conditions if they had been upgraded to meet current design standards. AusNet responded by saying that studies have shown that in the Anakie tower collapse event, winds reached speeds of up to 180km per hour, which is beyond what current standards are built to withstand. Another attendee asked out of the 12 tower collapse events in the last 50 years, how many would have still failed if the towers were strengthened to meet current standards. AusNet responded by saying that strengthening the towers would have reduced the likelihood of them collapsing. There was further discussion on the impacts of the cost benefit analysis to strengthen towers to the point where they can withstand winds seen in the Anakie event, which is classified as a 1 in 5000-year event. An attendee raised that given the implications of climate change, would it be worth AusNet building towers right the first time rather than needing to rebuild them if they collapse due to very extreme weather events. Another attendee asked whether the existing standard needs to be updated, given that the tower reinforcement program is intended to reduce the need for full tower rebuilds. There was further discussion around AusNet being constrained by existing standards, which limits their ability to strengthen towers beyond the determined requirements.
- **Tower assessments and design standards for extreme weather:** An attendee asked whether AusNet considers the age of suspension towers when conducting detailed strength assessments along priority lines. AusNet responded that it focuses on the condition of the towers rather than their age, noting that in the example analysis, all towers were in reasonable condition. Another attendee asked what type of weather events older towers were originally designed to withstand. AusNet explained that while new towers are being strengthened to handle 1-in-1000-year events, older towers were typically designed for around 1-in-500-year events.
- **Wind speed standards and the impact on tower design:** An attendee asked how often the average recurrence versus wind speed is reviewed, and if it is heading in a particular direction. AusNet responded by saying it's reviewed every 10 years. There was further discussion on the importance of the windspeed over the average recurrence interval, as it's the windspeed that ultimately impacts the towers. AusNet noted that it must align with the current Australian standards to ensure consistency and avoid arbitrary decision-making.

- 
- **AusNet's prioritisation approach to strengthen lines:** There was discussion about AusNet prioritising the reinforcement of transmission lines where failure would have the greatest impact. An attendee asked whether this approach aligns with past tower failures and changing weather patterns - specifically, whether the highest-consequence lines are also the most likely locations for future tower collapses. AusNet responded by saying that the highest consequence lines are determined on the basis of the market impact if they fail, rather than if the line has failed before.
  - **Estimating costs of tower strengthening:** An attendee asked how AusNet has estimated the cost of strengthening its towers. AusNet responded by sharing that its estimates are based on its most recent tower strengthening project.
  - **IoT Investment for environmental monitoring:** An attendee suggested that AusNet consider using Internet of Things (IoT) devices to enhance environmental monitoring, build long-term datasets, and improve early detection of risks like high wind gusts. AusNet responded that while they had discussed this with the Bureau of Meteorology, deploying such devices across the network would be challenging due to the difficulty in determining optimal locations, essentially requiring coverage everywhere. The conversation also explored whether investing in IoT monitoring would be more beneficial than strengthening towers. AusNet acknowledged that while monitoring could improve data visibility, it wouldn't prevent tower collapses. When asked if better data could lead to more accurate predictions, AusNet noted that it would take years of data collection to reach that point.
  - **Measuring effectiveness of resilience investments:** An attendee asked how AusNet evaluates the effectiveness of its resilience investments. AusNet responded that effectiveness is primarily measured by a reduction in the frequency of tower collapses. However, AusNet noted that this assessment occurs over a long timeframe, as the investments are aimed at preparing for rare but high-consequence events.
  - **Deliverability of tower strengthening options:** An attendee asked whether AusNet could realistically strengthen the number of towers proposed in the three options within the 2027–2032 timeframe. AusNet responded that it has not yet completed its deliverability analysis, which will also need to consider the implications of the Victorian Transmission Plan. Another attendee expressed concern about the feasibility of AusNet delivering Option 2 (674 towers) or Option 3 (784 towers) within the proposed period.
  - **Tower strengthening beyond the 5-year regulatory period:** An attendee asked whether AusNet's tower strengthening program would extend beyond the 2027–2032 regulatory period. AusNet responded that it plans to continue identifying the weakest points on each line and assessing whether strengthening them is economically justified. Another attendee shared that Distribution Network Service Providers in New South Wales have had a successful approach where they have staged upgrades over the next 3 regulatory periods.
  - **Implications of the Victorian Transmission Plan on Tower Strengthening:** An attendee raised that they would find it helpful to see what the implications of the Victorian Transmission Plan will have on AusNet's 3 proposed options for tower strengthening, including whether any of the proposed upgrades would be addressed through that plan. AusNet responded that it will cover this with the TSAP in June.
  - **Optimising resilience investments:** An attendee asked how AusNet evaluates resilience investments holistically, comparing the value of major projects against tower strengthening and other initiatives to determine where funds would be most effectively allocated to improve overall network resilience. AusNet responded by saying that the resilience expenditure is laid over reliability programs, but is justified with new benefits and is not double counting benefits from the two programs.
  - **Lifespan of towers:** An attendee asked whether resilience investments would extend the life of transmission towers. AusNet responded that asset life extension is not the primary objective, as towers in Victoria's low-corrosion environments already have
-



long lifespans. Instead, the focus is on preventing tower collapses during extreme events.

- **Different approaches to tower resilience:** There was discussion about the challenges some Australian networks face in justifying tower strengthening, given the unpredictability of extreme wind events. In contrast, an attendee highlighted that AusNet's approach is more targeted, using detailed tower-by-tower risk assessments to identify and reinforce weak points that would have the greatest impact if they failed.
- **Attendees comfortable with AusNet's tower resilience proposal:** Attendees shared that they were comfortable with AusNet's approach for resilience investment. AusNet shared it would add some sensitivity analysis to its resilience proposal, to test whether there are particular variables that are driving the results.

## South Morang Terminal Station Transformer Replacement

Tushar Mehta, Senior Planning Engineer at AusNet noted that AusNet has 14 major station projects it is proposing in the TRR 2027-2032, which all support reliability. Tushar provided a deeper overview of the South Morang Terminal Station 330/220kV transformer replacement project. Tushar noted that the way AusNet has chosen to deliver this specific project also provides resilience benefits as well as reliability benefits. Tushar shared that the South Morang Terminal Station plays a critical role in the reliability of Victoria's transmission system and already has business cases approved for upgrades, Stage 1 of which commenced in 2018.

Tushar shared that AusNet must replace deteriorating transformers to support reliability but have a choice to support resilience as well. Tushar presented three options for the transformer replacement project and shared that AusNet's preference is Option 1 as it delivers greater resilience benefits:

Option 1: Replace H1 and H2 with an in-service and hot spare transformer

Option 2: Replace H1 and H2 with an in-service and cold spare phase

Option 3: Deferred replacement with a cold spare phase

Stuart Dick shared an overview of AusNet's strategy in procuring and holding cold spares where it is economically efficient, to help support resilience. Stuart informed that the procurement lead time for power transformers is 12 – 36 months, which to mitigate risk to reliability and resilience, AusNet holds cold (and hot) spares for most types of power transformers. Stuart noted that as populations and energy at risk grow, AusNet's economic holding of spares is re-assessed.

## Discussion

- **Benefits of hot vs cold spare transformers:** An attendee asked for clarification if the benefits of having a hot spare vs a cold spare, is that a hot spare would:

1. be ready to go if one of the transformers fails,
2. allow AusNet to divert more power through South Morang to help the issue if something in the system fails

AusNet confirmed that this is correct. The attendee furthered by stating that the risk of a new transforming failing is very low and asked if AusNet has taken that into account in its calculations. AusNet confirmed that it has taken this into consideration and although the probability of this occurring is low, the consequence is still very high for South Morang Terminal Station given the criticality of this location (Vic-NSW interconnector into Melbourne).

- **Maintenance flexibility in spare transformer analysis:** An attendee asked whether AusNet's analysis accounted for the operational impact of maintenance, specifically whether having two units and a cold spare would reduce capacity during maintenance, compared to a setup where a hot spare allows full capacity to be maintained. AusNet responded that routine maintenance (RM) costs were included in the analysis both before and after replacement but noted that the value of this factor is minimal compared to the overall risk being addressed.



- **Clarification on project approval and enhancement for resilience:** An attendee asked (noting that the project has already commenced) if part of the upgrade was approved under the last TRR (TRR 2022-2027). AusNet confirmed and shared that the solution to enhance for resilience wasn't being considered during that time.
- **Accuracy of AusNet's cost estimate:** An attendee asked for clarification on AusNet's comment that a hot spare costs \$43 million more than a cold spare, but delivers \$66 million more benefit, noting that the \$66 million benefit figure appears only marginally higher than the \$43 million additional cost. The attendee furthered asked how much uncertainty exists in the \$66 million estimate, suggesting that even a small error could make it comparable to the lower-cost options. Additionally, the attendee asked whether the \$66 million is based on a six-week installation period for the cold spare. AusNet responded by sharing that those estimates are based on AusNet's experience during events of it taking less than 2hrs to switch in a hot transformer, versus taking up to 6 weeks to switch in a cold transformer. AusNet confirmed that transformer installation is an area that it has had experience in, so is confident in its estimates.
- **Greater benefits and flexibility of a hot transformer for this project:** An attendee asked if there is something AusNet can do to reduce the 6-week timeframe to switch in a cold-spare transformer, and if that would alter the analysis. AusNet responded by saying that there is more flexibility and benefits from a hot-spare transformer where it could potentially switch in the transformer in the future to make South Morang a three 330/220kV transformer station if there is a failure somewhere else on the network or to use the hot spare somewhere else in the network if required. An attendee noted that this would help in building an insurance mechanism and seems reasonable.
- **General agreement of this proposal:** There was general agreement from attendees that this proposal was reasonable.

## Digital investments in resilience

Ross Dunbar, Head of Strategy & Partner Management at AusNet, shared that 94% of AusNet's digital capex proposal for the TRR 2027-2032 will provide resilience benefits. Ross noted that AusNet will engage with the TSAP on its full digital proposal (including opex and non-resilience programs) in June. Ross shared that AusNet's digital resilience related programs are categorised into 3 groups:

- **Advanced Energy Management System:** to improve tools in AusNet's control room to uplift its forecasting, demand management and event response.
- **Asset Management and Field Enablement:** to uplift how AusNet maintains its assets, with better asset data, analytics and field solutions.
- **Cyber and end-of-life refresh:** to keep AusNet's digital systems secure and up-to-date.

Martin Cavanagh highlighted that operating the transmission network is becoming increasingly complex due to more frequent severe storms and the growing diversity in energy generation as the system transitions to renewables. Martin also noted that AusNet's investment in its digital capabilities has not kept pace with the rapid changes in the operating environment or with the investment levels of other Australian Transmission Network Service Providers.

Mario Ellaz, General Manager Cyber Security at AusNet, shared an overview of the AusNet's digital proposal that is targeted towards increasing resilience against cyber security risks and threats.

## Discussion

- **Digital twin modelling and future capabilities:** An attendee inquired about AusNet's efforts in digital twin modelling for assets. AusNet responded that while it currently has several database initiatives underway and is developing 3D models of terminal stations through its as-built work, it is still in the process of enhancing its capabilities in this area. AusNet expressed its aspiration to evolve towards a dynamic digital twin model, however, shared that similar to AI technologies, the market currently lacks mature solutions to support this vision. As a result, AusNet has deferred further

development in digital twin modelling to the next Transmission Revenue Reset (TRR) cycle, when the technology is expected to be more advanced.

- **Suggestions to include in digital proposal:** An attendee offered two key suggestions for AusNet to enhance its digital proposal in the TRR 2027-2032:
  - Link the proposed benefits more directly to strategic challenges such as increased outages, growing connection demands, and heightened control room activity. Clearly articulating how the digital tool addresses these issues would enhance the case.
  - Acknowledge the difficulty in evaluating digital investments from a traditional infrastructure perspective. It was suggested that benchmarking and involving committee members with digital expertise would help ensure a more informed assessment of costs.
- **Exploring digital technology adoption and regulatory expectations:** An attendee suggested it would be valuable to understand which digital technology have been successfully implemented by other networks and identify any gaps in AusNet's capabilities. The attendee continued asking if there are any regulatory expectations on how much AusNet should be investing in its digital capabilities. AusNet responded saying that in cyber security there is an overarching legislation framework that it must comply with. AusNet noted it received funding for a major cyber security upgrade in the last Transmission Revenue Reset (TRR), which has been successfully delivered. However, it emphasised that digital capability is a continually evolving area that requires ongoing development.
- **Telecommunications resilience and connectivity across the NEM:** An attendee shared their appreciation for the content presented and is comfortable with what AusNet is proposing in regard to resilience. The attendee continued by asking if AusNet is exploring alternative communication solutions if telecommunication networks fail during a major communications outage, or if its focus is on preventing such outages altogether. AusNet responded by saying that it's investing to maintain its telecommunications operational network, and are in the process of extending that network to South Australia and Tasmania so that the whole NEM will be connected via TNSP telecommunications.

## Wrap up and next steps

Tom Hallam outlined that the AusNet will be presenting its full capex proposal in the next engagement meeting scheduled in June. Tom raised that AusNet will be circulating a lot of reading material and will expect attendees to read through the materials and come to the session prepared with questions and comments, as AusNet will not be going through the content in the same level of detail as it did in this meeting.

Tom noted that the capex proposal which AusNet will present in June is not AusNet's final proposal and will not be seeking the panels endorsement at this stage. The goal for the session in June will be to get the panels thoughts and feedback on the capex proposal that AusNet will put into its draft TRR 2027-2032 proposal, which it will then engage more broadly with stakeholders and customers.

Tom then thanked attendees for their participation and closed the meeting.

## Action items

### Action from Deep Dive on Resilience

|                                                                                                                                                  | Assigned to     | Status      | Due            |
|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------|----------------|
| 1 AusNet to engage on it's risk assessment to help panel members understand the value of energy at risk and how that will change moving forward. | AusNet Reg Team | In-progress | September 2025 |

---

|   |                                                                                                                                                    |                      |             |           |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------------|-----------|
| 2 | AusNet to share what the implications of the Victorian Transmission Plan will have on it's 3 proposed options for its tower strengthening program. | AusNet Delivery Team | In-progress | June 2025 |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------------|-----------|

---