Transgrid

People. Power. Possibilities.

# Maintaining safe and reliable operation of Sydney East, Wagga 132 kV, and Dapto substations

RIT-T Project Assessment Conclusions Report

Date of issue: 22 August 2025

# Disclaimer

This suite of documents comprises Transgrid's application of the Regulatory Investment Test for Transmission (RIT-T) which has been prepared and made available solely for information purposes. It is made available on the understanding that Transgrid and/or its employees, agents and consultants are not engaged in rendering professional advice. Nothing in these documents is a recommendation in respect of any possible investment.

The information in these documents reflect the forecasts, proposals and opinions adopted by Transgrid at the time of publication, other than where otherwise specifically stated. Those forecasts, proposals and opinions may change at any time without warning. Anyone considering information provided in these documents, at any date, should independently seek the latest forecasts, proposals and opinions.

These documents include information obtained from the Australian Energy Market Operator (AEMO) and other sources. That information has been adopted in good faith without further enquiry or verification. The information in these documents should be read in the context of the Electricity Statement of Opportunities, the Integrated System Plan published by AEMO and other relevant regulatory consultation documents. It does not purport to contain all of the information that AEMO, a prospective investor, Registered Participant or potential participant in the National Electricity Market (NEM), or any other person may require for making decisions. In preparing these documents it is not possible, nor is it intended, for Transgrid to have regard to the investment objectives, financial situation and particular needs of each person or organisation which reads or uses this document. In all cases, anyone proposing to rely on or use the information in this document should:

1. Independently verify and check the currency, accuracy, completeness, reliability and suitability of that information
2. Independently verify and check the currency, accuracy, completeness, reliability and suitability of reports relied on by Transgrid in preparing these documents
3. Obtain independent and specific advice from appropriate experts or other sources.

Accordingly, Transgrid makes no representations or warranty as to the currency, accuracy, reliability, completeness or suitability for particular purposes of the information in this suite of documents.

Persons reading or utilising this suite of RIT-T-related documents acknowledge and accept that Transgrid and/or its employees, agents and consultants have no liability for any direct, indirect, special, incidental or consequential damage (including liability to any person by reason of negligence or negligent misstatement) for any damage resulting from, arising out of or in connection with, reliance upon statements, opinions, information or matter (expressed or implied) arising out of, contained in or derived from, or for any omissions from the information in this document, except insofar as liability under any New South Wales and Commonwealth statute cannot be excluded.

## Privacy notice

Transgrid is bound by the *Privacy Act 1988 (Cth)*. In making submissions in response to this consultation process, Transgrid will collect and hold your personal information such as your name, email address, employer and phone number for the purpose of receiving and following up on your submissions.

Under the National Electricity Law, there are circumstances where Transgrid may be compelled to provide information to the Australian Energy Regulator (AER). Transgrid will advise you should this occur.

Transgrid's Privacy Policy sets out the approach to managing your personal information. In particular, it explains how you may seek to access or correct the personal information held about you, how to make a complaint about a breach of our obligations under the Privacy Act, and how Transgrid will deal with complaints. You can access the Privacy Policy here (https://www.Transgrid.com.au/Pages/Privacy.aspx).

# Executive summary

We are applying the Regulatory Investment Test for Transmission (RIT-T) to options for maintaining the safe and reliable operation of Sydney East, Wagga 132 kV and Dapto substations. Publication of this Project Assessment Conclusions Report (PACR) is the final step in the RIT-T process.

Substation gantries are essential for the safe and reliable operation of the whole substation. The gantries at the Sydney East, Wagga 132 kV, and Dapto substations display evidence of corrosion, which, if unaddressed, may result in the failure of the steelwork, connection bolts, holding down bolts, or baseplates. The failure of the gantries may in-turn result in a loss of supply to end consumers, injury to staff and damage to other critical substation equipment. These events may also affect more than one system element at the same time, which would require significant time to rectify.

The purpose of this RIT-T is to examine and consult on options to address the corrosion of the existing gantries at the Sydney East, Wagga 132 kV, and Dapto substations and reduce the likelihood of prolonged and involuntary load shedding across NSW.

## Identified need: maintain safe and reliable operation of the Sydney East, Wagga 132 kV, and Dapto substations

The identified need for this project is to maintain the safe and reliable operation of the Sydney East, Wagga 132 kV, and Dapto substations and the broader transmission network in NSW by addressing the risk of gantry failure.

Condition assessments performed through our routine maintenance program has shown degradation in the condition of these gantries which will increase their risk of failure. Without intervention, other than ongoing business-as-usual maintenance, the assets are expected to deteriorate further and more rapidly. This will increase the risk of supply interruptions to our customers as well as safety, environmental and financial consequences.

Transgrid considers the proposed investment to be a ‘market benefits’ driven RIT-T as the proposed investment is for the purpose of maintaining network security at critical transmission substations, which is estimated to deliver significant benefits in terms of avoided involuntary load shedding (ie, compared to if nothing is done and corrosion worsens). The investment will also assist Transgrid to manage and mitigate safety risks that would otherwise arise from a failure in substation gantries[1].

While the purpose of the proposed investment has similarities to those made under a reliability corrective action identified need (ie, to avoid involuntary load shedding), the scope of the current reliability standards applicable to Transgrid do not extend to multiple failures of transmission network elements that would be expected to result from a failure of substation gantries (e.g., damage to and failure of multiple busbar sections at the same substation). It follows that the proposed investment is driven by a ‘market benefits’

[1]Transgrid manages and mitigates safety risk to ensure they are below risk tolerance levels or ‘As Low As Reasonably Practicable’ (‘ALARP’), in accordance with Transgrid’s obligations under the New South Wales *Electricity Supply (Safety and Network Management) Regulation 2014* and Transgrid’s Electricity Network

## No submissions received in response to the Project Specification Consultation Report

We published a Project Specification Consultation Report (PSCR) on 8 April 2025 and invited written submissions on the material presented within the document. No submissions were received in response to the PSCR.

## No material developments since publication of the PSCR

No additional credible options were identified during the consultation period following publication of the PSCR. In addition, no material changes have occurred since the PSCR that have made an impact on the preferred option.

## Credible options considered

We have considered that there is only one credible option from a technical, commercial, and project delivery perspective. This is summarised in Table E-1.

Table E-1 Summary of the credible options

| Option | Description | Capital costs ($M, 2024/25) |
|---|---|---|
| Option 1 | Steelwork replacement | 27.93 (± 25%) |

The preferred option is Option 1, as it has the highest positive weighted NPV result of the technically and commercially feasible options which have been considered at this stage of the RIT-T process. In consideration of the delivery requirements and the economic benefit NPV analysis for the need, its optimal timing is 2026/27.

It is expected that the replacement works will be undertaken in various phases between January to December in both 2026 and 2031. The total estimated capital cost is $27.93m ($2024-25). The breakdown of capital costs for each substation is listed below:

- Sydney East: $4.78m
- Wagga 132 kV: $8.04m
- Dapto: $15.11m

Two other options were considered but not progressed including on/offsite refurbishment and elimination of gantries by alternate methods. The reasons these options were not progressed are outlined in section 3.3 of this PACR.

## Non-network options are not expected to be able to assist with this RIT-T

We do not consider that non-network solutions can assist with meeting the identified need for this RIT-T. This is driven by the fundamental role that the identified gantries play in the transmission of electricity at a substation, the enduring need for the Sydney East, Wagga 132 kV, and Dapto substations.

## No submissions received in relation to non-network options

In the PSCR, we noted that we do not consider non-network options to be commercially and technically feasible to assist with meeting the identified need for this RIT-T. This is because any non-network solution for this need is expected to only add to the costs of this option without providing any net benefits. We invited parties to make written submissions regarding the potential of non-network options to satisfy, or contribute to satisfying, the identified need for this RIT-T. No submissions were received in response to the PSCR in relation to non-network options.

## The replacements are found to deliver strong positive net benefits

The figure below provides a breakdown of estimated benefits, showing almost all of the benefits are derived from avoided involuntary load shedding, while other avoided costs contribute relatively small amounts to overall gross benefits.

Figure E-1 Net economic benefits ($m, PV)


The table below summaries the net market benefit in NPV terms across the three scenarios, as well as on a weighted basis. The table shows that replacement of the assets is found to have positive net market benefits for all scenarios investigated. On a weighted basis, this investment is expected to deliver approximately $152.82 million in net market benefits.

## Conclusion

This PACR finds that replacement works on the identified assets is the preferred option. In particular, this involves the replacement of substation gantries at Transgrid's Sydney East, Wagga 132 kV, and Dapto substations, including the replacement of insulators and conductor fittings. By undertaking the replacement works, the life of the affected substation gantries at the Sydney East, Wagga 132 kV, and Dapto substations are expected to be extended by approximately 45 years.

Option 1 is found to have positive net benefits under all scenarios investigated and, on a weighted basis, will deliver $152.82 million in net economic benefits over the assessment period.

The estimated capital expenditure associated with this option is $27.93 million. The work is being executed in two stages:

- **Stage One:** Planning, design, development and procurement (including completion of the RIT-T) will occur between 2023/24 and 2025/26, while project delivery and construction will occur in 2025/26 and 2026/27. All works are expected to be completed by 2026/27.
- **Stage Two**: Planning, design, development and procurement will occur between 2028/29 and 2030/31, while project delivery and construction will occur in 2030/31 and 2031/32. All works are expected to be completed by 2031/32.

Routine operating and maintenance costs across both stages are estimated at approximately $91,298 per annum (in $2024/25).

All works would be completed in accordance with the relevant standards with minimal modification to the wider transmission assets. Necessary outages of affected line(s) in service would be planned appropriately in order to complete the works with minimal impact on the network.

## Next steps

This PACR represents the final step of the consultation process in relation to the application of the RIT-T process undertaken by Transgrid. It follows a PSCR released on 8 April 2025. No submissions were received in response to the PSCR.

The second step of the RIT-T process, production of a Project Assessment Draft Report (PADR), was not required as Transgrid considers its investment in relation to the preferred option to be exempt from that part of the process under NER clause 5.16.4(z1). Production of a PADR is not required due to:

- the estimated capital cost of the proposed preferred option being less than $54 million;
- we have identified in PSCR of our preferred option and the reasons for that option, and noted that we will be exempt from publishing PADR for our preferred option; and:
- we consider that the preferred option does not have a material market benefit (other than benefits associated with changes in voluntary load curtailment and involuntary load shedding).

Parties wishing to raise a dispute notice with the AER may do so prior to 20 September 2025 (30 days after publication of this PACR). Any dispute notices raised during this period will be addressed by the AER within 40 to 100 days, after which the formal RIT-T process will conclude. Further details on the RIT-T can be obtained from Transgrid's Regulation team via regulatory.consultation@transgrid.com.au. In the subject field, please reference 'Steelworks Remediation Program PACR'.

## Contents

# 1. Introduction

We are applying the Regulatory Investment Test for Transmission (RIT-T) to options for maintaining the safe and reliable operation of Sydney East, Wagga 132 kV, and Dapto substations. Publication of this Project Assessment Conclusions Report (PACR) is the final step in the RIT-T process.

More specifically, the gantries at the Sydney East, Wagga 132 kV, and Dapto substations display evidence of corrosion in recent inspections. The corrosion ranges from initial development to the commencement of loss of member thickness and, if unaddressed, may result in the failure of the steelwork, connection bolts, holding down bolts or baseplates. The failure of the steelwork may in-turn result in a loss of supply to end consumers, injury to staff and damage to equipment. The primary mode of failure of these gantries is from high wind exposure, which can result in multiple gantry failures. Given a multiple gantry failure, the asset restoration time would likely be three months which is deemed to be significant.

Further condition deterioration of the affected assets is due to corrosion. If left untreated, corrosion of some of the vital components of the steel towers could result in incidents such as conductor drop and gantry collapse.

Transgrid routinely assesses the condition of, and timing of ultimate replacement for its assets as part of its ongoing asset management processes. Asset condition assessments in the last few years have identified a number of corrosion related issues at the Sydney East, Wagga 132 kV, and Dapto substations and a plan has been developed to renew the affected steelwork. An allowance has been made for Stage One of addressing substation gantry corrosion in Transgrid's 2023-28 Revenue Proposal to the Australian Energy Regulator. We note that the remaining capital spend for Stage Two will be reflected in the next Revenue Proposal for the 2028-2033 period.

## 1.1. Purpose of this report

The purpose of this PACR[2] is to:

- describe the identified need;
- summarise the submissions received to the Project Specification Consultation Report (PSCR);
- describe and assess credible options to meet the identified need;
- describe the assessment approach used; and
- provide details of the proposed preferred option to meet the identified need.

## 1.2. No submissions received in response to the PSCR and no material developments

We published a PSCR on 8 April 2025 and invited written submissions on the material presented within the document. No submissions were received in response to the PSCR. No additional credible options were

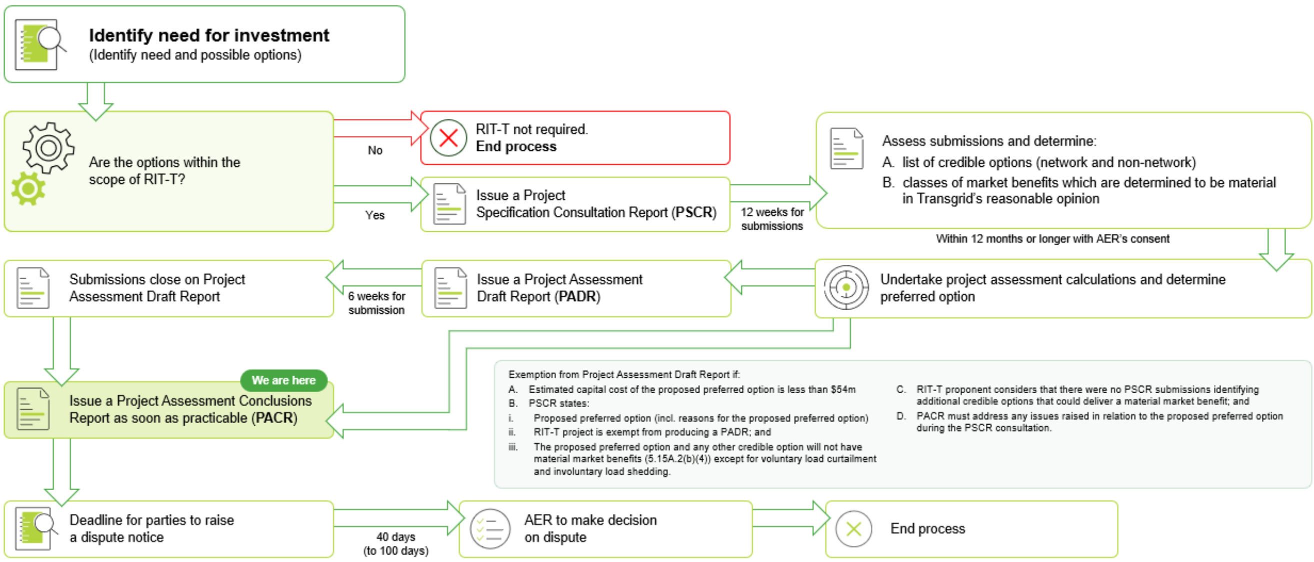
[2] See Appendix A for the National Electricity Rules requirements.

identified during the consultation period following publication of the PSCR. No material changes have occurred since the PSCR that have made an impact on the preferred option.

## 1.3. Next steps

This PACR represents the final step of the consultation process in relation to the application of the RIT-T process undertaken by Transgrid.

Figure 1-1 This PACR is the final stage of the RIT-T process




The second step of the RIT-T process, production of a Project Assessment Draft Report (PADR), was not required as Transgrid consider its investment in relation to the preferred option to be exempt from that part of the process under NER clause 5.16.4(z1). Production of a PADR is not required due to:

- the estimated capital cost of the proposed preferred option being less than $54 million;[3]
- the PSCR states:
  - the proposed preferred option, together with the reasons for the proposed preferred option
  - the RIT-T is exempt from producing a PADR; and
  - the proposed preferred option and any other credible option will not have a material market benefit for the classes of market benefit specified in clause 5.15A.2(b)(4), with the exception of market benefits arising from changes in voluntary and involuntary load shedding;
- the RIT-T proponent considers that there were no PSCR submissions identifying additional credible options that could deliver a material market benefit; and

[3] Varied from $46m to $54m based on the AER Final Determination: Cost threshold review, November 2024.

- the PACR must address any issues raised in relation to the proposed preferred option during the PSCR consultation.

Parties wishing to raise a dispute notice with the AER may do so prior to 20 September 2025 (30 days after publication of this PACR). Any dispute notices raised during this period will be addressed by the AER within 40 to 100 days, after which the formal RIT-T process will conclude.

Further details on the RIT-T can be obtained from Transgrid's Regulation team via regulatory.consultation@transgrid.com.au. In the subject field Steelworks Remediation Program PACR'.

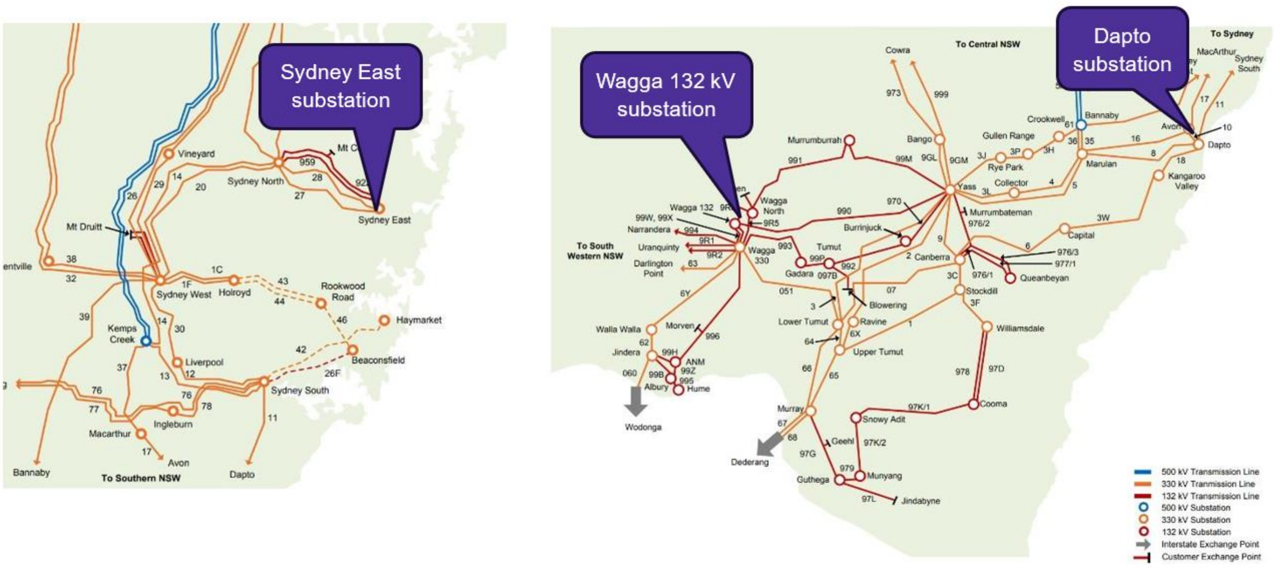
# 2. The identified need

This section outlines the identified need for this RIT-T, as well as the assumptions and date underpinning it. It first sets out background information relating the Sydney East, Wagga 132 kV, and Dapto substations.

## 2.1. Background to the identified need

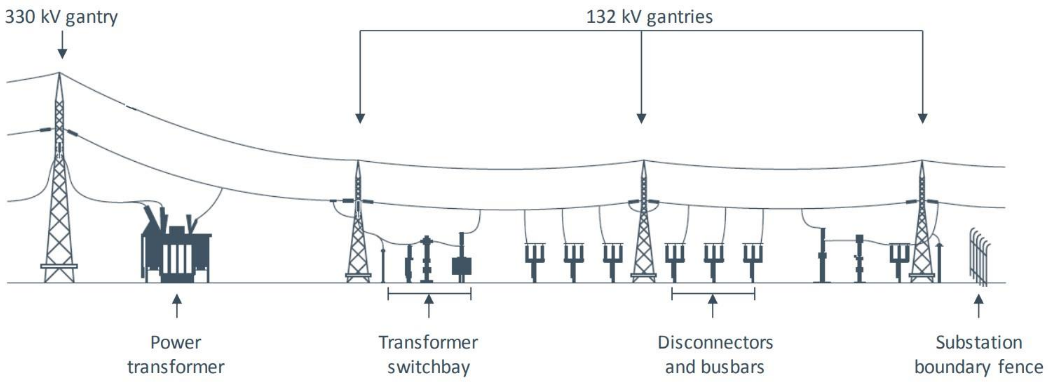
- **Sydney East substation** (330/132 kV) was established in 1974 and is located north of the Sydney Central Business District. It plays a critical role in suppling areas north of Sydney Harbour including North Sydney, Chatswood, and the suburbs along the Northern Beaches. The substation is supplied by two 330 kV lines (Line 27 and Line 28) from Sydney North and has three 330/132 kV transformers.
- **Wagga 132 kV substation** (132/66 kV) supplies load to the Wagga Wagga area at 66 kV. Supply is taken from the Wagga North, Yass 330/132 kV and Wagga 330/132 kV substations through four 132 kV lines. Two 60 MVA transformers substation supply load to seven 66 kV feeder bays. The substation was commissioned in 1955.
- **Dapto substation** (330/132 kV) is supplied by four 330 kV lines from Kangaroo Valley, Avon, Marulan and Sydney South. It was built in 1962 and supplies residential and industrial loads such as Bluescope Steel and also connects Tallawarra Power Station to the 330 kV network.

Figure 2-1 Location of Sydney East, Wagga 132 kV, and Dapto substations




Gantries support the high voltage connections between switchbays and busbars. They are mainly used to support conductors in both directions between the transmission tower closest to the substation and the equipment within the substation via the use high voltage insulators. Gantries are connected to concrete footings by concrete plinths, holding down bolts and baseplates. They also support overhead earthwires that protect the substation equipment from direct lightning strikes and are essential for the safe and reliable operation of the substation. Figure 2-2 below, illustrates the role of gantries in the substation.

Figure 2-2 Simplified diagram of substation elements highlighting the role that gantries play




Gantry structural members across the remediation sites exhibit evidence of corrosion that has resulted in loss of thickness in gantry steelwork, commonly referred to as members and bolts. The loss of thickness in members and bolts reduces the structural integrity of gantry structures, which over time leads to increasing risk of structural failure, particularly during high wind events and short circuit scenarios. Examples of corrosion on gantry structural members are shown in the Figure 2-3.

Figure 2-3 Typical gantry steel members showing corrosion

Figure 2-4 show examples of holding down bolts, base plates and member connection bolts displaying advanced stages of corrosion that Transgrid consider need to be addressed as a matter of urgency as some have already reached the end of their lives.

Figure 2-4 Typical corrosion to holding down bolts and baseplates

The proposed investment to address the corroded gantries and holding down bolts has significant benefits as the investment will avoid the likelihood of prolonged and involuntary load shedding across the areas supplied by Sydney East, Wagga 132 kV, and Dapto substations.

In addition, the increased risk of failure presents a safety risk which Transgrid is obligated to manage.

Rectifying the worsening condition of the gantries and holding down bolts will reduce safety risks, as well as lower planned and unplanned corrective maintenance costs.

The key economic benefits associated with addressing this need are summarised as:

Reduction of risk as quantified as a direct impact to Transgrid and consumers including:

- Involuntary load shedding
- Safety and environmental hazards associated with a catastrophic failure.

Avoided operating expenditure related to an increase in corrective maintenance for the relevant assets.

## 2.2. Description of the identified need

Transgrid considers the proposed investment a ‘market benefits’ driven RIT-T as the proposed investment is for the purpose of maintaining network security at critical transmission substations, which is estimated to deliver significant benefits in terms of avoided involuntary load shedding (ie, compared to if nothing is done and corrosion worsens). The investment will also assist Transgrid to manage and mitigate safety risks that would otherwise arise from a failure in substation gantries[4].

Investments made under a ‘market benefits’ identified need differs from those undertaken under a ‘reliability corrective action’ identified need in that market benefits driven investments are not made to meet externally imposed obligations on the network business and, consequently the preferred option must have positive net market benefits.

[4] Transgrid manages and mitigates safety risk to ensure they are below risk tolerance levels or ‘As Low As Reasonably Practicable’ (‘ALARP’), in accordance with Transgrid’s obligations under the New South Wales *Electricity Supply (Safety and Network Management) Regulation 2014* and Transgrid’s Electricity Network Safety Management System (ENSMS). In particular, risks for Transgrid and its consumers are mitigated unless it is possible to demonstrate that the cost involved in further reducing the risk would be grossly disproportionate to the benefit gained.

While the purpose of the proposed investment has similarities to those made under a reliability corrective action identified need (ie, to avoid involuntary load shedding), the scope of the current reliability standards applicable to Transgrid do not extend to multiple failures of transmission network elements that would be expected to result from a failure of substation gantries (eg, damage to and failure of multiple busbars at the same substation). It follows that the proposed investment is driven by a 'market benefits' identified need given the lack of externally imposed obligations relating to multiple failures of transmission network elements.

Overall, we consider that the option proposed in this PACR will enable Transgrid to appropriately manage the risk associated with substation gantries at the Sydney East, Wagga 132 kV, and Dapto substations going forward, which is expected to realise strongly positive net market benefits. The approach to determining this, and the assessment itself, is presented in this PACR.

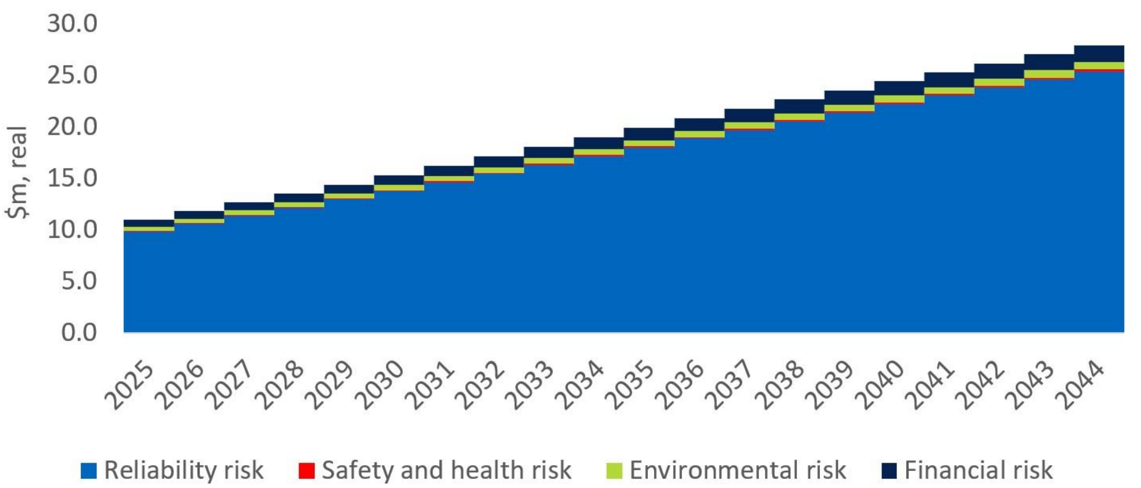
## 2.3. Assumptions underpinning the identified need

We adopt a risk cost framework to quantify and evaluate the risks and consequences of increased failure rates. Appendix B provides an overview of our risk assessment methodology.

We note that the risk cost estimating methodology aligns with that used in our revised revenue proposal for the 2023-28 period. It reflects feedback from the Australian Energy Regulator (AER) on the methodology initially proposed in our initial revenue proposal.

Figure 2-5 summarises the increasing risk costs over the assessment period under the base case.

Figure 2-5 Estimated risk costs under the central scenario ($m, real 2024/25)




This section describes the assumptions underpinning our assessment of the base case risk costs, ie, the value of the risk avoided by undertaking the credible options below. The aggregate risk cost is estimated at around $11.03 million/year currently in 2024/25, and it is expected to increase going forward if action is not taken and the lines are left to deteriorate further (reaching approximately $27.88 million/year by 2043/44).

## 2.4. Asset health and the probability of failure

Steelwork inspections were carried out to collect condition data on beams, columns, footings, baseplates and holding down bolts. The condition of each component was assessed on visual corrosion, galvanic and rust thickness. Structural models were developed for each substation using the collected condition data. The individual gantry's annual probability of capacity exceedance is calculated under wind loading conditions to determine the annual probability of failure (PoF). This is the same methodology as other transmission line structures. The model also considers the current condition of the steelwork and forecast corrosion over the next 30 years to predict the rate of degradation and its effect on the structural capacity. Short circuit forces under the ultimate design are used in utilisation calculations but it is not used in the capacity exceedance and PoF calculations. Using the capacity of exceedance for each gantry and

Transgrid's Network Asset Risk Assessment Methodology (NRAM) the risk associated with the failure of each gantry is calculated as follows:

- Safety, environmental, reputational and reliability risk is calculated based on the asset that has the highest impact due to the failure of the gantry regardless of the number of services and assets that is serviced by the gantry.
- Financial risk is calculated based on the failure of the gantry and all of the high voltage equipment that is serviced by the gantry.
- Restoration of services after a failure of 30 days which is the minimum expected time due to extent of damage to associated high voltage assets and the design and procurement of a new gantry.

Table 2-1 provides an overview of the total number of rows of gantries at each substation and the portion which are considered for replacement based on condition assessment, structural modelling, and investment evaluation.

Table 2-1 Gantry planned remediation

| Substation | Total | Stage One | | Stage Two | |
|---|---|---|---|---|---|
| | | Planned Remediation | Stage Percentage (%) | Future Remediation | Stage Percentage (%) |
| Sydney East | 25 | 1 | 4% | 1 | 4% |
| Wagga 132 kV | 16 | 1 | 6% | - | - |
| Dapto | 18 | 1 | 6% | 4 | 22% |

General asset health issues identified on steelwork gantries and their consequences are summarised in Table 2-2.

Table 2-2 Asset health issues and their consequences

| Issue | Consequences if not remediated |
| --- | --- |
| Corrosion of gantry steel bolts and members | Structural failure, leading to safety, reliability and financial risks |
| Corrosion of foundation interfaces | |
| Corrosion and deterioration of insulators | Conductor drop, leading to safety, reliability and financial risks |
| Corrosion of conductor attachment fittings | |
| Conductor spacers and corona rings | |
| Damaged earthwire bonding connection | |
| Corrosion of earthwire attachment fittings | |

## 2.5. Reliability risk

We have considered the risk of unserved energy for customers following a failure of one or more of the assets identified in this PACR. The likelihood of a consequence takes into account the likelihood of contingent planned/unplanned outages, the anticipated load restoration time (based on the expected time to undertake any repair work), and the load at risk (based on forecast demand). The monetary value is based on an assessment of the value of customer reliability, which measures the economic impact to affected customers of a disruption to their electricity supply.

Reliability risk makes up approximately 91 per cent of the total estimated risk cost in present value terms.

## 2.6. Financial risk

This risk refers to the direct financial consequence arising from the failure of an asset including the cost of replacement or repair of the asset (reactive maintenance) which may need to be under emergency conditions.

Financial risk makes up approximately 6 per cent of the total estimated risk cost in present value terms under the base case for this RIT-T.

## 2.7. Safety risk

This refers to the safety consequence to staff, contractors and/or members of the public of an asset failure. The likelihood of a consequence takes into account the frequency of workers on-site, the duration of maintenance and capital work on-site, and the probability and area of effect of an explosive asset failure. The monetary value takes into account the cost associated with fatality or injury compensation, loss of productivity, litigation fees, fines and any other related costs.

Consistent with our ALARP obligations, we apply a disproportionality factor of 'three' to the worker safety component of safety risk.[5]

Safety risk makes up less than 1 per cent of the total estimated risk cost in present value terms.

## 2.8. Environmental risk

This refers to the environmental consequence (including bushfire risk) to the surrounding community, ecology, flora and fauna of an asset failure. The likelihood of a consequence takes into account the location of the site and sensitivity of surrounding areas, the volume and type of contaminant, the effectiveness of control mechanisms, and the likelihood and impact of bushfires. The monetary value takes into account the cost associated with damage to the environment including compensation, clean-up costs, litigation fees, fines and any other related costs.

Environmental risk makes up less than 1 per cent of the total estimated risk cost in present value terms.

[5] Refer to Section 6.2.5 of the Network Asset Risk Assessment Methodology

# 3. Options that meet the identified need

In this RIT-T, we consider credible options as those that would meet the identified need from a technical, commercial, and project delivery perspective.[6] This section describes the options that we have explored to address the identified need, including the scope of each option and the associated costs.

Transgrid considers that there is only one feasible option from a technical, commercial, and project delivery perspective that can be implemented in sufficient time to meet the identified need. Two other options were considered but not progressed for reasons outlined in Table 3-3.

The program for Option 1 will be delivered in two stages: Stage 1: current regulatory period and Stage 2: future regulatory period.

All costs and benefits presented in this PACR are in 2024/25 dollars, unless otherwise stated.

Table 3-1 Summary of credible options

| Option | Description | Estimated capital expenditure ($M, 2024/25) | Expected commission date |
|---|---|---|---|
| 1 | Steelwork replacement | 27.93 | Stage 1: 2026/27<br><br>Stage 2: 2031/32 |

## 3.1. Base case

Consistent with the RIT-T requirements, the assessment undertaken in this PACR compares the costs and benefits of each credible option to a ‘do nothing’ base case. The base case is the (hypothetical) projected case if no action is taken, i.e.:[7]

*“The base case is where the RIT-T proponent does not implement a credible option to meet the identified need, but rather continues its 'BAU activities'. 'BAU activities' are ongoing, economically prudent activities that occur in absence of a credible option being implemented”.*

Under the ‘Base Case’ scenario, there is no consideration for planned replacement of the gantries or holding down bolts. This is a ‘run to fail’ scenario and will lead to an increase in the identified risks, the gantry’s eventual failure, and the materialisation of the expected consequences. This case shall only be considered as a last resort should no option be deemed viable through the economic evaluation process.

[6] As per clause 5.15.2(a) of the NER.

[7] AER, Regulatory Investment Test for Transmission Application Guidelines, November 2024, p. 21.

Replacement of a failed gantry is expensive and requires at least 30 days to restore capacity. Key considerations affecting the base case are:

- Transgrid does not hold spare gantries at any voltage as gantries are typically bespoke and a specific design to each site. Gantries would need to be designed and manufactured; this is expected to take between 2-3 weeks.
- If the gantry failure has caused catastrophic failure of HV equipment, there is substantial clean up and disposal costs especially for oil-filled equipment such as transformers and reactors, this is likely to take 1-2 weeks.
- Damaged equipment such as circuit breakers, instrument transformers and busbar equipment will also need replacement with suitable spares from inventory and may require design and civil modifications to suit.
- Constructing the gantries on-site and reinstating the high voltage conductors and earth wires will require outage planning and execution to minimise further load shedding.

These factors will increase the risk of prolonged and frequent involuntary load shedding for end-customers. We have estimated that the cost of involuntary load shedding due to asset failure will increase from approximately $9.85 million in 2024/25 to approximately $25.42 million in 2043/44 (in $2024/25). The above factors will also expose us and our end-customers to greater environmental, safety and financial risks associated with catastrophic asset failure, such as increased risk of explosive failure resulting in injury to nearby people and collateral damage to nearby assets.

## 3.2. Option 1 – Steelwork Replacement

Option 1 involves replacing the gantries and remediating holding down bolts which have reached end of life. The option will address the identified need by installing new gantries leading to a very low probability of failure, marked reduction in associated risks and lower operating costs.

This option involves:

- Remediating the holding down bolts and base plates by:
- Exposing and removal of concrete plinths
- Removal of corrosion, painting and repair of holding down bolts and base plates • Reinstatement of concrete plinths

Replacing the gantry:

- Removal and replacement of existing corroded gantry structures with new gantries.
- Removal of gantries that are not essential to the future operation of the substation.

Insulator & Fittings

- Replacement of insulators and fittings which have reached end of life or have corrosion

Gantry replacement and holding down bolt remediation is likely to be staged across multiple regulatory periods due to outage constraints.

The estimated total capital expenditure for addressing the gantries at each substation is $27.93m with an expected asset life of 45 years. Routine operating and maintenance costs are estimated at $92,011 per year.

The table below provides a breakdown of the expected capital expenditure by substation and expense type:

Table 3-2 Breakdown of capital expenditure by substation and expense type, $m (2024/25)

| | Stage 1 (current regulatory period) | | | Stage 2 (future regulatory period) | | |
|---|---|---|---|---|---|---|
| | Sydney East | Wagga 132 kV | Dapto | Sydney East | Dapto | Total |
| Labour | 1.87 | 5.23 | 4.00 | 1.24 | 5.82 | **18.15** |
| Material | 0.57 | 1.61 | 1.23 | 0.38 | 1.79 | **5.59** |
| Expenses | 0.43 | 1.21 | 0.92 | 0.29 | 1.34 | **4.19** |
| Total | **2.87** | **8.04** | **6.16** | **1.91** | **8.95** | |
| | **17.07**[8] | | | **10.86** | | **27.93** |

This program has been split into two stages, largely due to the different asset risk presented by each stage. Stage One assets are deemed higher risk and require attention within this regulatory period (2024-2028).

The program will be delivered in the following two stages:

- **Stage One:** The works are expected to be undertaken between 2023/24 and 2026/27. Planning, design, development and procurement (including completion of the RIT-T) will occur between 2023/24 and 2025/26, while project delivery and construction will occur from 2025/26. Project completion is assumed by 2026/27.
- **Stage Two:** The works are expected to be undertaken between 2028/29 and 2031/32. Planning, design, development and procurement will occur between 2028/29 and 2030/31, while project delivery and construction will occur from 2030/31. Project completion is assumed by 2031/32.

## 3.3. Options considered but not progressed

Table 3-3 summarises the reasons for the following credible options were not progressed further

[8] An allowance has been made for Stage One of addressing substation gantry corrosion in Transgrid's 2023-28 Revenue Proposal to the Australian Energy Regulator. We note that the remaining capital spend for Stage Two will be reflected in the next Revenue Proposal for the 2028-2033 period.

Table 3-3 Options considered but not progressed

| Description | Reason(s) for not progressing |
|---|---|
| Onsite or off-site Refurbishment | This option involves in-situ renewal of the steelwork by grit blasting to remove corrosion, painting and replacement of components and is expected to extend the steelwork life by 10-15 years depending on the local environment.<br>Transgrid has undertaken investigations to refurbish steelwork and utilised multiple blasting techniques on site. The field trials demonstrated:<br>• Grid blasting in a live switchyard takes significantly longer than originally anticipated primarily due to network outage constraints<br>• Blasting requires extensive outages of all nearby high voltage plant due to garnet overspray<br>• There are safety risks and cost impacts of blasting steelwork with lead contaminated paint<br><br>Due to the issues described above and the cost of refurbishment being equivalent to replacement, this option was not progressed as it is not economically feasible. |
| Elimination of gantries by alternate methods such as Gas Insulated Switchgear (GIS) or PASS (Plug and Switch System) | Gantries cannot be eliminated within a substation with GIS or PASS. Gantries would still be required as a landing structure to function as a transition point between the substation and the transmission lines. To eliminate the need for gantries, the overhead conductors would need to be replaced with either HV underground cables or with Gas Insulated Lines (GIL).<br>This option was not progressed as it is not technically feasible to eliminate gantries without requiring additional technologies such as cables and GIL. |
| Non-Network Solutions | We do not consider that non-network solutions can assist with meeting the identified need for this RIT-T. This is driven by the fundamental role that the identified gantries play in the transmission of electricity at a substation and the enduring need for the Sydney East, Wagga 132 kV, and Dapto Substations. No submissions were received in response to the PSCR in relation to non-network options. |

## 3.4. No material inter-network impact is expected

We have considered whether the credible options listed above are expected to have material inter-regional impact.[9] A 'material inter-network impact' is defined in the NER as:[10]

> *"A material impact on another Transmission Network Service Provider's network, which impact may include (without limitation): (a) the imposition of power transfer constraints within another Transmission Network Service Provider's network; or (b) an adverse impact on the quality of supply in another Transmission Network Service Provider's network."*

[9] As per clause 5.16.4(b)(6)(ii) of the NER.

[10] Definition of 'material inter-network impact,' in the Glossary to the NER.

AEMO's suggested screening test to indicate that a transmission augmentation has no material inter-network impact is that it satisfies the following:[16]

- a decrease in power transfer capability between transmission networks or in another TNSP's network of no more than the minimum of 3% of the maximum transfer capability and 50 MW;
- an increase in power transfer capability between transmission networks or in another TNSP's network of no more than the minimum of 3% of the maximum transfer capability and 50 MW;
- an increase in fault level by less than 10 MVA at any substation in another TNSP's network; and
- the investment does not involve either a series capacitor or modification in the vicinity of an existing series capacitor.

We note that Option 1 satisfies these conditions as it does not modify any aspect of electrical or transmission assets. As a consequence, by reference to AEMO' s screening criteria, there are no material internetwork impacts associated with Option 1.

## 3.5. Community engagement

Social licence costs can be reduced through early and continued engagement with communities and stakeholders who are reasonably expected to be affected by the project.

Transgrid is not proposing to undertake specific community engagement (in addition to the publication of the RIT-T consultation reports) in relation to this project. The proposed project relates to the replacement of infrastructure within an existing substation, and as such there will be no additional impact on communities located close to the current transmission infrastructure, apart from construction activities. Transgrid will ensure that all construction works associated to the project are conducted in a manner that causes the least disruption to communities and notes that the construction activities will be subject to separate environmental approval.

As a result, Transgrid does not consider that there is a need for additional community engagement as part of this RIT-T process. We will still engage with community as part of our project's construction works notifications and welcome any enquiries from community members to this project.

# 4. Materiality of market benefits

This section outlines the categories of market benefits prescribed in the National Electricity Rules (NER) and whether they are considered material for this RIT-T.[11]

## 4.1. Wholesale electricity market benefits are not material

The AER has recognised that if the credible options will not have an impact on the wholesale electricity market, then a number of classes of market benefits will not be material in the RIT-T assessment, and so do not need to be estimated.

Option 1 considered in this PACR will not address network constraints between competing generating centres and are therefore not expected to result in any change in dispatch outcomes and wholesale market prices. We therefore consider that the following classes of market benefits are not material for this RIT-T assessment:

- changes in fuel consumption arising through different patterns of generation dispatch;
- changes in Australia's greenhouse gas emissions
- changes in voluntary load curtailment (since there is no impact on pool price)
- changes in costs for parties other than the RIT-T proponent;
- changes in ancillary services costs
- changes in network losses; and
- competition benefits.

## 4.2. No other categories of market benefits are material

In addition to the classes of market benefits identified above, the NER also requires us to consider the following classes of market benefits, listed in Table 4.1, arising from each credible option.[12] We consider that none of the classes of market benefits listed are material for this RIT-T assessment for the reasons in Table 4-1.

Table 4-1 Reasons non-wholesale electricity market benefits categories are considered not material

| Market benefits | Reason |
|---|---|
| Differences in the timing of unrelated network expenditure | Option 1 will provide an alternative to meeting reliability requirements but are unlikely to affect decisions to undertake unrelated expenditure in the network. Consequently, material market benefits will neither be gained nor lost due to changes in the timing of other network expenditure from Option 1 considered. |

[11] The NER requires that all classes of market benefits identified in relation to the RIT-T are included in the RIT-T assessment, unless the TNSP can demonstrate that a specific class (or classes) is unlikely to be material in relation to the RIT-T assessment for a specific option – NER clause 5.15A.2(b)(5). See Appendix A for requirements applicable to this document.

[12] NER, clause 5.15A.2(b)(4)-(6).

| | |
|---|---|
| Option value | We note the AER's view that option value is likely to arise where there is uncertainty regarding future outcomes, the information that is available is likely to change in the future, and the credible options considered by the TNSP are sufficiently flexible to respond to that change.[13]<br>We also note the AER's view that appropriate identification of credible options and reasonable scenarios captures any option value, thereby meeting the NER requirement to consider option value as a class of market benefit under the RIT-T. We note that no credible option is sufficiently flexible to respond to change or uncertainty for this RIT-T. Specifically, each option is focused on proactively replacing deteriorating assets ahead of when they fail. |
| Changes in network losses | As there is no change to the transmission lines or the destination of the line under any of the options considered, there will not be any material market benefits associated with changes to network losses. |
| Changes in Australian greenhouse gas emissions | Option 1 is not expected to affect direct emissions in the NEM (from generation and network infrastructure). No material indirect emissions were also identified.<br>Accordingly, this benefit has not been estimated. |

[13] AER, *Regulatory Investment Test for Transmission Application Guidelines*, November 2024, p.57-58.

# 5. Overview of the assessment approach

This section outlines the approach that we have applied in assessing the net benefits associated with each of the credible options against the base case.

## 5.1. Assessment period and discount rate

A 20-year assessment period from 2024/25 to 2043/44 has been adopted for this RIT-T analysis. This period takes into account the size, complexity and expected asset life of the options.

Where the capital components of the credible options have asset lives extending beyond the end of the assessment period, the NPV modelling includes a terminal value to capture the remaining asset life. This ensures that the capital cost of long-lived options over the assessment period is appropriately captured, and that all options have their costs and benefits assessed over a consistent period, irrespective of option type, technology or asset life. The terminal values are calculated as the undepreciated value of capital costs at the end of the analysis period.

A real, pre-tax discount rate of 7 per cent has been adopted as the central assumption for the NPV analysis presented in this PSCR, consistent with the assumptions adopted in AEMO's 2024 Integrated System Plan (ISP).[20] The RIT-T requires that sensitivity testing be conducted on the discount rate and that the regulated weighted average cost of capital (WACC) be used as the lower bound. We have therefore tested the sensitivity of the results to a lower bound discount rate of 3.63 per cent.[21] We have adopted an upper bound discount rate of 10.50 per cent (ie, AEMO's 2023 Inputs, Assumptions and Scenarios Report).[13]

## 5.2. Approach to estimating option costs

We have estimated the capital costs of the options based on the scope of works necessary together with costing experience from previous projects of a similar nature.

The cost estimates are developed using our 'MTWO' cost estimating system. This system utilises historical average costs, updated by the costs of the most recently implemented project with similar scope. All estimates in MTWO are developed to deliver a 'P50' portfolio value for a total program of works (i.e., there is an equal likelihood of over- or under-spending the estimate total).[14]

We estimate that actual costs will be within +/- 25 per cent of the central capital cost estimate. An accuracy of +/-25 per cent for cost estimates is consistent with industry best practice and aligns with the accuracy range of a 'Class 4' estimate, as defined in the Association for the Cost Engineering classification system. All cost estimates are prepared in real, 2024/25 dollars based on the information and pricing history available at the time that they were estimated. The cost estimates do not include or forecast any real cost escalation for materials.

---

[14] For further detail on our cost estimating approach refer to section 7 of our Augmentation Expenditure Overview Paper submitted with our 2023-28 Revenue Proposal.

Routine operating and maintenance costs are based on works of similar nature.

Construction works are planned to occur within existing Transgrid substations and their adjacent easements, where access is expected to be available. Work extending outside substation boundary fences involves temporarily removing landing spans from Transgrid and/or Distributor transmission lines, as well as laydown areas within Transgrid property boundaries. Only minor access track upgrades have been assessed as part of the desktop assessment.

On 21 November 2024, the requirements set out in the Australian Energy Regulator's Regulatory Investment Test for Transmission (RIT-T) Application Guidelines were amended. The amended guidelines now expect a RIT-T proponent to explicitly consider community engagement and social licence during the RIT-T process.

The amended guidelines mean that Transgrid must consider social licence principles in the identification of credible options. This may affect how we determine the most likely cost and delivery timeline for an option.

Transgrid believes building relationships and trust is how we can gain and grow social licence. Through engagement with affected communities, we identify prudent and efficient investment opportunities that can build and gain community acceptance for our options. Costs associated with social licence include those associated with engagements, community benefits, minor route adjustments and legislated additional landholders' payments, as applicable.

We acknowledge this important change to the RIT-T guidelines. However, due to the nature of these works being a replacement to infrastructure within existing substations, and therefore low impact on community, we do not anticipate the need to provide additional costs to address social license considerations (as outlined in section 3.5).

## 5.3. Value of customer reliability

Consistent with the AER's RIT-T Guideline, we have developed VCR estimates that are based on the estimates developed and consulted on by the AER, weighted to reflect the mix of customers that are likely to be affected by the options.

We have applied a NSW-wide VCR value of $31,536/MWh based on the estimates developed and consulted on by the AER.[15] We have used this VCR as we consider this reasonably reflects the mix of customers supplied from the Sydney East, Wagga 132 kV, and Dapto substations, which includes residential, agricultural and industrial customers.

[15] AER, *Values of Customer Reliability, Final Report on VCR Values,* December 2024. Escalated to a $2024/25 estimate using implied 6-month escalation rate of 1.96% derived from RBA February 2025 CPI forecast of 2.4% for the year end June 2025

## 5.4. Three different scenarios have been modelled

The RIT-T must include any of the ISP scenarios from the most recent IASR that are relevant unless:[16]

- the RIT–T proponent demonstrates why it is necessary to vary, omit or add a reasonable scenario to what was in the most recent IASR, and
- the new or varied reasonable scenarios are consistent with the requirements for reasonable scenarios set out in the RIT–T instrument.

The AER's RIT-T Guidelines clarifies that the number and choice of reasonable scenarios must be appropriate to the credible options under consideration, and that the choice of reasonable scenarios must reflect any variables or parameters that are likely to affect the ranking or sign of the net benefit of any credible option.[17]

For the purposes of this RIT-T, we consider that the ISP scenarios are not relevant. The key input parameter that is likely to affect the ranking or sign of the net market benefits of the credible options is the probability of failure and consequence of failure of the assets at Sydney East, Wagga 132 kV, and Dapto substations. The probability and consequence are assessed by reference to the condition of the asset under consideration and the reliability, safety, environmental and financial consequences. These are independent from the assumptions underpinning the ISP scenarios. It follows that adopting the ISP scenarios would not be consistent with adopting scenarios that reflect parameters that could reasonably change the ranking or sign of the net market benefits of the credible options.

In line with the RIT-T Guideline, we have constructed reasonable alternative scenarios. To do this, we developed a **Central Scenario** which reflects our best estimate of each of the modelling parameters, including the asset risk (probability of failure and consequence of failure), expected unserved energy, and capital and operating costs. We developed the Central Scenario around a static model of demand scenarios, described further in our Section A.3 of our Network Asset Criticality Framework. We consider that this approach is appropriate since it materially reduces the computational effort required, and since differences in demand forecasts will not materially affect the sign or ranking of the credible options.

As indicated above, we consider that the key input parameter that is likely to affect the ranking or sign of the net market benefits of the credible options is the asset failure risk of the identified high voltage and secondary systems assets. We do not consider that variations in other parameters of the Central Scenario are likely to affect the outcome of the RIT-T assessment. In view of this, we have developed additional reasonable scenarios that reflect variations in the asset risk while holding other parameters the same as the Central Scenario.

Specifically, we have developed the following additional scenarios:

- A **High Risk Costs Scenario**, where the asset failure risk is 25% higher than in the Central Scenario. This higher risk would be expected to increase the frequency and duration of outages, and safety, environmental and financial risk costs, in the base case (as compared with the Central Scenario).

[16] AER, *Regulatory investment test for transmission – Application guidelines*, November 2024, p 42-44.
[17] AER, *Regulatory investment test for transmission: Application guidelines*, November 2024, p.42-44.

We have modelled this scenario by increasing our estimate of gross benefits associated with avoided unserved energy and risk costs in this scenario by 25%.

- A **Low Risk Costs Scenario**, where the asset failure risk is 25% lower than in the Central Scenario. This lower failure risk would be expected to reduce the frequency and duration of outages, and safety, environmental and financial risk costs, in the base case (as compared with the Central Scenario). We have modelled this scenario by reducing our estimate of gross benefits associated with avoided unserved energy and risk costs in this scenario by 25%.

The NPV results in this PACR are reported for each scenario, as well as on a weighted basis. As we have no evidence or rationale for assigning a higher probability for one reasonable scenario over another, we have weighted each reasonable scenario equally.[18]

A summary of the key variables in each scenario is provided in the table below.

Table 5-1 Summary of scenarios

| Variable / Scenario | Central scenario | Low risk costs scenario | High risk costs scenario |
|---|---|---|---|
| Scenario weighting | 1/3 | 1/3 | 1/3 |
| Discount rate | 7.0% | 7.0% | 7.0% |
| VCR ($2024/25 m) | 31,536/MWh | 31,536/MWh | 31,536/MWh |
| Network capital costs | Base estimate | Base estimate | Base estimate |
| Avoided unserved energy | Central demand forecast (POE50) | Low demand forecast (POE90) | High demand forecast (POE10) |
| Safety, environmental and financial risk benefit | Base estimate | Base estimate - 25% | Base estimate + 25% |
| Avoided routine operating and maintenance costs | Base estimate | Base estimate | Base estimate |

## 5.5. Sensitivity analysis

In addition to the scenario analysis, we have also considered the robustness of the outcome of the cost benefit analysis through undertaking a range of sensitivity testing, focused on the central scenario.

The range of factors tested as part of the sensitivity analysis in this PACR are:

- lower and higher capital costs of the credible options;
- lower and higher estimated safety, environmental and financial risk benefits; and
- alternate commercial discount rate assumptions.

[18] As per: AER, *Regulatory investment test for transmission: Application guidelines*, November 2024.

The above list of sensitivities focuses on the key variables that could impact the identified preferred option. The results of the sensitivity tests are set out in section 6.4.

In addition, we have also sought to identify the ‘boundary value’ for key variables beyond which the outcome of the analysis would change.

# 6. Assessment of credible options

This section outlines the assessment we have undertaken of the credible options. The assessment compares the costs and benefits of the option to the base case. The benefits of each credible option are represented by reduction in costs or risks compared to the base case. The benefits of the option are represented by a reduction in costs or risks compared to the base case.

All costs and benefits presented in this PACR are in 2024/25 dollars.

## 6.1. Estimated gross benefits

Table 6-1 below summarises the present value of the gross benefits of Option 1 under the three scenarios. These include both the avoided risk cost estimates for Option 1 relative to the base case.

Table 6-1 Estimated gross benefits from Option 1 relative to the base case ($m, PV)

| Option/scenario | Central | Low risk cost scenario | High risk cost scenario | Weighted |
|---|---|---|---|---|
| Scenario weighting | 33% | 33% | 33% | |
| Option 1 | 169.53 | 127.15 | 211.91 | 169.53 |

## 6.2. Estimated costs

Table 6-2 below summarises the costs of Option 1, relative to the base case, in present value terms. The cost includes the direct capital and routine operating costs of the option, relative to the base case.

Table 6-2 Costs of Option 1 relative to the base case ($m, PV)

| Option/Scenario | Cost |
|---|---|
| Option 1 | 16.71 |

## 6.3. Estimated net economic benefits

The net economic benefits are the differences between the estimated gross benefits and the estimated costs. Table 6-3 below summarises the present value of the net economic benefits for Option 1 is found to have positive net benefits for all scenarios investigated. On a weighted basis, Option 1 is found to deliver approximately $255.95 million.

Table 6-3 Net economic benefits for Option 1 relative to the base case ($m, PV)

| Option | Central | Low risk cost scenario | High risk cost scenario | Weighted |
|---|---|---|---|---|
| Scenario weighting | 33% | 33% | 33% | |
| Option 1 | 152.82 | 110.44 | 195.20 | 152.82 |

Figure 6-1 Net economic benefits ($m, PV)


## 6.4. Sensitivity testing

We have undertaken sensitivity testing to examine how the net economic benefit of the credible options changes with respect to changes in key modelling assumptions. The factors tested as part of the sensitivity analysis for this PACR are:

- Optimal timing of the project
- Alternate scenario weights
- Higher or lower VCRs
- Higher or lower network capital costs of the credible options
- Alternate commercial discount rate assumptions.

The sensitivity testing was undertaken as against the central scenario. Specifically, we individually varied each factor identified above and estimated the net economic benefit in that scenario relative to the base case while holding all other assumptions under the central scenario constant. The results of the sensitivity tests are set out in the sections below.

### 6.4.1. Optimal timing of the project

We have estimated the optimal timing for the preferred option. The optimal timing of an investment is the year when the annual benefits (avoided risk costs) from implementing the option become greater than the annualised investment costs. The analysis was undertaken under the central set of assumptions and a range of alternative assumptions for key variables. The purpose of the analysis is to examine the sensitivity of the commissioning year to changes in the underlying assumptions.

The sensitivities we considered are:

- a 25% increase / decrease in capital costs
- a 25% increase / decrease in demand
- a lower discount rate of 3.63% and a higher discount rate of 10.5%
- a 30% increase / decrease in the VCR
- a 25% increase / decrease in reliability, safety, environmental and financial risk costs

The results of this analysis are presented in the figure below. In all cases, the optimal timing for the preferred option is 2026/27.

Figure 6-2 Optimal timing of Option 1.


### 6.4.2. Scenario weights

As we have identified only one credible option, and since we have assessed this option to be net beneficial under all three reasonable scenarios, there are no alternative scenario weights that will change the RIT-T outcome (i.e., lead to the identification of a different preferred option, or no preferred option).

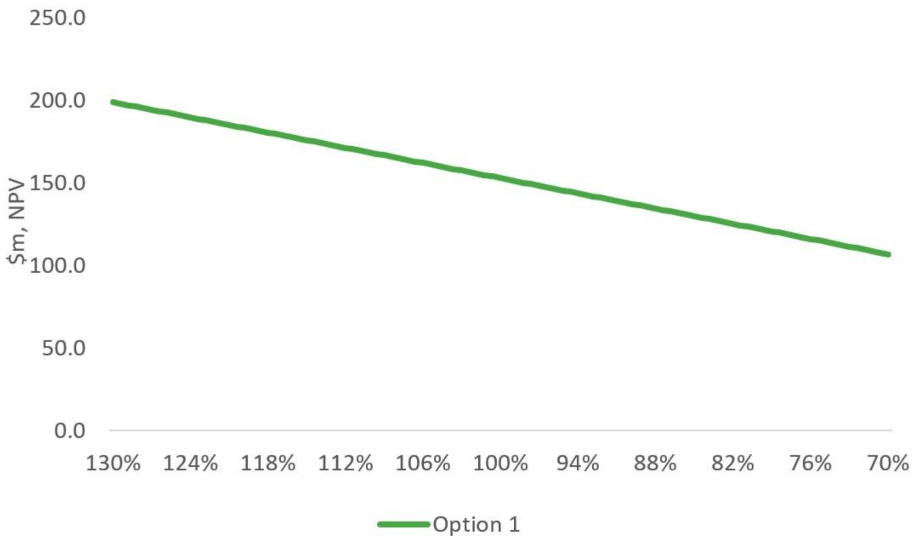
### 6.4.3. Value of customer reliability

We estimated the net economic benefit of each option by adopting a VCR that is 30% higher (the 'High VCR' scenario) and 30% lower (the 'Low VCR' scenario) than the estimate of VCR adopted in our central scenario. The results of this analysis are presented in the table and figure below.

Table 6-4 Sensitivity of net economic benefits under a lower and higher VCR ($2024/25 m)

| Option/scenario | Low VCR | High VCR | Ranking |
|---|---|---|---|
| Sensitivity | Central estimate - 30% | Central estimate + 30% | |
| Option 1 | 106.84 | 198.80 | 1 |

Figure 6-3 Sensitivity of net economic benefits under a lower and higher VCR ($2024/25 m)




We have also undertaken a threshold analysis to identify the change in VCR that would need to occur for the one credible option to have a zero net benefit. The estimated VCR would need to decrease to $92/MWh to result in no expected net market benefits (i.e. an NPV of zero) under the central scenario, holding all else constant.  Such a change in VCR is outside the expected range and, as such, this result of Option 1 being expected to provide positive net benefits is robust to reasonable VCR sensitivities.

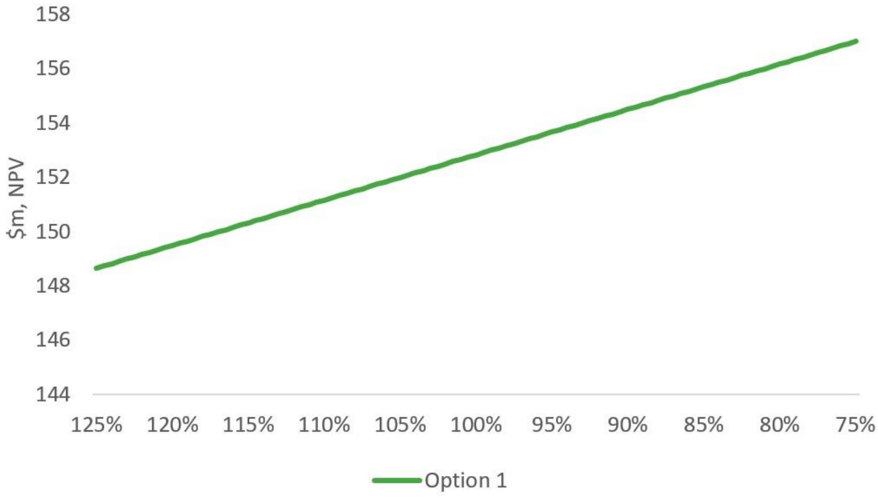
### 6.4.4. Network capital costs

We estimated the net economic benefit of each option by adopting capital costs for each option that are 25% higher (the 'High capital expenditure' scenario) and 25% lower (the 'Low capital expenditure' scenario) than the capital cost estimates in our central scenario. The results of this analysis are presented in the table and figure below.

Table 6-5 Sensitivity of net economic benefits under lower and higher capital costs ($2024/25 m)

| Option/scenario | Low capital expenditure | High capital expenditure | Ranking |
|---|---|---|---|
| Sensitivity | Central estimate - 25% | Central estimate + 25% | |
| Option 1 | 157.00 | 148.65 | 1 |

Figure 6-4 Sensitivity of net economic benefits under lower and higher capital costs ($2024/25 m)




We have also undertaken a threshold analysis to identify the change in capital cost estimates that would need to occur for the credible option to have a zero net benefit. Specifically, we analyse the extent to which capital costs would need to change. The result of this analysis was that the capital cost would need to increase by more than 915% for the net benefits to become negative. Such a change in capital costs is outside the expected range. As a result, the expectation of Option 1 providing positive net benefits is considered robust to reasonable capital cost sensitivities.

### 6.4.5. Discount rate

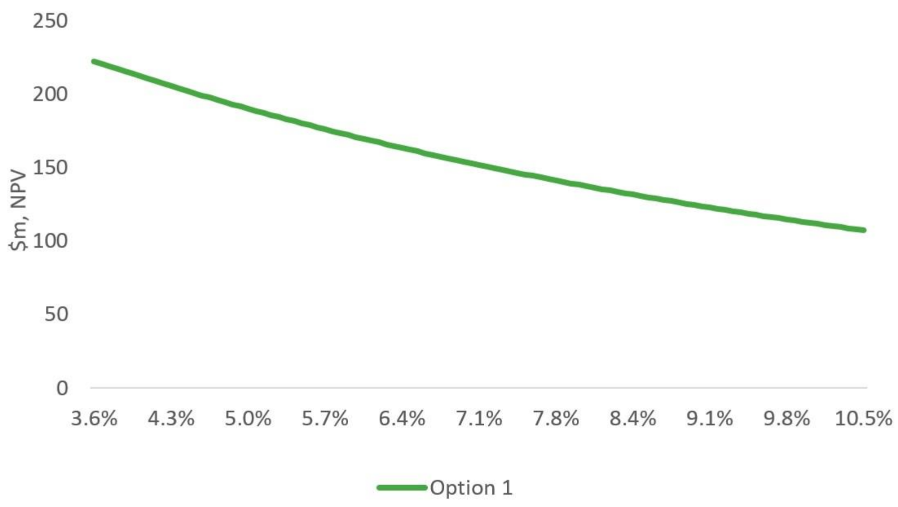
We estimated the net economic benefit of each option by adopting a low discount rate of 3.63% which is consistent with the AER's latest final determination for a TNSP (the 'Low discount rate' scenario),[19] and a high discount rate of 10.5% which aligns with the high discount rate scenario in the 2023 IASR (the 'High discount rate' scenario).[20] The results of this analysis are presented in the table and figure below.

Table 6-6 Sensitivity of net economic benefits under a lower and higher discount rates ($2024/25 m)

| Option/scenario | Low discount rate | High discount rate | Ranking |
|---|---|---|---|
| Sensitivity | 3.63% | 10.5% | |
| Option 1 | 222.42 | 107.25 | 1 |

[19] This is equal to WACC (pre-tax, real) in the latest final decision for a transmission business in the NEM as of the date of this analysis, see: AER, TasNetworks – 2024-29 – Final decision – PTRM, April 2024, WACC sheet.
[20] AEMO '2023 Inputs, Assumptions and Scenarios Report', July 2023, p 123.

Figure 6-5 Sensitivity of net economic benefits under a lower and higher discount rate ($2024/25 m)




We have also undertaken a threshold analysis to identify whether a change in the discount rate would change the RIT-T outcome. Our approach involved solving for the discount rate that would result Option 1 having a net benefit of zero. Our results suggests that there is no reasonable discount rate that would change the expected net benefit to negative, we therefore consider the expected positive net benefits provided by Option 1 to be robust to reasonable discount rate sensitivities.

# 7. Final conclusion on the preferred option

This PACR finds that Option 1 is the preferred option to address the identified need. Option 1 involves replacing the gantries and remediating holding down bolts which have reached end of life.

The estimated capital expenditure associated with this option is $27.93 million. Routine operating and maintenance costs relating to planned checks by our field crew are $91,298 per year.

Stage 1 planning, design, development and procurement (including completion of the RIT-T) will occur between 2023/24 and 2025/26, while project delivery and construction will occur in 2025/26 and 2026/27. All works are expected to be completed by 2026/27.

Stage 2 planning, design, development and procurement will occur between 2028/29 and 2030/31, while project delivery and construction will occur in 2030/31 and 2031/32. All works are expected to be completed by 2031/32.

Transgrid considers this conclusion to be robust to changes in capital cost inputs, estimated risk costs and underlying discount rates, noting that there would need to be unrealistic changes to these key assumptions to change the ranking of the options (as shown via the boundary testing at the end of Section 6.4). Transgrid will however continue to monitor these key assumptions and will notify the AER if such changes do occur (or appear likely), which would constitute a material change in circumstance.

# 8. Appendix A Compliance checklist

This appendix sets out a checklist which demonstrates the compliance of this PACR with the requirements of the National Electricity Rules version 233.

| Rules clause | Summary of requirements | Relevant section(s) in the PACR |
|---|---|---|
| 5.16.4(v) | The project assessment conclusions report must set out: | |
| | (1) the matters detailed in the project assessment draft report as required under paragraph (k) See below. | See below |
| | (2) a summary of, and the RIT-T proponent's response to, submissions received, if any, from interested parties sought under paragraph (q). | N/A |
| 5.16.4(k) | The project assessment draft report must include: | |
| | (1) a description of each credible option assessed; | 3 |
| | (2) a summary of, and commentary on, the submissions to the project specification consultation report; | N/A |
| | (3) a quantification of the costs, including a breakdown of operating and capital expenditure, and classes of material market benefit for each credible option; | 3 & 4 |
| | (4) a detailed description of the methodologies used in quantifying each class of material market benefit and cost; | 4 & 5 |
| | (5) reasons why the RIT-T proponent has determined that a class or classes of market benefit are not material; | 4 |
| | (6) the identification of any class of market benefit estimated to arise outside the region of the Transmission Network Service Provider affected by the RIT-T project, and quantification of the value of such market benefits (in aggregate across all regions); | 4 |
| | (7) the results of a net present value analysis of each credible option and accompanying explanatory statements regarding the results; | 6 |
| | (8) the identification of the proposed preferred option; | 6 & 7 |
| | (9) for the proposed preferred option identified under subparagraph (8), the RIT-T proponent must provide:<br>(i) details of the technical characteristics;<br>(ii) the estimated construction timetable and commissioning date;<br>(iii) if the proposed preferred option is likely to have a material inter-network impact and if the Transmission Network Service Provider affected by the RIT-T project has received an augmentation technical report, that report; and<br>(iv) a statement and the accompanying detailed analysis that the preferred option satisfies the regulatory investment test for transmission. | 3 & 7 |
| | (10) if each of the following apply to the RIT-T project: | N/A |

| | | |
|---|---|---|
| | (i) if the estimated capital cost of the proposed preferred option is greater than $100 million[21] (as varied in accordance with a cost threshold determination); and<br>(ii) AEMO is not the sole RIT-T proponent,<br>the reopening triggers applying to the RIT-T project. | |
| 5.16.4(z1) | A RIT-T proponent is exempt from preparing a PADR (paragraphs (j) to (s)) if:<br>(1) the estimated capital cost of the proposed preferred option is less than $35 million[22] (as varied in accordance with a cost threshold determination);<br>(2) the relevant Network Service Provider has identified in its project specification consultation report: (i) its proposed preferred option; (ii) its reasons for the proposed preferred option; and (iii) that its RIT-T project has the benefit of this exemption;<br>(3) the RIT-T proponent considers, in accordance with clause 5.15A.2(b)(6), that the proposed preferred option and any other credible option in respect of the identified need will not have a material market benefit for the classes of market benefit specified in clause 5.15A.2(b)(4) except those classes specified in clauses 5.15A.2(b)(4)(ii) and (iii), and has stated this in its project specification consultation report; and<br>(4) the RIT-T proponent forms the view that no submissions were received on the project specification consultation report which identified additional credible options that could deliver a material market benefit. | 1 |

In addition, the table below outlines a separate compliance checklist demonstrating compliance with the binding guidance in the latest AER RIT-T guidelines.

| Guidelines section | Summary of the requirements | Section in the PACR |
|---|---|---|
| 3.1 | In all cases, it is essential that RIT-T proponents express the identified need as the achievement of an objective or end, and not simply the means to achieve the objective or end. This objective should be expressed as a proposal to electricity consumers and be clearly stated and defined in RIT-T reports, as opposed to being implicit. | 2.2 |
| 3.2.5 | A RIT-T proponent must consider social licence issues in the identification of credible options. There are many potential sources of information when considering how this should be done, which include community sentiment data, prior experience, best practices, relevant guidelines, and early engagement with consumers, stakeholders and communities. | 3.6 & 5.3 |

[21] Varied to $103m based on the AER Final Determination: Cost threshold Review published November 2024 (see: 2024 RIT and APR cost threshold review - final determination - 12 November 2024.pdf ).

[22] Varied to $54m based on the AER Final Determination: Cost threshold Review published November 2024 (see: 2024 RIT and APR cost threshold review - final determination - 12 November 2024.pdf ).

| | | |
|---|---|---|
| 3.4 | Except for specific circumstances, RIT-T proponents must adopt the inputs, assumptions and scenarios from the most recent inputs, assumptions and scenarios report (IASR). | 5.5 |
| 3.4.1 | The RIT-T specifies that:<br>(i) The RIT-T proponent must adopt the discount rate from the most recent inputs, assumptions and scenarios report unless it provides demonstrable reasons why a variation is necessary. If the RIT-T proponent decides to vary this parameter, this variation must be consistent with paragraph 19.<br>(ii) The present value calculations must use a commercial discount rate appropriate for the analysis of a private enterprise investment in the electricity sector. The discount rate used must be consistent with the cash flows being discounted.<br><br>Consistent with the RIT-T requirement, present value calculations in the ISP must use a commercial discount rate appropriate for the analysis of a private enterprise investment in the electricity sector. Given this consistency, it should be suitable for RIT-T proponents to apply the discount rate that AEMO has applied in the most recent ISP. | 5.2 |
| 3.5 | In the RIT-T, costs are the present value of a credible option's direct costs. These must include the following classes of costs:<br>• Costs incurred in constructing or providing the credible option.<br>• Operating and maintenance costs over the credible option's operating life. For clarity, a consequence of this is that, if the modelling period is shorter than the life of the credible option, the RIT-T proponent would incorporate the operating and maintenance costs (if any) for the remaining years of the credible option into the terminal value.<br>• Costs of complying with relevant laws, regulations and administrative requirements.<br>A RIT-T proponent must exclude from its analysis, the costs (or negative benefits) of a credible option's harm to the environment or to any party that is not prohibited under the relevant laws, regulations or legal instruments, with the exception of changes in Australia's greenhouse gas emissions. | 5.2 & 5.3 |
| 3.5A.1 | Where the estimated capital costs of the preferred option exceeds $100 million[23] (as varied in accordance with a cost threshold determination), a RIT-T proponent must, in a RIT-T application: | NA |
| | (i) outline the process it has applied, or intends to apply, to ensure that the estimated costs are accurate to the extent practicable having regard to the purpose of that stage of the RIT-T | |
| | (ii) for all credible options (including the preferred option), either | |
| | • apply the cost estimate classification system published by the AACE, or | |

[23] Varied to $103m based on the AER Final Determination: Cost threshold Review published November 2024 (see: 2024 RIT and APR cost threshold review - final determination - 12 November 2024.pdf ) .

| | | |
|---|---|---|
| | • if it does not apply the AACE cost estimate classification system, identify the alternative cost estimation system or cost estimation arrangements it intends to apply, and provide reasons to explain why applying that alternative system or arrangements is more appropriate or suitable than applying the AACE cost estimate classification system in producing an accurate cost estimate | |
| 3.5A.2 | For each credible option, a RIT-T proponent must specify, to the extent practicable and in a manner which is fit for purpose for that stage of the RIT-T: | 3 & 5 |
| | (i) all key inputs and assumptions adopted in deriving the cost estimate | |
| | (ii) a breakdown of the main components of the cost estimate | |
| | (iii) the methodologies and processes applied in deriving the cost estimate (e.g. market testing, unit costs from recent projects, and engineering-based cost estimates) | |
| | (iv) the reasons in support of the key inputs and assumptions adopted and methodologies and processes applied | |
| | (v) the level of any contingency allowance that have been included in the cost estimate, and the reasons for that level of contingency allowance | |
| 3.5.3 | The RIT-T proponent is required to provide the basis for any social licence costs in their RIT-T reports and may choose to refer to best practice from a reputable, independent and verifiable source. | 3.6 & 5.3 |
| 3.6.1 | Under the RIT-T instrument, a RIT-T proponent must include all classes of market benefits unless:<br>• it can provide reasons for why a particular class of market benefit is unlikely to materially affect the outcome of the credible options assessment, or<br>• it expects the cost of undertaking the analysis to quantify the market benefits will be disproportionate to the scale, size and potential benefits of the credible options. | 4 |
| 3.6.2 | Under the RIT-T instrument, a RIT-T proponent must also consider classes of market benefits that:<br>• the RIT-T proponent determines relevant, and<br>• we have agreed to in writing before the RIT-T proponent publishes its consultation report. | 4.3 |
| 3.7.1 | For each credible option, a RIT-T proponent must develop two states of the world (one with the credible option in place and the other being the base case with no option in place) for each reasonable scenario. This allows the RIT-T proponent to later derive the market benefits of an option by comparing these states of the world, and then probability weighting those benefits across a range of reasonable scenarios. | 5.1 |
| | All assets and facilities that exist during a RIT-T application must, at least initially, form part of all relevant states of the world (both with and without the credible option in place and in all reasonable scenarios). Beyond taking account of existing assets and facilities, a state of the world must capture the future evolution of and investment in generation, network and load. To | NA |

| | | |
|---|---|---|
| | capture this, the RIT-T instrument requires the RIT-T proponent to include appropriate:<br>• Committed projects: these must form part of all states of the world, consistent with the treatment of existing assets and facilities.<br>• Actionable ISP projects: these must form part of all states of the world, consistent with the treatment of committed projects unless the level of analysis required to include the actionable ISP project is disproportionate to the scale and likely impact of the credible options under consideration.<br>• Anticipated projects: the RIT-T proponent must use the ISP, and where absent from the ISP, its reasonable judgement to include these in all relevant states of the world.<br>• Modelled projects: appropriate market development modelling will determine which modelled project to include in a given state of the world. For completeness, where a RIT-T proponent adopts the market modelling from the most recent ISP, ISP projects that are not actionable ISP projects (that is, future ISP projects and ISP development opportunities) will usually be modelled projects. | |
| 3.8.1 | Where no scenarios from the ISP are relevant to the RIT-T application, the RIT-T proponent must form reasonable scenarios consistently with the requirements for reasonable scenarios in the RIT-T instrument. | 5.5 |
| | Under the RIT-T instrument, the number and choice of reasonable scenarios must be appropriate to the credible options under consideration. Specifically, the choice of reasonable scenarios must reflect any variables or parameters that are likely to affect:<br>• the ranking of the credible options, where the identified need is for reliability corrective action, inertia network services or system strength services. In these cases, only the ranking (as opposed to the sign) of credible options' net economic benefits is important; and<br>• the ranking or sign of the net economic benefit of any credible option where the identified need is not for reliability corrective action, inertia network services or system strength services. In these cases, the preferred option must have a positive net economic benefit. | |
| 3.8.2 | Where the estimated capital cost of the preferred option exceeds $100 million[24] (as varied in accordance with an applicable cost threshold determination), a RIT-T proponent must undertake sensitivity analysis on all credible options, by varying one or more inputs and/or assumptions. | NA |

[24] Varied to $103m based on the AER Final Determination: Cost threshold Review published November 2024 (see: 2024 RIT and APR cost threshold review - final determination - 12 November 2024.pdf ) .

| | | |
|---|---|---|
| 3.9.1 | The methodology for assigning probabilities to each reasonable scenario must be consistent with the methodology for choosing the reasonable scenarios themselves. Where a RIT-T proponent has no evidence or rationale for assigning a higher probability for one reasonable scenario over another, it may weight all reasonable scenarios equally.<br><br>Moreover, where the RIT-T proponent uses the most recent ISP scenarios as its reasonable scenarios, it must adopt the probability weightings that AEMO used in the most recent ISP. | 5.5 |
| 3.9.2 | A RIT-T proponent must separately undertake a weighted averaging of the direct costs of a credible option as well as the market benefits of a credible option. | 5.5 |
| 3.9.3 | The RIT-T instrument requires RIT-T proponents to consider option value as a class of potential market benefit. | 4.3 |
| 3.9.4 | If a contingency allowance is included in a cost estimate for a credible option, the RIT-T proponent must explain:<br>• the reasons and basis for the contingency allowance, including the particular costs that the contingency allowance may relate to, and<br>• how the level or quantum of the contingency allowance was determined. | NA |
| 3.11.2 | While there are no specific requirements for the level of information required of concessional finance agreements at the RIT-T stage of a project, enough information must be provided to justify an agreement's inclusion.<br><br>If a proponent seeks to include an unexecuted concessional finance agreement in the RIT-T, they must undertake sensitivity testing for the scenario the agreement doesn't eventuate | NA |
| 4.1 | RIT-T proponents are required to describe in each RIT-T report<br>• how they have engaged with local landowners, local council, local community members, local environmental groups or traditional owners and sought to address any relevant concerns identified through this engagement<br>• how they plan to engage with these stakeholder groups, or<br>• why this project does not require community engagement | 3.6 |

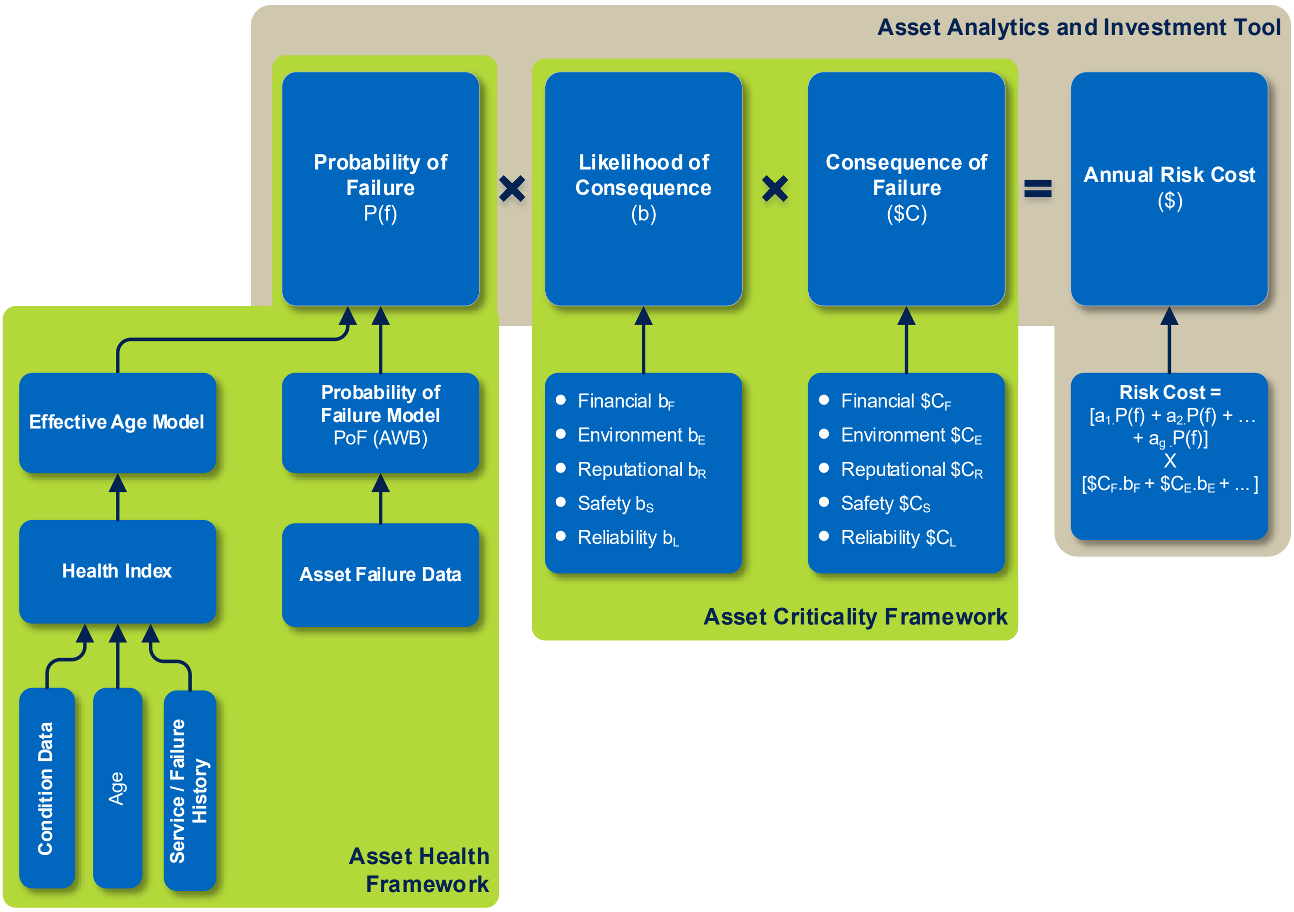
# Appendix B Risk assessment framework

This appendix summarises our network risk assessment methodology that underpins the identified need for this RIT-T. Our risk assessment methodology is aligned with the AER's Asset Replacement Planning guideline[25] and its Principles.

A fundamental part of the risk assessment methodology is calculating the annual 'risk costs' or the monetised impacts of the reliability, safety, bushfire, environmental and financial risks.

The monetary value of risk (per year) for an individual asset failure resulting in an undesired outcome, is the likelihood (probability) of failure (in that year with respect to its age), as determined through modelling the failure behaviour of an asset (Asset Health), multiplied by the consequence (cost of the impact) of the undesired outcome occurring, as determined through the consequence analysis (Asset Criticality). Figure B-1 illustrates the base risk equation that we apply.

Figure B-1 Risk cost calculation




Economic justification of Repex to address an identified need is supported by risk monetised benefit streams, to allow the costs of the project or program to be assessed against the value of the avoided risks

[25] Industry practice application note - Asset replacement planning, AER July 2024

and costs. The major quantified risks we apply for Repex justifications include asset failures that materialise as:

- Bushfire risk
- Safety risk
- Environmental risk
- Reliability risk, and
- Financial risk.

The risk categories relevant to this RIT-T are explained in Section 2.

Further details are available in our Network Asset Risk Assessment Methodology.

# Appendix C Asset Health and Probability of Failure

The first step in calculating the probability of failure of an asset is determining the Asset Health and associated effective age,[26] which considers:

- An asset consists of different components, each with a particular function, criticality, underlying reliability, life expectancy and remaining life. The overall health of an asset is a compound function of all of these attributes.
- Key asset condition measures and failure data provides vital information on the current health of an asset. The 'Current effective age' is derived from asset information and condition data.
- The future health of an asset (health forecasting) is a function of its current health and any factors causing accelerated (or decelerated) degradation or 'age shifting' of one or more of its components. Such moderating factors can represent the cumulative effects arising from continual or discrete exposure to unusual internal, external stresses, overloads and faults.
- 'Future effective age' is derived by moderating 'current effective age' based on factors such as, external environment/influence, expected stress events and operating/loading condition.

The Probability of Failure (PoF) is the likelihood that an asset will fail during a given period resulting in a particular adverse event.

The outputs of the Probability of Failure (PoF) calculation are one or more probability of failure time series which provide a mapping between the effective age, discussed above, and the yearly probability of failure value for a given asset class. This analysis is performed by generating statistical failure curves, normally using Weibull analysis, to determine a PoF time series set for each asset that gives a probability of failure for each further year of asset life. This establishes how likely it is that the asset will fail over time.

The Weibull parameters which represent the probability of failure curve for key assets are summarised in the table below.

Table C-1 Weibull parameters for asset components

| Asset | Weibull parameters | |
|---|---|---|
| | η | β |
| Transformer | 54.21 | 3.61 |
| Oil Reactor | 38.84 | 2.95 |
| Circuit Breaker | 47.76 | 4.3 |
| Oil filled Current Transformer | 50 | 3.08 |
| Magnetic Voltage Transformer | 50 | 3.8 |
| Capacitive Voltage Transformer | 50 | 3.8 |
| Disconnector | 67 | 4.8 |
| Surge Arrester | 55 | 3.2 |

[26] Apparent age of an asset based on its condition.

| | | |
|---|---|---|
| Auxillary Transformer | 70 | 4.5 |
| Capacitor bank | 50 | 4.5 |
| Multifunction Intelligent Electronic Device:<br>- Protection<br>- Controller<br>- Telecommunication | 14.3 | 1.78 |
| Protection Relay - Solid State | 32.7 | 1.24 |
| Protection Relay - Electromechanical | 92.9 | 1.57 |
| Protection Relay - Intertrip | 26.2 | 1.54 |
| Remote Terminal Unit | 22.5 | 1.77 |
| PC | 12.7 | 2.09 |
| Meter - Microprocessor | 15.5 | 1.74 |
| DC Battery | 16.5 | 1.49 |
| DC Charger | 19.8 | 1.24 |