People. Power. Possibilities.

Addressing low spans on Line 1, Line 2, and Line 973/9GL

RIT-T Project Specification Consultation Report

Issue date: 7 May 2024

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 mitigating safety and financial risks caused by 'low spans' on three transmission lines in regional NSW, being:

- Line 1 – a 330 kV line that links Upper Tumut and Stockdill;
- Line 2 – a 330 kV line that links Ravine and Yass; and
- Line 973/9GL – a 132 kV line that links Yass and Cowra (via Bango).

Overhead transmission lines are designed and constructed to achieve standard minimum electrical clearances to the conductor, i.e., a minimum distance between the 'wire' and any land, vegetation or infrastructure around it. This ensures that safety and environmental risks from the lines are minimised.

Design of transmission lines considers a range of safety and environmental factors, including thermal expansion of the conductor (known as sag) and movement of the conductor position due to wind (known as blowout). Sag occurs where load on the conductor causes the conductor to stretch when it is hot, such that the conductor between two poles or towers of a transmission line hangs low. To account for sag, line design temperatures are set as the maximum temperature that a conductor may operate at while still achieving minimum electrical clearance. If the conductor at its lowest point exceeds the minimum electrical clearance specified in that line's design, this is referred to as the line having 'low span'.

There are a number of spans between towers on the above lines that do not currently meet the applicable design standards (i.e., exhibit 'low spans') and thus could pose safety and financial risks if left unaddressed. While these lines were identified as not meeting the original design standards, utilisation had historically been sufficiently low such that there was not a material safety or operational risk. However, as line utilisations have increased, operating temperatures on the lines have also increased causing line clearances from the ground to reduce.

The remediation of the lines subject to this RIT-T has now been prioritised based on their utilisation rates and estimated risks in accordance with Low Span Risk Assessment Methodology.

Identified need: managing risks on Line 1, Line 2 and Line 973/9GL

If action is not taken, there is a higher likelihood for the conductor to breach the minimum clearance requirement.

Under the 'do nothing' base case, incidents could occur that pose safety risks for members of the public. These incidents also have financial risks associated with litigation, investigation, and legislation breaches.

We manage and mitigate environmental and safety risk to ensure they are below risk tolerance levels or 'As Low As Reasonably Practicable' ('ALARP'), in accordance with our obligations under the *New South Wales Electricity Supply (Safety and Network Management) Regulation 2014* and our Electricity Network Safety Management System (ENSMS).[1]

The proposed investment will enable us to continue to manage safety risk to ALARP, consistent with our obligations. Consequently, we consider this to be a reliability corrective action under the RIT-T. A reliability

[1] Our ENSMS follows the International Organization for Standardization's ISO31000 risk management framework which requires following a hierarchy of hazard mitigation approach.

corrective action differs from a 'market benefits'-driven RIT-T in that the preferred option is permitted to have negative net economic benefits on account of it being required to meet an externally imposed obligation on the network business.

One credible option has been considered

We consider that there is only one feasible option from a technical, commercial, and project delivery perspective that will meet the identified need.

Option 1 involves remediating the low spans on Lines 1, 2, and 973/9GL to the line design temperatures and will align all lines with AS/NZS 7000 (the current industry standard). Remediation is expected to involve mid-span structure installation, 'dummy strain' insulator arrangements and associated landscaping near the line.

All works are estimated to take place over a period of 36 months, with a commissioning date of 2025/26 for Line 2 and Line 973/9GL, and 2026/27 for Line 1.

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.

The estimated capital cost of this option is approximately $19.07 million and there are not expected to be any additional annual routine operating costs (i.e., the cost under the option is the same as under the base case) since it does not affect the frequency of required inspections.

There is no expectation of needing to uprate the line at this point in time

The proposed works under Option 1 are focused simply on raising the spans of the existing conductors. We do not expect the conductors included in this RIT-T need to be uprated at this point in time as we do not expect the line loadings to exceed their existing line ratings in the near future.

Specifically, we consider that uprating would cost significantly more than Option 1 and not add a commensurate increase in estimated market benefit. Uprating is therefore not considered commercially feasible at this point in time.

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

We do not consider non-network options to be commercially or technically feasible to assist with meeting the identified need for this RIT-T, as non-network options will not mitigate the safety and financial risks posed as a result of the identified low spans.

The option has been assessed against three reasonable scenarios

The credible option has been assessed under three scenarios as part of this PSCR assessment, which differ in terms of the key drivers of the estimated net market benefits (i.e., the estimated risk costs avoided)

Given that wholesale market benefits are not relevant for this RIT-T, the three scenarios implicitly assume the expected most likely scenario in the draft 2024 ISP (i.e., the 'Step Change' scenario). The scenarios differ by the assumed risk costs, given that this is the key parameter that may affect the benefits associated with this option.

Table E.1 Summary of scenarios

Variable / Scenario	Central	Low risk cost scenario	High risk cost scenario
Scenario weighting	*1/3*	*1/3*	*1/3*
Discount rate	7.0%	7.0%	7.0%
Network capital costs	Base estimate	Base estimate	Base estimate
Risk costs	Base estimate	Base estimate -25%	Base estimate +25%

We have weighted the three scenarios equally given there is nothing to suggest an alternate weighting would be more appropriate.

Option 1 is the preferred option at this draft stage of the RIT-T

Option 1 is estimated to deliver net economic benefits of $2.39 million on a weighted basis in present value terms. The benefits included in this assessment consist of avoided risk costs (i.e., a reduction in safety and financial risks) and are estimated to be between $13.16 million and $21.94 million across the three scenarios.

Table E.2 Estimated gross benefits, costs and net benefits of Option 1 relative to the base case ($m, PV)

Option/scenario	Central	Low risk cost scenario	High risk cost scenario	Weighted
Scenario weighting	*1/3*	*1/3*	*1/3*	
Estimated gross benefits	17.55	13.16	21.94	17.55
Estimated costs	-15.16	-15.16	-15.16	-15.16
Net economic benefits	**2.39**	**-2.00**	**6.78**	**2.39**

While the estimated net benefit is marginally negative under the low risk cost scenario, it is positive under the central, high risk cost and weighted cases. On balance, we consider the expected benefits of the investment to outweigh the costs.

This PSCR therefore finds that Option 1 is the preferred option at this stage of the RIT-T.

Exemption from preparing a PADR

NER clause 5.16.4(z1) provides for a TNSP to be exempt from producing a PADR for a particular RIT-T application, in the following circumstances:

- if the estimated capital cost of the preferred option is less than $46 million;
- if the TNSP identifies in its PSCR its proposed preferred option, together with its reasons for the preferred option and notes that the proposed investment has the benefit of the clause 5.16.4(z1) exemption; and
- if the TNSP considers that the proposed preferred option and any other credible options 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), with the exception of market benefits arising from changes in voluntary and involuntary load shedding.

We consider that the investment in relation to Option 1 and the analysis in this PSCR meets these criteria and therefore that we are exempt from producing a PADR under NER clause 5.16.4(z1).

In accordance with NER clause 5.16.4(z1)(4), the exemption from producing a PADR will no longer apply if we consider that an additional credible option that could deliver a material market benefit is identified during the consultation period.

Accordingly, if we consider that any such additional credible options are identified, we will produce a PADR which includes an NPV assessment of the net market benefit of each additional credible option.

Should we consider that no additional credible options were identified during the consultation period that could have material market benefits, we intend to produce a PACR in October 2024 that addresses all submissions received, including any issues in relation to the proposed preferred option raised during the consultation period, and presents our conclusion on the preferred option for this RIT-T.

Contents

1. Introduction

This Project Specification Consultation Report (PSCR) represents the first step in the application of the Regulatory Investment Test for Transmission (RIT-T) to options for addressing 'low spans' on three transmission lines in regional NSW, being:

- Line 1 – a 330 kV line that links Upper Tumut and Stockdill;
- Line 2 – a 330 kV line that links Ravine and Yass; and
- Line 973/9GL – a 132 kV line that links Yass and Cowra (via Bango).

Overhead transmission lines are designed and constructed to achieve standard minimum electrical clearances to the conductor, i.e., a minimum distance between the 'wire' and any land, vegetation or infrastructure around it. This ensures that safety and environmental risks from the lines are minimised.

Design of transmission lines considers a range of safety and environmental factors, including thermal expansion of the conductor (known as sag) and movement of the conductor position due to wind (known as blowout). Sag occurs where load on the conductor causes the conductor to stretch when it is hot, such that the conductor between two poles or towers of a transmission line hangs low. To account for sag, line design temperatures are set as the maximum temperature that a conductor may operate at while still achieving minimum electrical clearance. If the conductor at its lowest point exceeds the minimum electrical clearance specified in that line's design, this is referred to as the line having 'low span'.

Line 1 and Line 2 were commissioned in 1959 and 1961, respectively, and some spans on these lines were not built to prevailing design standards at the time (which was not detected until the development of laser survey technologies). With the advent of laser survey technologies around the late 2000s and early 2010s, some of the spans on Line 1 and Line 2 were identified as not meeting their original design standards clearances.

In general, spans that meet the original design standards when they were built, but not the current AS/NZS 7000 standard, are considered to meet the current standard under grandfathering provisions in AS/NZS 7000. However, where lines do not meet the original design standards, then they are not considered to meet AS/NZS 7000.

While these lines were identified as not meeting the original design standards, utilisation had historically been sufficiently low such that there was not a material safety or operational risk. However, as line utilisations have increased, operating temperatures on the lines have also increased causing line clearances from the ground to reduce.

The remediation of the lines subject to this RIT-T has now been prioritised based on their utilisation rates and estimated risks in accordance with the Low Span Risk Assessment Methodology.

In addition, Line 973/9GL also did not comply with prevailing design standards at the time it was built but has historically had low utilisation and therefore presented very low levels of risk. However, changes to the generation location on Transgrid's network in recent years have increased its utilisation, resulting in the line operating at higher temperatures and increasing the likelihood of low span on this line.

We manage and mitigate safety and environmental risk to ensure they are below risk tolerance levels or 'As Low As Reasonably Practicable' ('ALARP'), in accordance with our obligations under the *New South Wales*

Electricity Supply (Safety and Network Management) Regulation 2014 and our Electricity Network Safety Management System (ENSMS).

This RIT-T therefore examines options for addressing the low span issues so that network safety continues to meet a risk mitigation level of ALARP, consistent with our obligations. Consequently, we consider this to be a reliability corrective action under the RIT-T.

1.1. Purpose of this report

The purpose of this PSCR[2] is to:

- set out the reasons why we propose that action be undertaken (the 'identified need');
- present the option that we currently consider addresses the identified need;
- outline the technical characteristics that non-network options would need to provide (although we note that non-network options are unlikely to be able to contribute to meeting the identified need for this RIT-T);
- present the economic assessment of the credible option, as well as the assumptions feeding into the analysis, and identify a preferred option at this draft stage of the RIT-T; and
- allow interested parties to make submissions and provide inputs to the RIT-T assessment.

Overall, this report provides transparency into the planning considerations for investment options to ensure continuing safe and reliable supply to our customers. A key purpose of this PSCR, and the RIT-T more broadly, is to provide interested stakeholders the opportunity to review the analysis and assumptions, provide input to the process, and have certainty and confidence that the preferred option has been robustly identified as optimal.

1.2. Exemption from preparing a PADR

NER clause 5.16.4(z1) provides for a TNSP to be exempt from producing a Project Assessment Draft Report (PADR) for a particular RIT-T application, in the following circumstances:

- if the estimated capital cost of the preferred option is less than $46 million;
- if the TNSP identifies in its PSCR its proposed preferred option, together with its reasons for the preferred option and notes that the proposed investment has the benefit of the clause 5.16.4(z1) exemption; and
- if the TNSP considers that the proposed preferred option and any other credible options 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), with the exception of market benefits arising from changes in voluntary and involuntary load shedding.

We consider the investment considered and the analysis presented in this PSCR meets these criteria and therefore that we are exempt from producing a PADR under NER clause 5.16.4(z1).

2 See Appendix A for the National Electricity Rules requirements.

In accordance with NER clause 5.16.4(z1)(4), the exemption from producing a PADR will no longer apply if we consider that an additional credible option that could deliver a material market benefit is identified during the consultation period.

Accordingly, if we consider that any such additional credible options are identified, we will produce a PADR which includes an NPV assessment of the net market benefit of each additional credible option.

1.3. Submissions and next steps

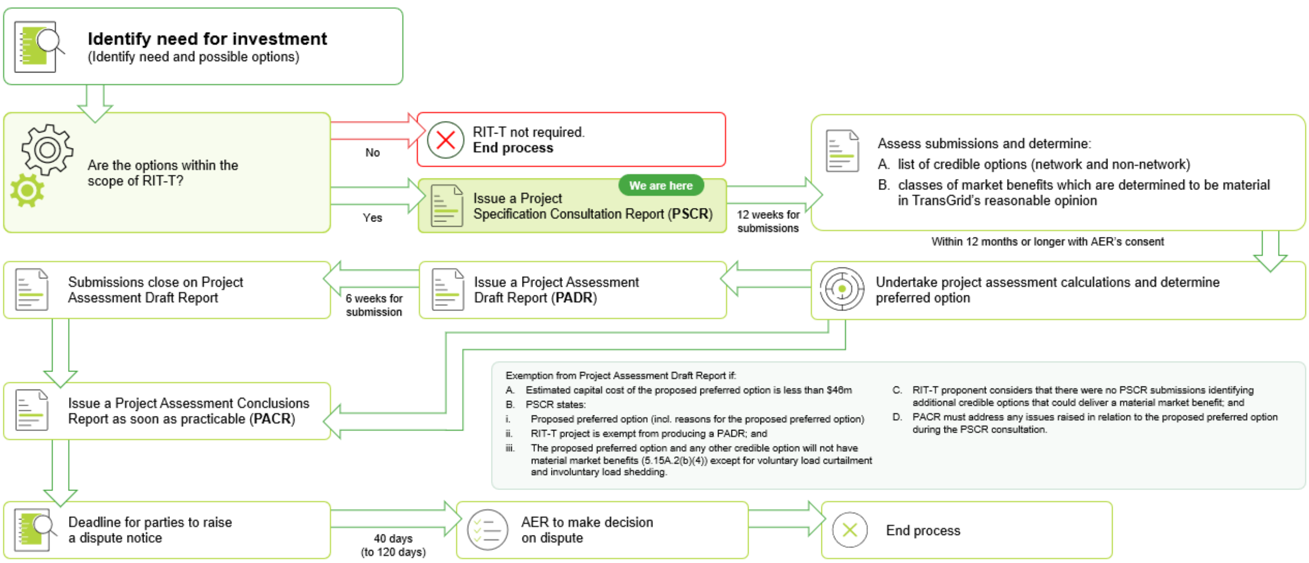
We welcome written submissions on materials contained in this PSCR. Submissions are due on 5 August 2024.

Submissions should be emailed to our Regulation team via regulatory.consultation@transgrid.com.au.[3] In the subject field, please reference 'low spans on Line 1, Line 2, and Line 973/9GL PSCR'.

At the conclusion of the consultation process, all submissions received will be published on our website. If you do not wish for your submission to be made public, please clearly specify this at the time of lodgement.

Should we consider that no additional credible options were identified during the consultation period that could provide material market benefits, we intend to produce a Project Assessment Conclusions Report (PACR) that addresses all submissions received including any issues in relation to the proposed preferred option raised during the consultation period, and presents our conclusion on the preferred option for this RIT-T.[4] Subject to additional credible options being identified, we anticipate publication of a PACR in October 2024.

Figure 1.1 This PSCR is the first stage of the RIT-T process[5]



---

[3] We are bound by the *Privacy Act 1988 (Cth)*. In making submissions in response to this consultation process, we 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. If you do not wish for your submission to be made public, please clearly specify this at the time of lodgement. See Privacy Notice within the Disclaimer for more details.

[4] In accordance with NER clause 5.16.4(z2).

[5] AEMC, *Replacement expenditure planning arrangements, Rule determination*, 18 July 2017.

2. The identified need

This section outlines the identified need for this RIT-T, as well as the assumptions and data underpinning it. It first sets out background information related to the low spans on Line 1, Line 2 and Line 973/9GL.

2.1. Background to the identified need

Overhead transmission lines are designed and constructed to achieve standard minimum electrical clearances to the conductor, i.e., a minimum distance between the 'wire' and any land, vegetation or infrastructure around it. This ensures that safety and environmental risks from the lines are minimised.

Design of transmission lines considers a range of safety and environmental factors, including thermal expansion of the conductor (known as sag) and movement of the conductor position due to wind (known as blowout). Sag occurs where load on the conductor causes the conductor to stretch when it is hot, such that the conductor between two poles or towers of a transmission line hangs low. and, to account for sag, line design temperatures are set as the maximum temperature that a conductor may operate at while still achieving minimum electrical clearance. If the conductor at its lowest point exceeds the minimum electrical clearance specified in that line's design, this is referred to as the line having 'low span'.

The current industry standard for minimum electrical clearance is set out in the 'AS/NZS 7000 – Design of Overhead Lines'.

Lines that meet the original design standards when they were built, but not the current AS/NZS 7000 standard, are considered to meet the current standard under grandfathering provisions in AS/NZS 7000. However, where lines do not meet the original design standards, then they are not considered to meet AS/NZS 7000.

With the advent of aerial laser survey technology around the late 2000s and early 2010s, Transgrid was able to identify sections of lines that have low spans based on the design temperature and line clearances from the ground. While these lines were identified as not meeting the original design standards, utilisation had historically been sufficiently low such that there was not a material safety or operational risk.

However, as line utilisations have increased, operating temperatures on the lines have also increased causing line clearances from the ground to reduce. The remediation of the lines subject to this RIT-T has now been prioritised based on their utilisation rates and estimated risks in accordance with the Low Span Risk Assessment Methodology.

These lines include:

- Line 1 – a 330 kV line that links Upper Tumut and Stockdill;
- Line 2 – a 330 kV line that links Ravine and Yass; and
- Line 973/9GL – a 132 kV line that links Yass and Cowra (via Bango).

In addition, Line 973/9GL also did not comply with prevailing design standards at the time it was built but has historically had low utilisation and therefore presented very low levels of risk. However, changes to the generation mix on Transgrid's network in recent years have increased its utilisation, resulting in the line operating at higher temperatures and increasing the likelihood of low span on this line. Specifically, the connection and commissioning of the Bango Windfarm (244 MW) in 2023 means that Line 973/9GL now operates at higher utilisation and temperatures and consequently has lower clearances than previously.

2.2. Description of the identified need

If action is not taken, remediation of the low spans on Lines 1, 2 and 973/9GL would not occur and the lines would operate with a level of risk going forward.

Under the ‘do nothing’ base case, incidents could occur that pose safety risks for members of the public. These incidents also have financial risks associated with litigation, investigation, and legislation breach cost.

We manage and mitigate environmental and safety risk to ensure they are below risk tolerance levels or ‘As Low As Reasonably Practicable’ (‘ALARP’), in accordance with our obligations under the *New South Wales Electricity Supply (Safety and Network Management) Regulation 2014* and our Electricity Network Safety Management System (ENSMS).[6]

The proposed investment will enable us to continue to manage safety risk to ALARP, consistent with our obligations. Consequently, we consider this to be a reliability corrective action under the RIT-T. A reliability corrective action differs from a ‘market benefits’-driven RIT-T in that the preferred option is permitted to have negative net economic benefits on account of it being required to meet an externally imposed obligation on the network business.

2.3. Assumptions underpinning the identified need

We adopt a risk cost framework to quantify and evaluate the risks and consequences of low spans continuing to exist. Appendix B provides an overview of our risk assessment methodology.

This section describes the assumptions underpinning our assessment of the risk costs, i.e., the value of the risk avoided by undertaking the credible option. The aggregate risk cost under the base case is currently estimated in 2023/24 dollars at around $1.96 million in 2023/24, which is expected to be constant over the assessment period.

2.3.1. Probability of failure

The probability of failure (PoF) is the likelihood of member of public being injured contacting a span and we use the following to model it:

- Australian land use and management classification data;
- human movement data from mobile phones;
- the proximity of span to roadways; and
- activities undertaken near span.

[6] Our ENSMS follows the International Organization for Standardization’s ISO31000 risk management framework which requires following a hierarchy of hazard mitigation approach.

2.3.2. Safety risk

This risk refers to the safety consequence to members of the public of an asset failure whose failure modes can create harm. The estimated value accounts for the cost associated with a fatality or injury including compensation, loss of productivity, litigation fees, fines and any other related costs.

Our safety model underwent a comprehensive update during 2021 and was developed in conjunction with asset management specialist consultancy AMCL.[7] The main changes to the model relate to consequence and likelihood quantifications with our safety risk now considering a range of consequences, from minor injury to fatality, and the likelihood of each based on historical events, human movement data and land use.

Consistent with our ALARP obligations, we apply a disproportionality factor of ‘six’ to the public safety component.

Safety risk is the second largest of all risks quantified under the base case for this RIT-T, making up 99.4 per cent of the total estimated risk cost in present value terms.

2.3.3. Financial risk

This risk refers to the direct financial consequence arising from the any incidents, including litigation, investigation, and legislation breach costs.

Financial risk is the smallest of all risks quantified under the base case for this RIT-T, making up 0.6 per cent of the total estimated risk cost in present value terms.

7 Refer to Network Asset Criticality Framework

3. Potential credible options

We consider that there is only one feasible option from a technical, commercial, and project delivery perspective that will meet the identified need.

All costs presented in this PSCR are in real 2023/24 dollars, unless otherwise stated.

3.1. Base case

The costs and benefits in this PSCR are compared against those of a base case. Under this base case, no proactive capital investment is made to remediate the identified low spans and all assets are left as-is, exposing our workforce, contractors and/or members of the public to significant safety risks.

While the base case is not a situation we plan to encounter, and this RIT-T has been initiated specifically to avoid it, the RIT-T assessment is required to use this base case as a common point of reference when estimating the net benefits.

We estimate that the base case will expose us and end-customers to approximately $1.96 million in safety and financial risk costs each year, which is expected to be constant over the assessment period.[8] The large risk costs are mainly due to the significant consequences of safety risks resulting from the low spans.

3.2. Option 1 – remediating the low spans to the line design temperature

Option 1 involves remediating the low spans on Lines 1, 2, and 973/9GL in accordance with Transgrid's low span risk assessment methodology to the line design temperature and will align all lines with AS/NZS 7000 (the current industry standard). Transgrid's low span risk assessment methodology takes into account land use, violation area size and means of access (types of vehicles/machinery, by foot, horseback, etc.) in determining level of risk exposure and identifying the appropriate treatment.

Remediation is expected to involve mid-span structure installation, 'dummy strain' insulator arrangements and associated landscaping near the line.

All works are estimated to take place over a period of 36 months, with a commissioning date of 2025/26 for Line 2 and Line 973/9GL, and 2026/27 for Line 1. 7.2.1

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.

The estimated capital cost of this option is approximately $19.07 million, which is comprised of:[9]

- $3.2 million in labour costs;
- $0.92 million materials costs; and
- $14.95 million in expenses.

8 This determination of yearly risk costs is based on our network asset risk assessment methodology and incorporates variables such as likelihood of failure/exposure, various types of consequence costs and corresponding likelihood of occurrence.

9 Note costs may not add due to rounding.

Table 3.1 provides a breakdown of these capital cost categories by line.

Table 3.1 Breakdown of Option 1 expected capital cost, $m real

Component	Labour	Materials	Expenses	Land	Total
Line 1	1.86	0.60	8.97	-	11.43
Line 2	0.39	0.16	2.09	-	2.64
Line 973/9GL	0.95	0.16	3.89	-	5.00
Total capital cost	**3.2**	**0.92**	**14.95**	**-**	**19.07**

Note, costs may not add due to rounding.

Table 3.2 shows the expected expenditure profile of Option 1 for each line across the three-year build period that is remediation is expected to take place.

Table 3.2 Annual breakdown of Option 1's expected capital cost, $m real

Year	Line 1	Line 2	Line 973/9GL	Year total
2023/24	0.21	0.06	0.12	0.38
2024/25	10.70	2.58	4.88	18.16
2025/26	0.52	0.00	0.00	0.52
Total capital cost	**11.43**	**2.64**	**5.00**	**19.07**

Option 1 will not affect annual routine operating costs (i.e., the cost is the same as under the base case) since it does not affect the frequency of inspections.

3.3. Options considered but not progressed

No other options are considered as potentially credible to address the identified need and remediate low spans on Lines 1, 2 and 973/9GL.

The lines specified in this RIT-T have been selected because their low spans require remediation now in order minimise risks. Transgrid therefore does not view staged timing as a viable option as any deferral would extend the duration of non-compliance.

Derating of lines to the extent where low span risk is acceptable will not be feasible as there is high market impact for the lines with high utilisation.

In addition, the proposed works under Option 1 are focused simply on raising the spans of the existing conductors. In addition, we do not expect the conductors included in this RIT-T need to be uprated at this point in time as we do not expect the line loadings to exceed their existing line ratings in the near future.

Specifically, we consider that uprating would cost significantly more than Option 1 and not add a commensurate increase in estimated market benefit. Uprating is therefore not considered commercially feasible at this point in time.

3.4. No material inter-network impact is expected

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

> *"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."*

AEMO's suggested screening test to indicate that a transmission augmentation has no material inter-network impact is that it satisfies the following:[11]

- 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. By reference to AEMO's screening criteria, there is no material inter-network impacts associated with the credible option considered.

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

[11] Inter Regional Planning Committee, *Final determination: Criteria for assessing material inter-network impact of transmission augmentations*, 2004, pp 16-18.

4. Non-network options

We do not consider non-network options to be commercially and technically feasible to assist with meeting the identified need for this RIT-T, as non-network options will not mitigate the safety and financial risks posed as a result of the identified low spans.

For non-network options to assist, they would need to provide greater net economic benefits than the network option. That is, non-network options would need to reduce the safety and financial risk related costs (which in practice are not expected to be affected by non-network solutions).

The objective of this identified need is not load dependent, given that all three lines in the identified need of this RIT-T form part of Transgrid's wider meshed network.

Non-network options are unable to technically reduce risk related costs associated with the identified low spans, which forms the identified need for this RIT-T.

Any non-network solution is therefore expected to add to the costs of the options considered, without providing material market benefits.

In summary, we consider that non-network options are unable to contribute to meeting the identified need for this RIT-T. This is based on:

- the nature of the identified need, meaning that non-network options would not defer or avoid the preferred network option – irrespective of the size, nature and location of the non-network option; and
- any non-network solution for this need is expected to add to the costs of the options considered and would not provide net benefit.

5. 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.[12]

5.1. Wholesale electricity market benefits are not material

The AER has recognised that if the credible options considered 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.[13]

The credible option considered in this RIT-T will not address network constraints between competing generating centres and is 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 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.

5.2. No other classes of market benefits are considered material

In addition to the classes of market benefits discussed above, NER clause 5.15A.2(b)(4) requires that we consider the following classes of market benefits arising from each credible option. We consider that none of the classes of market benefits listed will be material for this RIT-T assessment for the reasons in Table 5.1.

[12] 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(c)(6). See Appendix A for requirements applicable to this document.

[13] Australian Energy Regulator, *Regulatory investment test for transmission Application guidelines*, October 2023, Melbourne: Australian Energy Regulator. https://www.aer.gov.au/system/files/2023-10/AER%20-%20RIT-T%20guidelines%20-%20final%20amendments%20%28clean%29%20-%206%20October%202023_0.pdf

Table 5.1 Reasons why other non-wholesale electricity market benefits are considered immaterial

Market benefits	Reason
Changes in involuntary load curtailment	Load and transmission capacity on the three lines identified for remediation do not change and so there is no expected impact on unserved energy.
Difference in the timing of unrelated expenditure	The investment is specific to each line's low span and will not affect investment in other parts of the network.
Option value	We note the AER's view is 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.[14] Option 1 is not flexible to respond to change or uncertainty for this RIT-T.
Changes in Australian greenhouse gas emissions	Neither option is expected to induce a material change in Australia's greenhouse gas emissions.

[14] AER, *Regulatory Investment Test for Transmission – Application Guidelines*, October 2023, p. 57.

6. Overview of the assessment approach

This section outlines the approach that we have applied in assessing the net benefits associated the credible option against the base case.

6.1. Description of the base case

The costs and benefits are compared against the base case. Under this base case, Transgrid and the general public would be exposed to safety and financial risks associated with the low spans.

We note that this outcome is not expected in practice. However, this approach has been adopted since it is consistent with AER guidance on the base case for RIT-T applications.[15]

6.2. Assessment period and discount rate

A 20-year assessment period from 2023/24 to 2042/43 has been adopted for this RIT-T analysis. This period takes into account the size, complexity and expected asset life of the option.

Where the capital components have asset lives extending beyond the end of the assessment period, the NPV modelling includes a residual value to capture the remaining functional asset life. This ensures that the capital cost of the long-lived assets over the assessment period is appropriately captured, and that costs and benefits are assessed over a consistent period, irrespective of option type, technology or serviceable 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 7.00 per cent has been adopted as the central assumption for the NPV analysis presented in the PADR, consistent with AEMO's latest Input Assumptions and Scenarios Report (IASR).[16] 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 3.21 per cent.[17] We have also adopted an upper bound discount rate of 10.5 per cent (i.e., the upper bound in the latest IASR).[18]

6.3. Approach to estimating option costs

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

All costs estimated by Transgrid's project development team use the estimating tool 'MTWO'. The MTWO cost estimating database reflects actual outturn costs built up over more than 10 years from:

- period order agreement rates and market pricing for plant and materials;

[15] We note that the AER RIT-T Guidelines state that 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'. The AER define 'BAU activities' as ongoing, economically prudent activities that occur in the absence of a credible option being implemented. Australian Energy Regulator, *Regulatory investment test for transmission Application guidelines*, October 2023, Melbourne: Australian Energy Regulator. https://www.aer.gov.au/system/files/2023-10/AER%20-%20RIT-T%20guidelines%20-%20final%20amendments%20%28clean%29%20-%206%20October%202023_0.pdf

[16] AEMO, *2023 Inputs, Assumptions and Scenarios Report*, Final report, July 2023, p 123.

[17] This is equal to WACC (pre-tax, real) in the latest final decision for a transmission business in the NEM (Transgrid) as of the date of this analysis, see: https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/transgrid-determination-2023%E2%80%9328/final-decision

[18] AEMO, *2023 Inputs, Assumptions and Scenarios Report*, Final report, July 2023, p 123.

- labour quantities from recently completed project; and
- construction tender and contract rates from recent projects.

The MTWO estimating database is reviewed annually to reflect the latest outturn costs and confirm that estimates are within their stated accuracy range and represent the most likely expected cost of delivery (P50 costs[19]). As part of the annual review, Transgrid benchmarks the outcomes against independent estimates provided by various engineering consultancies.[20]

Transgrid does not generally apply the Association for the Advancement of Cost Engineering (AACE) international cost estimate classification system to classify cost estimates. Doing so for this RIT-T would involve significant additional costs, which would not provide a corresponding increase in benefits compared with the use of MWTO estimates and so this has not been undertaken.

We estimate that actual costs will be within +/- 25 per cent of the central capital cost estimate. While we have not explicitly applied the AACE cost estimate classification system, we note that 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 AACE classification system.

No specific contingency allowance has been included in the cost estimates.

Work is planned along existing Transgrid easements, where access is expected to be available. Only minor access track upgrades have been assessed as part of the desktop assessment. Where civil works is anticipated, normal soil conditions have been assumed.

All cost estimates are prepared in real, 2023/24 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.

6.4. The option has been assessed against three reasonable scenarios

The RIT-T is focused on identifying the top ranked credible option in terms of expected net benefits (or lowest net costs for a RIT-T with a reliability correction identified need). However, uncertainty exists in terms of estimating future inputs and variables (termed future 'states of the world').

To deal with this uncertainty, the NER requires that costs and market benefits for each credible option are estimated under reasonable scenarios and then weighted based on the likelihood of each scenario to determine a weighted ('expected') net benefit. It is this 'expected' net benefit that is used to rank credible options and identify the preferred option.

The credible option has been assessed under three scenarios as part of this PSCR assessment, which differ in terms of the key drivers of the estimated net market benefits (i.e., the estimated risk costs avoided)

Given that wholesale market benefits are not relevant for this RIT-T, the three scenarios implicitly assume the expected most likely scenario for the draft 2024 ISP (i.e., the 'Step Change' scenario). The scenarios

---

19 I.e., there is an equal likelihood of over- or under-spending the estimate total.

20 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.

differ by the assumed risk costs, given that this is the key parameter that may affect the benefits associated with this option.

How the NPV results are affected by changes to other variables (including the discount rate and capital costs) has been investigated in the sensitivity analysis. This is consistent with the latest AER guidance for RIT-Ts of this type (i.e., where wholesale market benefits are not expected to be material).[21,22]

Table 6.1 Summary of scenarios

Variable / Scenario	Central	Low risk cost scenario	High risk cost scenario
Scenario weighting	*1/3*	*1/3*	*1/3*
Discount rate	7.0%	7.0%	7.0%
Network capital costs	Base estimate	Base estimate	Base estimate
Risk costs	Base estimate	Base estimate -25%	Base estimate +25%

We have weighted the three scenarios equally given there is nothing to suggest an alternate weighting would be more appropriate.

6.5. Sensitivity analysis

In addition to the scenario analysis, we have also considered the robustness of the outcome of the cost benefit analysis through undertaking various sensitivity testing.

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

- lower and higher assumed capital costs;
- lower and higher estimated safety and financial risk benefits; and
- alternate commercial discount rate assumptions.

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 7.2.

[21] AER, *Regulatory Investment Test for Transmission – Application Guidelines*, October 2023, pp. 42-44.
[22] See: AER, *Decision: North West Slopes and Bathurst, Orange and Parkes Determination on dispute - Application of the regulatory investment test for transmission*, November 2022, pp. 18-20 & 31-32.

7. Assessment of the credible option

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

7.1. Estimated net market benefits

Table 7.1 below summarises the present value of the gross benefits, gross costs and net market benefits for Option 1 relative to the base case under the three scenarios.

The benefits included in this assessment consist of avoided risk (i.e., a reduction in safety and financial risks) and are estimated to be between $13.16 million and $21.94 million across the three scenarios.

Gross costs consist of only direct capital costs, which are estimated to be $15.16 million, relative to the base case, in present value terms.

The net economic benefits are the differences between the estimated gross benefits less the estimated costs.

Table 7.1 Estimated gross benefits, costs and net benefits of Option 1 relative to the base case ($m, PV)

Option/scenario	Central	Low risk cost scenario	High risk cost scenario	Weighted
Scenario weighting	*1/3*	*1/3*	*1/3*	
Estimated gross benefits	17.55	13.16	21.94	17.55
Estimated costs	-15.16	-15.16	-15.16	-15.16
Net economic benefits	**2.39**	**-2.00**	**6.78**	**2.39**

Option 1 is estimated to deliver net economic benefits of $2.39 million on a weighted basis in present value terms.

Figure 7.1 Net economic benefits ($m, NPV) – weighted

7.2. Sensitivity testing

We have undertaken sensitivity testing to understand the robustness of the RIT-T assessment to underlying assumptions about key variables. In particular, we have undertaken two sets of sensitivity tests:

- Step 1 – testing the sensitivity of the optimal timing of the project ('trigger year') to different assumptions in relation to key variables; and
- Step 2 – once a trigger year has been determined, testing the sensitivity of the total NPV benefit associated with the investment proceeding in that year, in the event that actual circumstances turn out to be different.

The application of the two steps to test the sensitivity of the key findings is outlined below.

7.2.1. Step 1 – sensitivity testing of the optimal timing

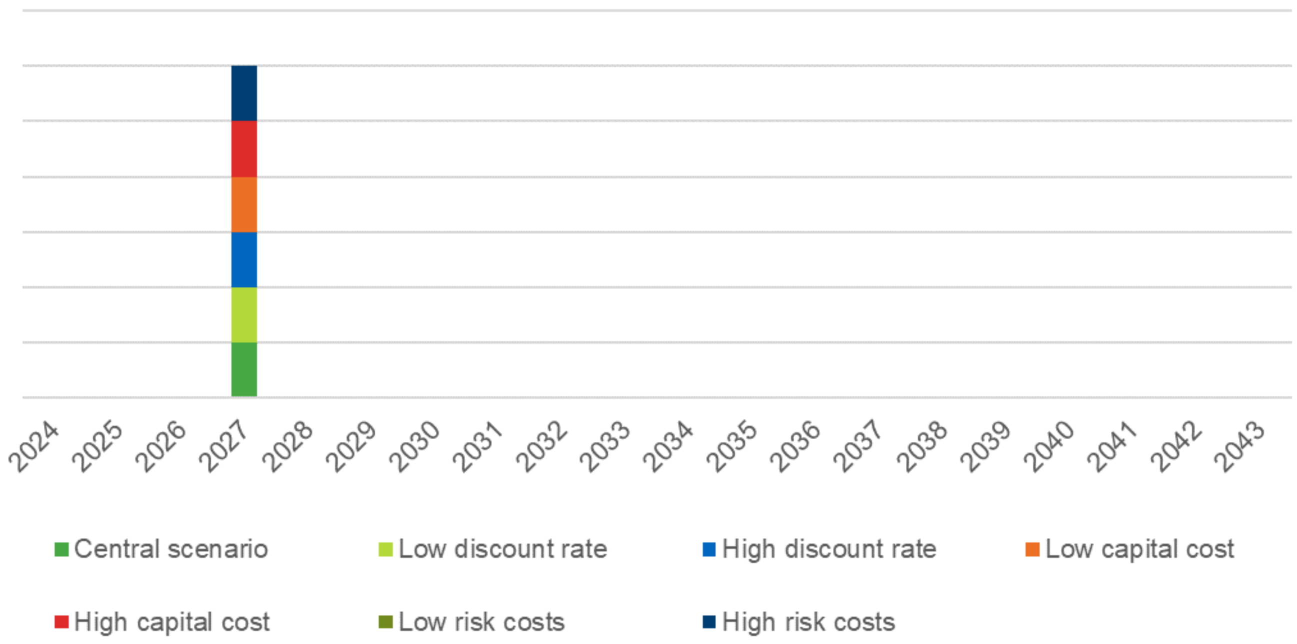
This section outlines the sensitivity of the identification of the commissioning year to changes in the underlying assumptions. Each timing sensitivity has been undertaken on the central scenario.

The optimal timing of Option 1 is found to be invariant to most assumptions of:

- a 25 per cent increase/decrease in the assumed network capital costs;
- lower (or higher) assumed safety and financial risks; and
- lower discount rate of 3.21 per cent as well as a higher rate of 10.50 per cent.

Specifically, Figure 7.2 below outlines the impact on the optimal commissioning year for each line, under a range of alternate assumptions. It demonstrates that the optimal timing for Option 1 is FY2027, except for the low risk costs scenario, where the project is no longer justified.

Figure 7.2 Optimal timing for Option 1



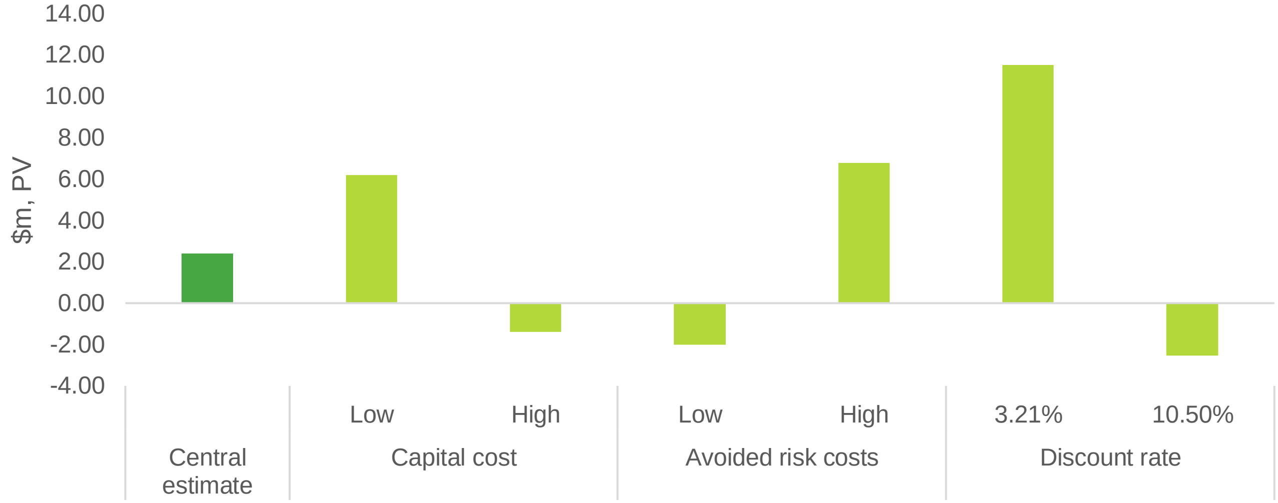
7.2.2. Step 2 – sensitivity of the overall net benefit

We have conducted sensitivity analysis on the present value of the net economic benefit, based on undertaking the project in 2023/24 and completion in 2026/27. Specifically, we have investigated the same sensitivities under this step as in the first step:

- a 25 per cent increase/decrease in the assumed network capital costs;
- lower (or higher) assumed safety and financial risks; and
- lower discount rate of 3.21 per cent as well as a higher rate of 10.50 per cent.

Figure 7.3 below illustrates the estimated net economic benefits if separate key assumptions in the central scenario are varied individually. All these sensitivities investigate the consequences of 'getting it wrong' having committed to a certain investment decision.

Figure 7.3 Sensitivity testing



Sensitivity tests show that net benefit results are sensitive to changes in capital costs, safety and financial risk costs and discount rates. We present further analysis of these sensitivities in the figures below.

The figures below illustrate the estimated net economic benefits for each option if separate key assumptions in the central scenario are varied individually.

Figure 7.4 Capital cost sensitivity

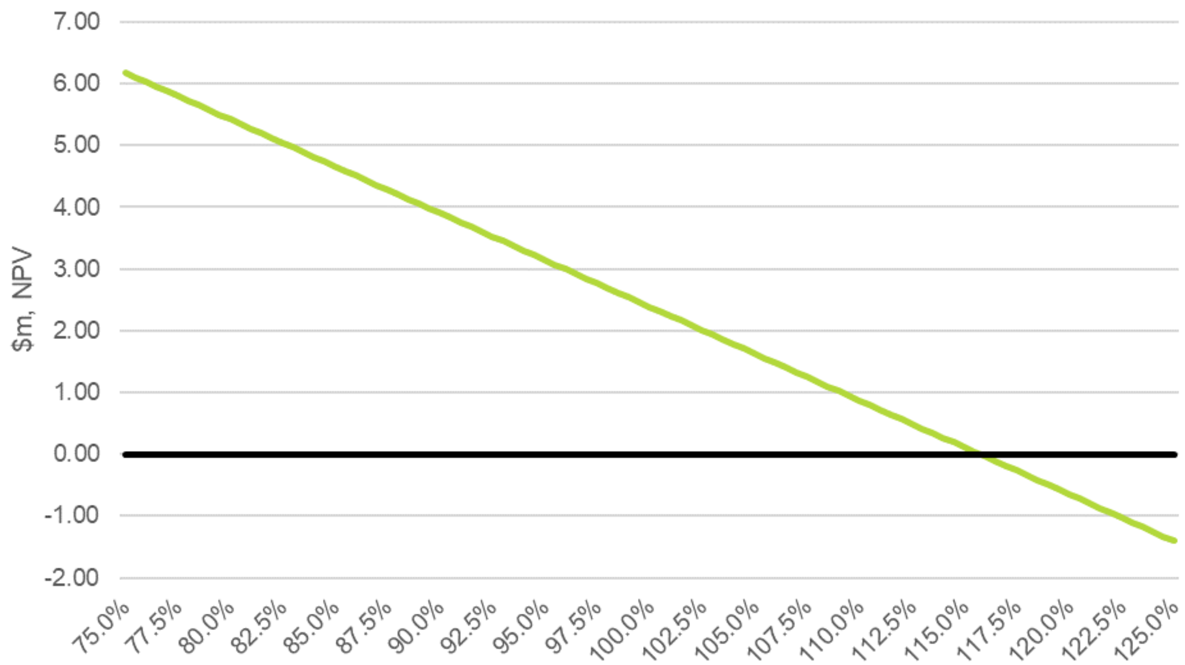


Figure 7.5 Risk cost sensitivity

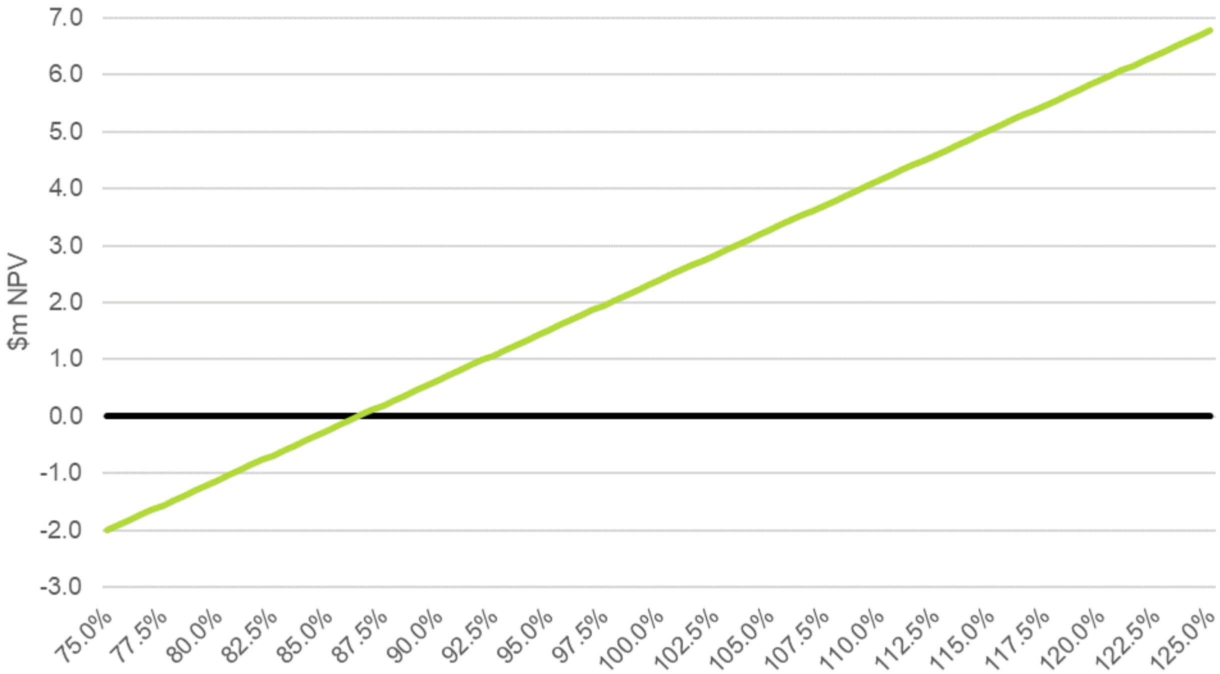
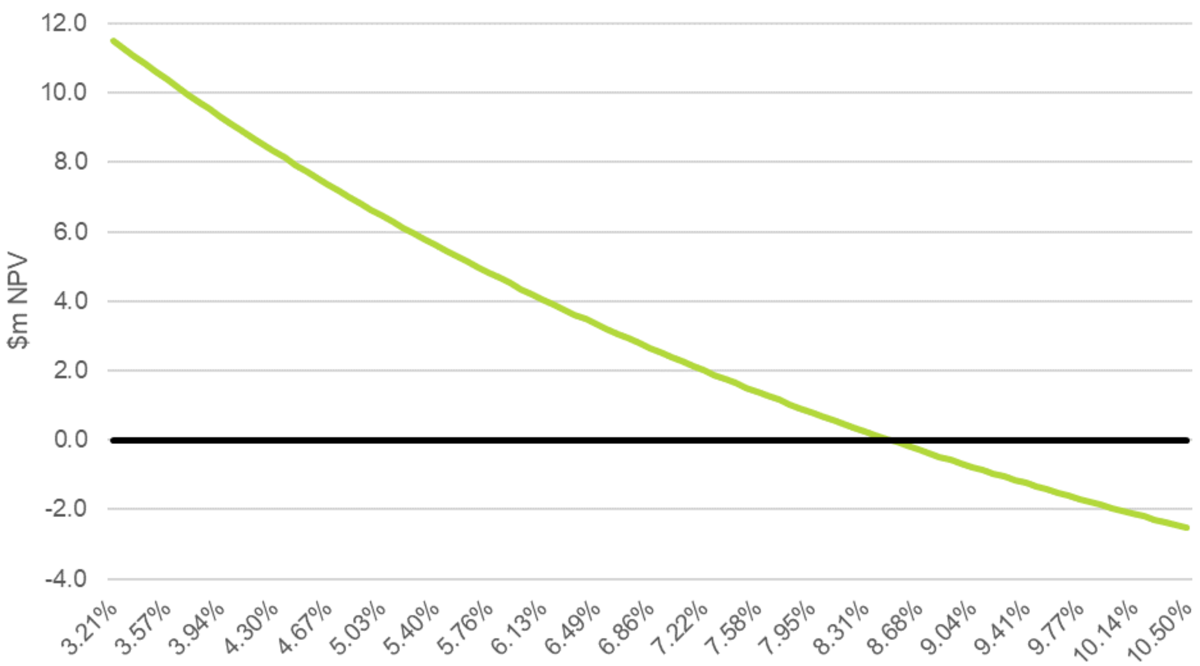


Figure 7.6 Commercial discount rate sensitivity



In terms of boundary testing, we find that the following would need to occur for Option 1 to have zero net market benefits:

- assumed network capital costs would need to increase by 15.8 per cent;
- risk costs would need to decrease by 13.7 per cent; and

- a discount rate of at least 8.48 per cent.

While the estimated net benefit is marginally negative under the low risk cost scenario and is shown, via the boundary testing, to be moderate sensitive to changes in key underlying assumptions, we note that it is positive under the central, high risk cost and weighted cases. On balance, we consider the expected benefits of the investment to outweigh the costs.

8. Draft conclusion and exemption from preparing a PADR

This PSCR has found that Option 1 is the preferred option at this stage of the RIT-T. Option 1 involves the remediation of low spans on Line 1, Line 2, and Line 973/9GL. The estimated capital expenditure associated with Option 1 is $19.07 million (in 2023/24 dollars).

All works are estimated to take place over a period of 36 months, with a commissioning date of 2025/26 for Line 2 and Line 973/9GL, and 2026/27 for Line 1. 7.2.1

NER clause 5.16.4(z1) provides for a TNSP to be exempt from producing a PADR for a particular RIT-T application, in the following circumstances:

- if the estimated capital cost of the preferred option is less than $46 million;
- if the TNSP identifies in its PSCR its proposed preferred option, together with its reasons for the preferred option and notes that the proposed investment has the benefit of the clause 5.16.4(z1) exemption; and
- if the TNSP considers that the proposed preferred option and any other credible options 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), with the exception of market benefits arising from changes in voluntary and involuntary load shedding.

We consider that the investment in relation to Option 1 and the analysis in this PSCR meets these criteria and therefore that we are exempt from producing a PADR under NER clause 5.16.4(z1).

In accordance with NER clause 5.16.4(z1)(4), the exemption from producing a PADR will no longer apply if we consider that an additional credible option that could deliver a material market benefit is identified during the consultation period.

Accordingly, if we consider that any such additional credible options are identified, we will produce a PADR which includes an NPV assessment of the net market benefit of each additional credible option.

Should we consider that no additional credible options were identified during the consultation period that could have material market benefits, we intend to produce a PACR in October 2024 that addresses all submissions received, including any issues in relation to the proposed preferred option raised during the consultation period, and presents our conclusion on the preferred option for this RIT-T.

Appendix A Compliance checklist

This appendix sets out a checklist which demonstrates the compliance of this PSCR with the requirements of the National Electricity Rules version 209.

Rules clause	Summary of requirements	Relevant section
5.16.4 (b)	A RIT-T proponent must prepare a report (the project specification consultation report), which must include:	–
	(1) a description of the identified need;	2.2
	(2) the assumptions used in identifying the identified need (including, in the case of proposed reliability corrective action, why the RIT-T proponent considers reliability corrective action is necessary);	2.3
	(3) the technical characteristics of the identified need that a non-network option would be required to deliver, such as: (i) the size of load reduction of additional supply; (ii) location; and (iii) operating profile;	4
	(4) if applicable, reference to any discussion on the description of the identified need or the credible options in respect of that identified need in the most recent National Transmission Network Development Plan;	NA
	(5) a description of all credible options of which the RIT-T proponent is aware that address the identified need, which may include, without limitation, alterative transmission options, interconnectors, generation, demand side management, market network services or other network options;	3
	(6) for each credible option identified in accordance with subparagraph (5), information about: (i) the technical characteristics of the credible option; (ii) whether the credible option is reasonably likely to have a material inter-network impact; (iii) the classes of market benefits that the RIT-T proponent considers are likely not to be material in accordance with clause 5.15A.2(b)(6), together with reasons of why the RIT-T proponent considers that these classes of market benefit are not likely to be material; (iv) the estimated construction timetable and commissioning date; and (v) to the extent practicable, the total indicative capital and operating and maintenance costs.	3.2

Appendix B Risk assessment methodology

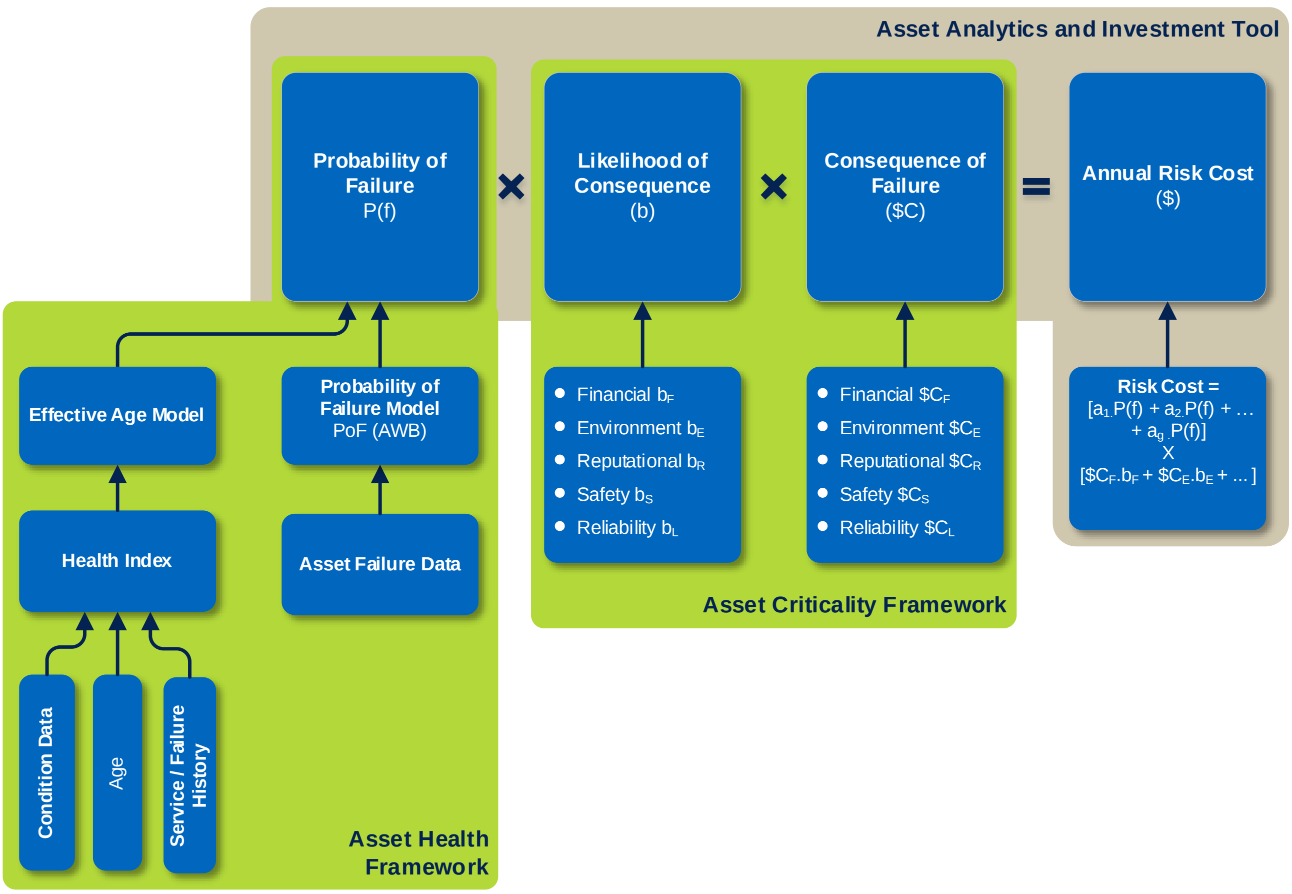
This appendix summarises our network risk assessment methodology that underpins the identified need for this RIT-T. Our risk assessment methodology is aligned with the AER's Asset Replacement Planning guideline[23] and its principles.

A fundamental part of the risk assessment methodology is calculating the annual 'risk costs' or the monetised impacts of the environmental, safety 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 (likelihood of member of public being injured contacting a span), multiplied by the consequence (cost of the impact) of the undesired outcome occurring, as determined through the consequence analysis (Asset Criticality).

Figure B-8.1 below summarises the framework for calculating the 'risk costs', which has been applied on our asset portfolio considered to need replacement or refurbishment.

Figure B-8.1 Risk cost calculation



23 Industry practice application note - Asset replacement planning, AER January 2019

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 and costs. The major quantified risks we apply 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 2.3.

Further details are available in our [Network Risk Assessment Methodology.]