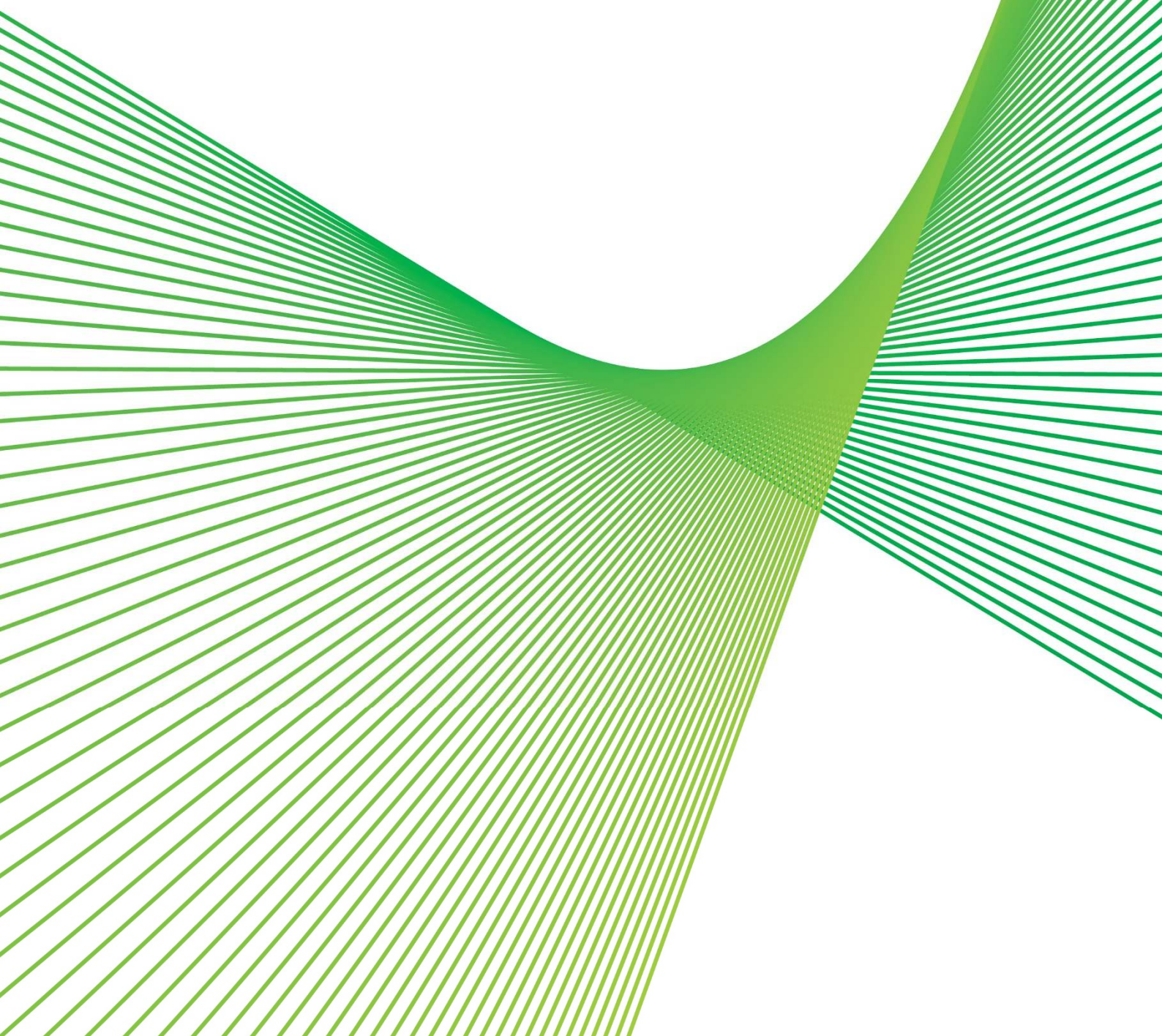


Managing risk on Line 8C/8J and 8C/8E

RIT-T Project Specification Consultation Report

Issue date: 15 August 2024



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Executive summary

We are applying the Regulatory Investment Test for Transmission (RIT-T) to options for mitigating safety, environmental (bushfire) and financial (high reactive maintenance) risks caused by the deteriorating condition of certain components of the 330 kV transmission line linking Dumaresq, Sapphire, and Armidale substations ('Line 8C/8J and 8C/8E'). The transmission line is a key link in the east coast network and is on the QNI transmission path which links the NSW and QLD regions of the National Electricity Market (NEM). Publication of this Project Specification Consultation Report (PSCR) represents the first step in the RIT-T process.

The purpose of this PSCR is to set out the reasons we propose that action be taken, present the options that address the identified need, outline the technical characteristics of the identified need that a non-network option would be required to deliver, and allow interested parties to make submissions and provide input to the RIT-T assessment.

The two double circuit, steel tower 330 kV transmission lines covered by this RIT-T are:

- Line 8C/8J – spanning a route of 58.9km between Dumaresq and Sapphire substations; and
- Line 8C/8E – spanning a route of 113.5km between Sapphire and Armidale substations.

The lines were constructed in 2000 as part of the interconnector between New South Wales and Queensland transmission networks and consists of 427 structures across the two lines. They mainly traverses rural agricultural land, bushland areas, and crosses some waterways, minor roads, and highways (the Gwydir Highway south of Sapphire substation, the New England Highway, and Waterfall Way north of Armidale substation).

Lines 8C/8J and 8C/8E were amongst the first constructed utilising Non-Ceramic Insulators (NCI) within the Transgrid network, and these are now approaching the end of their service life. The sample test results have shown a large reduction in hydrophobicity (ie ability of the insulator to resist the ingress of moisture), reduction in rod to housing adhesion and corona activity at the end fitting to housing interface, due to degradation and older design of this interface, after 21 years in service.

Recent inspection data and detailed asset condition analysis has identified that 140 of the 143 structures on Line 8C/8J and 280 of the 284 structures on Line 8C/8E have condition issues which require refurbishment to address its health and maintain appropriate risk levels across the network.

Identified need: Managing risks on Line 8C/8J and 8C/8E

If action is not taken, the condition of Line 8C/8J and 8C/8E is expected to expose us and our customers to increasing levels of risk going forward, as the likelihood of failure increases. There are safety and bushfire risks under the 'do nothing' base case, as well as replacement costs captured in the financial risk cost). The proposed investment will enable us to manage safety, environmental, reliability and financial risks on Line 8C/8J and 8C/8E.

Options considered under this RIT-T have been assessed relative to a base case. Under the base case, no proactive capital investment is made, and the condition of the lines will continue to deteriorate.

We manage and mitigate safety and bushfire 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 and operate this part of the network to a safety and risk mitigation level consistent with ALARP. Consequently, it is considered 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.

We note that the risk cost estimating methodology adopted for this RIT-T 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 original revenue proposal.

Credible options considered

In this PSCR, we have considered one credible option that would meet the identified need from a technical, commercial, and project delivery perspective.² This sole credible option is summarised in Table E-1.

Table E-1 Summary of credible options

Option	Description	Capital costs (\$m, +/- 25%, Real 2023-24)
Option 1	Remediate all identified condition issues for line components which have experienced deterioration and/or reached the end of their technical lives	31.35 (±25%)

The preferred option is Option 1, as it has positive weighted NPV result of the technically and commercially feasible options which have been considered at this stage of the RIT-T.

Four other options were considered but not progressed including increased inspections, elimination of all associated risk, new transmission line and non-network solutions. The reasons these options were not progressed are outlined in section 3.3 of this PSCR.

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 and technically feasible to assist with meeting the identified need for this RIT-T, as non-network options will not mitigate the safety and environment risk posed as a result of deteriorating asset condition.

The options have been assessed against three reasonable scenarios

The RIT-T is focused on identifying the top ranked credible option in terms of expected net benefits. 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

¹ Our ENSMS follows the International Organization for Standardization’s ISO31000:2018 Risk Management framework which requires following a hierarchy of hazard mitigation approach.

² As per clause 5.15.2(a) of the NER.

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 options have 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 (ie, the estimated risk costs avoided).

Given that wholesale market benefits are not relevant for this RIT-T, the three scenarios implicitly assume the most likely scenario from the 2024 ISP (ie, the 'Step Change' scenario). The scenarios differ by the assumed level of risk costs, given that these are key parameters that may affect the ranking of the credible options. Risk cost assumptions do not form part of AEMO's ISP assumptions, and have been based on Transgrid's analysis, as discussed in section 2.

We developed the Central Scenario around a static model of demand scenarios, described further in 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 ranking of the credible options.

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. We consider this is consistent with the latest AER guidance for RIT-Ts of this type (ie, where wholesale market benefits are not expected to be material).^{3, 4, 5}

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

Table E-2 Summary of scenarios

Variable / Scenario	Central	Low risk cost scenario	High risk cost scenario risk
Scenario weighting	1/3	1/3	1/3
Discount rate	7%	7%	7%
Network capital costs	Base estimate	Base estimate	Base estimate
Operating and maintenance costs	Base estimate	Base estimate	Base estimate
Safety, environmental, and financial risk benefit	Base estimate	Base estimate – 25%	Base estimate +25%

The sensitivity analysis has investigated how the NPV results are affected by changes to other variables, including the discount rate and capital costs.

Draft conclusion

Option 1 (remediation of all identified condition issues for components of lines) is the preferred option to meet the identified need at this stage of the RIT-T. Moving forward with this option is the most prudent and economically efficient solution to manage and mitigate safety and environmental risk to ALARP. Consequently, it will ensure our obligations under the *New South Wales Electricity Supply (Safety and*

³ AER, *Application Guidelines Regulatory Investment Test for Transmission*, October 2023, pp. 43-44.

⁴ We consider the approach to scenarios and sensitivities to be consistent with the AER guidance provided in November 2022 in the context of the disputes of the North West Slopes and Bathurst, Orange and Parkes RIT-Ts. 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, as well as with the AER's RIT-T Guidelines.

⁵ AEMO '2023 Inputs, Assumptions and Scenarios Report', July 2023, p 123-124

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

The estimated capital expenditure associated with this option is \$31.35 million. Routine operating and maintenance costs relating to planned checks by our field crew are approximately \$40,096 per year. We calculate that the avoided risk cost by undertaking Option 1 ranges from approximately \$6.1 million per year to \$25.0 million per year in real terms over the assessment period.

Option 1 is found to have positive net benefits under all scenarios investigated and, on a weighted basis, will deliver \$89.22 million⁶ in net economic benefits.

The works would be completed by 2026/27. 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.

Exemption from preparing a PADR

Subject to additional credible options being identified during the consultation period, publication of a Project Assessment Draft Report (PADR) is not required for this RIT-T as we 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 \$46 million⁷;
- 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
- the PACR must address any issues raised in relation to the proposed preferred option during the PSCR consultation.

We consider the investment in relation to Option 1 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 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, we intend to produce a PACR that addresses all submissions received, including any issues in relation to the

⁶ The relative size of this net economic benefits is due to the reduction of bushfire risk of the circuits concerned.

⁷ Varied from \$43m to \$46m based on the [AER Final Determination: Cost threshold review](#) November 2021.

proposed preferred option raised during the consultation period, and presents our conclusion on the preferred option for this RIT-T.

Submissions and next steps

We welcome written submissions on materials contained in this PSCR. Submissions are due on 14 November 2024.⁸

Submissions should be emailed to our Regulation team via regulatory.consultation@transgrid.com.au.⁹ In the subject field, please reference 'Line 8C/8J and 8C/8E 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.

Subject to additional credible options being identified during consultation, we anticipate publication of a PACR by January 2025.

⁸ Consultation period is for 12 weeks, additional days have been added to cover public holidays.

⁹ 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.

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1. Introduction

We are applying the Regulatory Investment Test for Transmission (RIT-T) to options for mitigating safety, environmental (bushfire) and financial (high reactive maintenance) risks caused by the deteriorating condition of certain components of the 330 kV line linking Dumaresq, Sapphire, and Armidale substations ('Line 8C/8J and 8C/8E'). The transmission line is a key link in the east coast network and is on the QNI transmission path which links the NSW and QLD regions of the National Electricity Market. Publication of this Project Specification Consultation Report (PSCR) represents the first step in the RIT-T process.

We manage and mitigate bushfire 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).

This RIT-T therefore examines options for addressing the asset condition issues so that network safety continues to meet a risk mitigation level of ALARP. Consequently, it is considered a reliability corrective action under the RIT-T.

1.1. Purpose of this report

The purpose of this PSCR¹⁰ is to:

- set out the reasons why we propose that action be undertaken (the 'identified need');
- present the options that we currently consider address 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 all credible options, 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 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

Subject to additional credible options being identified during the consultation period, publication of a Project Assessment Draft Report (PADR) is not required for this RIT-T as we 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 \$46 million¹¹;

¹⁰ See Appendix A for the National Electricity Rules requirements.

¹¹ Varied from \$43m to \$46m based on the [AER Final Determination: Cost threshold review November 2021](#).

- 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 except for voluntary load curtailment 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
 - > the PACR must address any issues raised in relation to the proposed preferred option during the PSCR consultation.

If an additional credible option that could deliver a material market benefit is identified during the consultation period, then we will produce a Project Assessment Draft Report (PADR) that updates the NPV assessment presented in this PSCR.

If no additional credible options with material market benefits are identified during the consultation period, then the next step in this RIT-T process will be the publication of a PACR that addresses all submissions received, including any issues in relation to the proposed preferred option raised during the consultation period.

1.3. Submissions and next steps

We welcome written submissions on materials contained in this PSCR. Submissions are due on 14 November 2024.¹²

Submissions should be emailed to our Regulation team via regulatory.consultation@transgrid.com.au.¹³ In the subject field, please reference 'Line 8C/8J and 8C/8E 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.

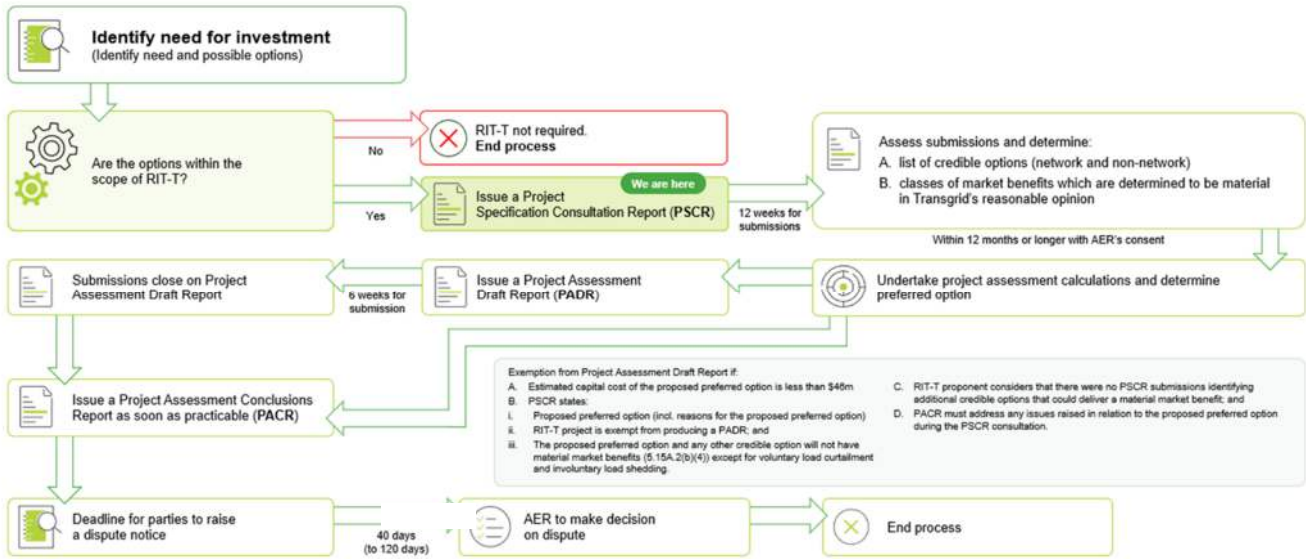
Should we consider that no additional credible options were identified during the consultation period, we intend to produce a Project Assessment Conclusions Report (PACR) that addresses all submissions received including any issues in relation to the proposed preferred option raised during the consultation period, and presents our conclusion on the preferred option for this RIT-T.¹⁴ Subject to additional credible options being identified, we anticipate publication of a PACR by January 2025.

¹² Consultation period is for 12 weeks.

¹³ 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.

¹⁴ In accordance with NER clause 5.16.4(z2).

Figure 1-1 This PSCR is the first stage of the RIT-T process¹⁵



¹⁵ Australian Energy Market Commission. *“Replacement expenditure planning arrangements, Rule determination”*. Sydney: AEMC, 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 relating to Line 8C/8J and Line 8C/8E.

2.1. Background to the identified need

Two transmission lines in northern NSW links our Dumaresq, Sapphire, and Armidale 330 kV substations. These transmission lines are a key link in the east coast network and is on the QNI transmission path which links the NSW and QLD regions of the National Electricity Market.

The two double circuit, steel tower 330 kV transmission lines covered by this RIT-T are:

- Line 8C/8J – spanning a route of 58.9km between Dumaresq and Sapphire substations; and
- Line 8C/8E – spanning a route of 113.5km between Sapphire and Armidale substations.

The lines were constructed in 2000 as part of the interconnector between New South Wales and Queensland transmission networks and consists of 427 structures across the two lines. It mainly traverses rural agricultural land, bushland areas, and crosses some waterways, minor roads, and highways (the Gwydir Highway south of Sapphire substation, the New England Highway, and Waterfall Way north of Armidale substation).

Figure 2-1 depicts the location of Line 8C/8J and 8C/8E in our Northern NSW network.

Figure 2-1 Location of Line 8C/8J and 8C/8E



The line was amongst the first constructed utilising Non-Ceramic Insulators (NCI) within the Transgrid network and these are now approaching the end of their service life. The sample test results have shown a large reduction in hydrophobicity (ie ability of the insulator to resist the ingress of moisture), reduction in rod to housing adhesion and corona activity at the end fitting to housing interface, due to degradation and older design of this interface, after 21 years in service.

Majority of the line has NCIs installed, and a health assessment predicts that these will reach end of life at around 2025. This is consistent with current industry practise to restrict service life of NCIs at Extra High Voltage to 25 years due to the expected degradation of insulator materials under electrical stress. Inspection data and detailed asset condition analysis have identified that 140 of the 143 structures on Line 8C/8J and 280 of the 284 structures on Line 8C/8E have condition issues which require refurbishment to address its health and maintain appropriate risk levels across the network.

Other issues on both lines include:

- Deterioration of public safety – danger signs
- Deterioration on tower components such as marker balls, climbing deterrents and signage.

Broken strands on earthwire bonding Appendix C provides a summary of the number of structures with condition issues within each asset component category. The figures are based on the Transmission Line Refurbishment Criteria document.

2.2. Description of identified need

The proposed investment will enable us to manage safety and environmental risks on Line 8C/8J and 8C/8E. Options considered under this RIT-T have been assessed relative to a base case. Under the base case, no proactive capital investment is made and the condition of the line will continue to deteriorate.

We manage and mitigates bushfire 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).¹⁶

The proposed investment will enable us to continue to manage and operate this part of the network to a safety and risk mitigation level of ALARP. Consequently, it is considered 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

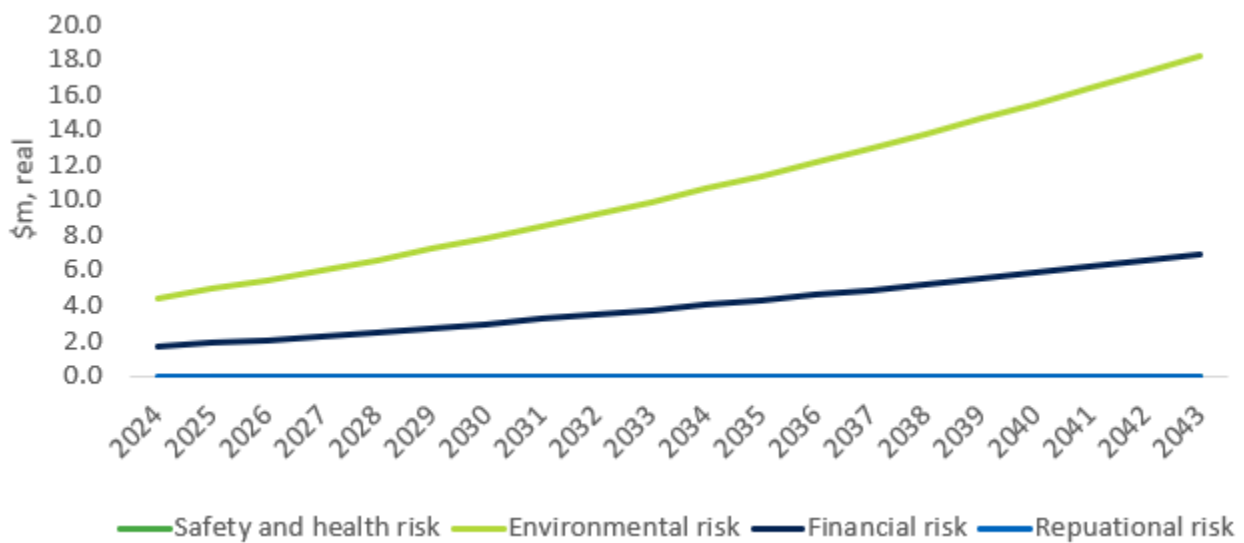
We adopt a risk cost framework to quantify and evaluate the risks and consequences of increased failure rates. Appendix B provides an overview of our Risk Assessment Methodology.

¹⁶ Our ENSMS follows the International Organization for Standardization's ISO31000:2018 Risk Management framework which requires following a hierarchy of hazard mitigation approach.

We note that the risk cost estimating methodology aligns with that used in our submitted 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 2-6 summarises the increasing risk costs over the assessment period under the base case.

Figure 2-6 Estimated risk costs



This section describes the assumptions underpinning our assessment of the risk costs, ie, the value of the risk that may be avoided by undertaking a credible option that addresses the identified need. The aggregate risk cost under the base case is currently estimated at \$6.1 million/year and it is expected to increase going forward if action is not taken and the line is left to deteriorate further (reaching approximately \$10.8 million/year by 2030 and \$25.0 million/year by the end of the 20-year assessment period).

2.3.1. Asset health and the probability of failure

Our asset health modelling aligns with Chapter 5.2 of the AER’s Asset Replacement Planning guideline.¹⁷ Condition information for each asset is assessed to generate an Asset Health Index and assets in relatively poor condition, as identified through the Asset Health Index, are candidates for a replacement or refurbishment intervention.

The asset health issues identified on Line 8C/8J and 8C/8E are summarised in Table 2-12-1.

¹⁷ AER, *Industry practice application note – Asset replacement planning*, January 2019 – available at <https://www.aer.gov.au/system/files/D19-2978%20-%20AER%20-Industry%20practice%20application%20note%20Asset%20replacement%20planning%20-%202025%20January%202019.pdf>

Table 2-1: Asset health issues along Line 8C/8J and 8C/8E and their consequences

Issue	Consequences if not remediated
Non-Ceramic insulators (NCI) have reached end of serviceable life	Bushfire resulting in potential loss of property and/or life Safety incident resulting in potential injury or death Line outage with potential network reliability impacts.
Earthwire bonding deterioration	Safety incident resulting in potential injury or death Line outage with potential network reliability impacts.
Aerial Marker Balls, Climbing deterrent, danger signs, deterioration	Safety incident resulting in potential injury or death Line outage with potential network reliability impacts.
Deterioration of conductor fittings and spacers	Bushfire resulting in potential loss of property and/or life Safety incident resulting in potential injury or death Line outage with potential network reliability impacts.

Appendix C provides a further summary of the number of structures with condition issues within each asset component category. The figures are based on the Transmission Line Refurbishment Criteria document.

Asset Health is used to estimate the remaining life of an asset and forecast the associated probability of failure (PoF) of the asset now and into the future. 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 events, external stresses, overloads and faults.

Asset condition information is the primary source of information on the current health of the transmission line and its components. Condition information obtained through routine inspections of transmission line, such as condition rating of each component, and asset information, such as natural age, location and ideal life expectancy, form the basis for deriving current health.

The PoF is the likelihood that an asset will fail during a given period resulting in a particular adverse event. The probability of each failure mode is calculated using reliability engineering techniques that take into account conditional age (chronological age moderated by asset health), failure and defect history, and industry benchmarking studies. We screen out failures that are not related to end-of-life when quantifying risk for replacement projects because such risks are not addressed by these works.

2.3.2. Bushfire risk

This risk refers to the consequence to the community of an asset failure that results in a bushfire starting. We recently undertook assessment with the University of Melbourne¹⁸ to improve our quantification of bushfire risks across our network, including the moderation of risk costs, using an electricity industry-developed approach.

The bushfire risk model:

- models the potential spread from a fire started at each asset in the network using recognised fire modelling software;
- calculates the consequence based on the number of houses, agricultural and forestry land use (and other infrastructure in the predicted burn area);
- moderates the consequence using a statistical distribution of fire conditions across the year to come up with a most likely consequence to be used in the investment decision;
- moderates this likely consequence by the likelihood of network assets igniting a fire in the event a catastrophic asset failure occurs (i.e., not all asset failures will ignite a fire); and
- further moderates this likely consequence taking in to account the expected emergency services response to a fire based on the proximity to population (i.e., locations close to population centres have the highest moderation of likely consequence as the emergency services response is expected to be relatively expeditious).

Consistent with our ALARP obligations, we apply a disproportionality factor of ‘six’ to the bushfire risk.¹⁹

Bushfire risk makes up approximately 73 per cent of the total estimated risk cost in present value terms under the base case for this RIT-T. The relative size of this risk is due to severe bushfire consequence and the increased likelihood of failure as the insulators reach their end of service life.

2.3.3. 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 27 per cent of the total estimated risk cost in present value terms under the base case for this RIT-T.

2.3.4. 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 takes into account the cost associated with a fatality or injury including compensation, loss of productivity, litigation fees, fines and any other related costs.

Our safety model has recently been updated and developed in conjunction with asset management specialist consultancy AMCL²⁰. 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.

¹⁸ Refer to [Network Asset Criticality Framework](#)

¹⁹ Refer to section 6.2.5 of the [Network Risk Assessment Methodology](#)

²⁰ Refer to [Network Asset Criticality Framework](#)

Consistent with our ALARP obligations, we apply a disproportionality factor of 'six' to the public safety component and 'three' to the worker safety component of safety risk.

Safety risk makes up less than 1 per cent of the total estimated risk cost in present value terms under the base case for this RIT-T.

3. Potential credible options

This section describes the options we have investigated to address the need, including the scope of each option and the associated costs.

We consider that there is one feasible option from a technical, commercial, and project delivery perspective that can be implemented in sufficient time to meet the identified need. Four other options were considered but not progressed for the reasons that are outlined in Table 3-2.

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

3.1. Base case

The costs and benefits of each option in this PSCR are compared against those of a base case. Under the base case, assets are left in service until they fail and require replacement, which is defined as a ‘do nothing’ scenario. The replacement cost has been captured in the NPV assessment under financial risk cost.

It is noted that a ‘run to fail’ scenario, where the issues are addressed through increased asset monitoring and preventative maintenance tasks, is not a valid base case for this Need. The condition issues on the asset have already been identified through maintenance inspections, and increasing the frequency of inspections to monitor the condition issues will not necessarily address them.

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 of each credible option.

The regular maintenance regime will not be able to mitigate the risk of asset failure that will expose us and end-customers to approximately \$8.3 million per year in safety, environmental, and financial costs by 2026/27, rising to \$25.0 million per year by the end of the assessment period.²¹ The environmental and safety risk costs are mainly due to consequences of a bushfire event resulting from insulators failure.. Under the base case, all of these risks will continue to increase.

Routine operating and maintenance costs are estimated at approximately \$40,096 per annum (in \$2023/24). We do not expect this to change with any of the investment options considered, since the options will not change the frequency of planned inspections (however, the reactive maintenance costs do differ and are captured under financial risks). No capital costs are included within the base case.

3.2. Option 1 – Remediate all identified condition issues for line components

Option 1 considers the remediation of all identified condition issues for components of lines 8C/8J and 8C/8E which have experienced deterioration and/or reached the end of their technical lives.

The refurbishment work may include the following:

- conductor fittings and spacers
- earthwire bonding

²¹ 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.

- insulator
- public safety structures – aerial marker balls, climbing deterrents, danger signs, and structure ID sign
- tower crossarm

Detail of scope can be found in Appendix C.

The work will be undertaken over a 4-year period with all works expected to be completed by 2027. The capital cost of this option is approximately \$31.35m (in \$2023/24). This capital cost is comprised of:

- \$21.7m in labour costs;
- \$5.5m in materials costs; and
- \$4.1m in expenses

Routine operating and maintenance costs are the same as the base case for this option and estimated at \$40,096 per year.

Table 3-1 Option 1 Capital Cost (\$m, 2023/24)

Year	Capital expenditure (\$m, 2023/24)
2024	0.27
2025	1.01
2026	13.46
2027	16.61
2028	-
2029	-
2030	-
2031	-
2032	-
2033	-
2034	-
2035	-
2036	-
2037	-
2038	-
2039	-
2040	-
2041	-
2042	-
2043	-

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 to complete the works with minimal impact on the network.

3.3. Options considered but not progressed

We considered several additional options to meet the identified need in this RIT-T. Table 3-2 summarises the reasons the following options were not progressed further.

Table 3-2 Options considered but not progressed

Option	Reason(s) for not progressing
Increased inspections	The condition issues have already been identified and cannot be rectified through increased inspections, and therefore is not technically feasible.
Eliminations of all associated risk	This can only be achieved through retirement and decommissioning of the associated assets which may lead to reliability issue. Therefore, it is considered not technically feasible.
New transmission line	Due to significant costs of this option, a new double circuit 330 kV transmission line is not considered commercially feasible.
Non-network solutions	Transgrid does not consider non-network options to be commercially and technically feasible to assist with meeting the identified need, as non-network options will not mitigate the environment (bushfire) and safety posed resulting from corrosion-related deterioration.

3.4. No material inter-network impact is expected

We have considered whether the credible options described above is expected to have material inter-regional impact.²² 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-regional impact is that it satisfies the following:²³

- 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.

²² As per clause 5.16.4(b)(6)(ii) of the NER.

²³ Inter-Regional Planning Committee. *“Final Determination: Criteria for Assessing Material Inter-Network Impact of Transmission Augmentations.”* Melbourne: Australian Energy Market Operator, 2004. Appendix 2 and 3. Accessed 15 March 2024. [Critical for Assessing Material Inter-Network of Transmission Augmentations : Final Determination \(aemo.com.au\)](https://aemo.com.au)

We note that the credible option satisfies these conditions as it does not modify any aspect of electrical or transmission assets. By reference to AEMO's screening criteria, there is no material inter-network impacts associated with the credible option.

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. Non-network options are unable to reduce the safety and risk related costs associated with deteriorating asset condition of Line 8C/8J and 8C/8E that forms the identified need for this RIT-T. We consider that non-network options are unable to contribute to meeting the identified need for this RIT-T – this is based on:

- the fact that identified need for this investment is not driven by avoiding potential unserved energy; no amount of demand reduction would defer or avoid the preferred network option; and
- any non-network solution for this need is expected add to the costs of this option and would not provide any net benefits.

The requirement to specify the technical characteristics of a non-network option under clause 5.16.4 (b)(3) does not apply as non-network options cannot meet the identified need.

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.²⁴

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 several classes of market benefits will not be material in the RIT-T assessment, and so do not need to be estimated.²⁵

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 minor 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 material

In addition to the classes of market benefits listed above, NER clause 5.15A.2(4) requires that we consider the following classes of market benefits, listed in Table 5-1 arising from each credible option. We consider that none of the classes of market benefits listed are material for this RIT-T assessment for the reasons outlined below.

²⁴ 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(5). See Appendix A for requirements applicable to this document.

²⁵ AER, *Application Guidelines Regulatory Investment Test for Transmission*, October 2023.

Table 5-1 Reasons non-wholesale electricity market benefits are considered immaterial

Market benefits	Reason
Changes in involuntary load curtailment	Since Line 8C/8J and 8C/8E forms part of a meshed network (with an N-1 level of redundancy) required to supply the Northern NSW region, a failure of one line due to condition issues results in a negligible chance of unserved energy.
Differences in the timing of expenditure	Option considered will provide an alternative to meeting reliability requirements but is 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 the option considered.
Option value	<p>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 option considered by the TNSP is sufficiently flexible to respond to that change.²⁶</p> <p>We also note the AER's view that appropriate identification of the credible option 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.</p> <p>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.</p>
Changes in Australian greenhouse gas emissions	The option is not expected to induce a material change in Australia's greenhouse gas emissions.

²⁶ AER, Application Guidelines Regulatory Investment Test for Transmission, October 2023.

6. 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.

6.1. Description of the base case

The costs and benefits of each option are compared against the base case. Under the base case, assets are left in service until they fail and require replacement, which is defined as a 'do nothing' scenario. The replacement cost has been captured in the NPV assessment under financial risk cost.

We note that this course of action 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.²⁷

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 considers 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 AEMO's Inputs, Assumptions and Scenarios Consultation Report²⁸ and the assumptions adopted in AEMO's 2024 Integrated System Plan (ISP).²⁹ 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.³⁰ We have also adopted an upper bound discount rate of 10.5 per cent (ie, AEMO's 2023 Inputs, Assumptions and Scenarios Report).³¹

6.3. 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

²⁷ 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. AER, *Application Guidelines Regulatory Investment Test for Transmission*, October 2023.

²⁸ AEMO '2023 Inputs, Assumptions and Scenarios Report', July 2023, p 123.

²⁹ AEMO, *2024 Integrated System Plan, June 2024*.

³⁰ 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: AER, *TasNetworks – 2024-29 – Final decision – PTRM*, April 2024, WACC sheet.

³¹ AEMO '2023 Inputs, Assumptions and Scenarios Report', July 2023, p 123.

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).³²

We estimate the majority of structures will be replaced in normal soil. As work is to replace structures on an existing line, minor access track upgrade work, water crossing upgrades and vegetation clearing have been allowed for.

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, 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.

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

6.4. The options have been assessed against three reasonable scenarios

The RIT-T is focused on identifying the top ranked credible option in terms of expected net benefits. 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 options have 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 (ie, the estimated risk costs avoided).

Given that wholesale market benefits are not relevant for this RIT-T, the three scenarios implicitly assume the most likely scenario from the 2024 ISP (ie, the 'Step Change' scenario). The scenarios differ by the assumed level of risk costs, given that these are key parameters that may affect the ranking of the credible options. Risk cost assumptions do not form part of AEMO's ISP assumptions, and have been based on Transgrid's analysis, as discussed in section 2.

We developed the Central Scenario around a static model of demand scenarios, described further in 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 ranking of the credible options.

³² 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.

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. We consider this is consistent with the latest AER guidance for RIT-Ts of this type (ie, where wholesale market benefits are not expected to be material).^{33, 34, 35}

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

Table 6-1 Summary of scenarios

Variable / Scenario	Central	Low risk cost scenario	High risk cost scenario risk
Scenario weighting	1/3	1/3	1/3
Discount rate	7%	7%	7%
Network capital costs	Base estimate	Base estimate	Base estimate
Operating and maintenance costs	Base estimate	Base estimate	Base estimate
Safety, environmental, and financial risk benefit	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, environmental, 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 7.4.

In addition, we have also sought to identify the ‘boundary value’ for key variables beyond which the outcome of the analysis would change, including the amount by which capital costs would need to increase for the preferred option to no longer be preferred.

³³ AER, Application Guidelines Regulatory Investment Test for Transmission, October 2023, pp. 43-44.

³⁴ We consider the approach to scenarios and sensitivities to be consistent with the AER guidance provided in November 2022 in the context of the disputes of the North West Slopes and Bathurst, Orange and Parkes RIT-Ts. 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, as well as with the AER’s RIT-T Guidelines.

³⁵ AEMO ‘2023 Inputs, Assumptions and Scenarios Report’, July 2023, p 123-124

7. Assessment of credible options

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. The benefits of the credible option are represented by reduction in costs or risks compared to the base case.

7.1. Estimated gross benefits

Table 7-1 below summarises the present value of the gross benefit estimates for the credible option relative to the base case under the three scenarios. The benefits included in this assessment consist only of avoided risk, ie, a reduction in safety, environmental, and financial risks.

Table 7-1 Estimated gross benefits from credible options relative to the base case (\$m, PV)

Option	Central	Low risk costs scenario	High risk costs scenario	Weighted
<i>Scenario weighting</i>	1/3	1/3	1/3	
Option 1	110.66	82.99	138.32	110.66

7.2. Estimated costs

Table 7-2 below summarises the costs of the credible option, Option 1 in present value terms. The cost includes the direct capital and routine operating costs of each option, relative to the base case, and is the same in all scenarios for the option given nothing that affects the direct costs is varied between scenarios.

Table 7-2 Costs of credible options relative to the base case (\$m, PV)

Option	Cost
Option 1	-21.44

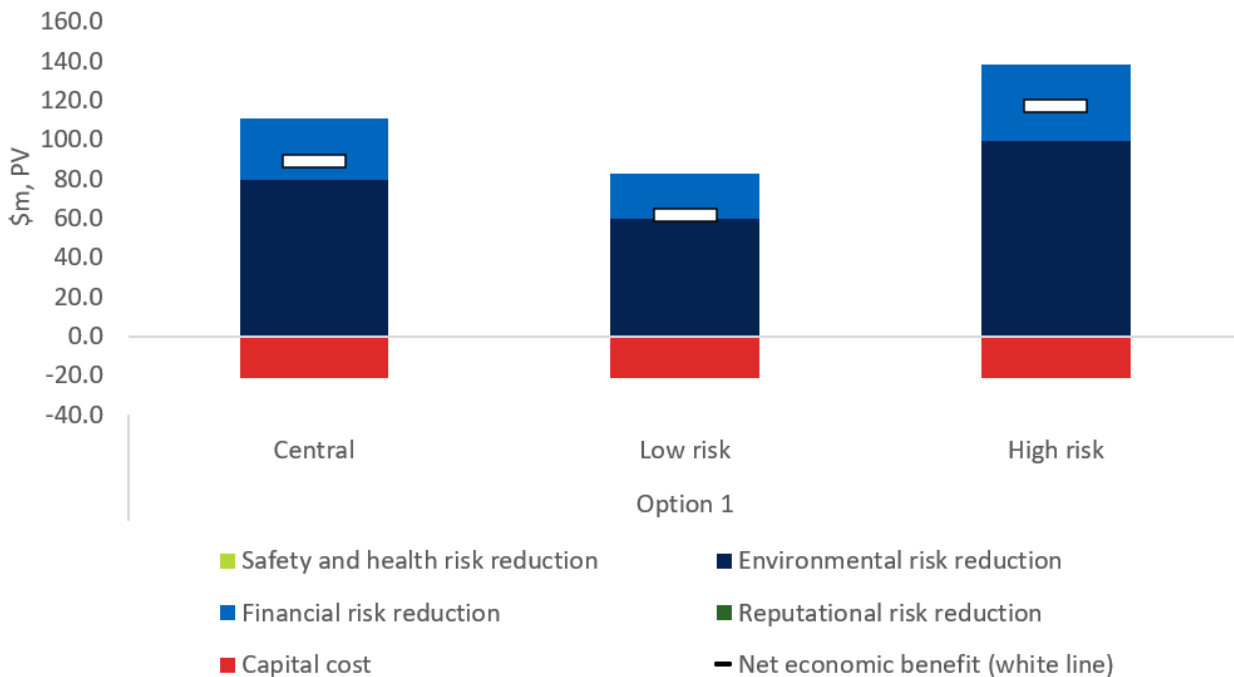
7.3. Estimated net economic benefits

The net economic benefits are the differences between the estimated gross benefits less the estimated costs. Table 7-3 below summarises the present value of the net economic benefits for each credible option relative to the base case across the three scenarios. On a weighted basis, Option 1 is found to deliver approximately \$89.22 million.

Table 7-3: NPV of net economic benefits relative to the base case (\$2023/24 m)

Option	Central	Low risk costs scenario	High risk costs scenario	Weighted
<i>Scenario weighting</i>	1/3	1/3	1/3	
Option 1	89.22	61.55	116.88	89.22

Figure 7-1 Net economic benefits (\$m, PV)



7.4. Sensitivity testing

We have undertaken sensitivity testing to understand the robustness of the RIT-T assessment to underlying assumptions about key variables. 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, if actual circumstances turn out to be different.

Having assumed to have committed to the project by this date, we have also looked at the consequences of 'getting it wrong' under step 2 of the sensitivity testing. That is, if expected safety and environmental risks are not as high as expected, for example, the impact on the net economic benefit associated with the project continuing to go ahead on that date.

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

7.4.1. 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.

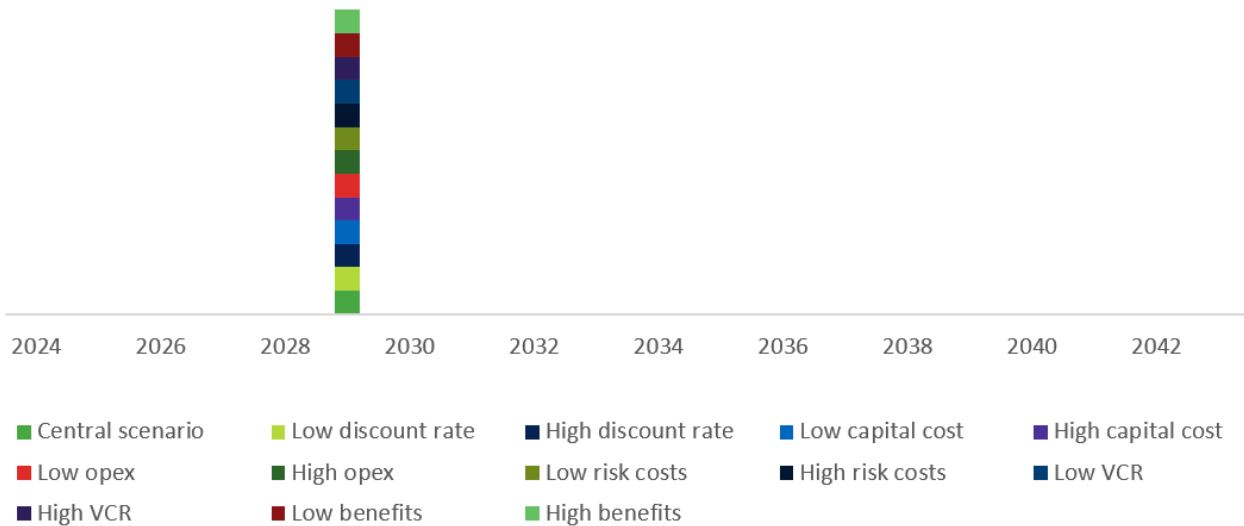
The optimal timing of Option 1 is found to be invariant in the following situations:

- a 25 per cent increase/decrease in the assumed network capital costs;
- lower discount rate of 3.63 per cent as well as a higher rate of 10.5 per cent;

- lower (or higher) assumed safety, environmental, and financial risks.

Figure 7-2 below outlines the impact on the optimal commissioning year, under a range of alternative assumptions. It illustrates that for Option 1, the optimal commissioning date is found to be in 2028/29 for all the sensitivities investigated.

Figure 7-2 Optimal timing of Option 1



7.4.2. 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 by 2023/24. 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, environmental, and financial risks; and
- lower discount rate of 3.63 per cent as well as a higher rate of 10.5 per cent.

All these sensitivities investigate the consequences of ‘getting it wrong’ having committed to a certain investment decision.

The figures below illustrate the estimated net economic benefits for Option 1 if separate key assumptions in the central scenario are varied individually.

Option 1 delivers positive benefits under all scenarios. We do not expect Option 1 to exhibit net costs within reasonable capital cost, risk cost and discount rate sensitivities.

Figure 7-3 Capital cost sensitivity

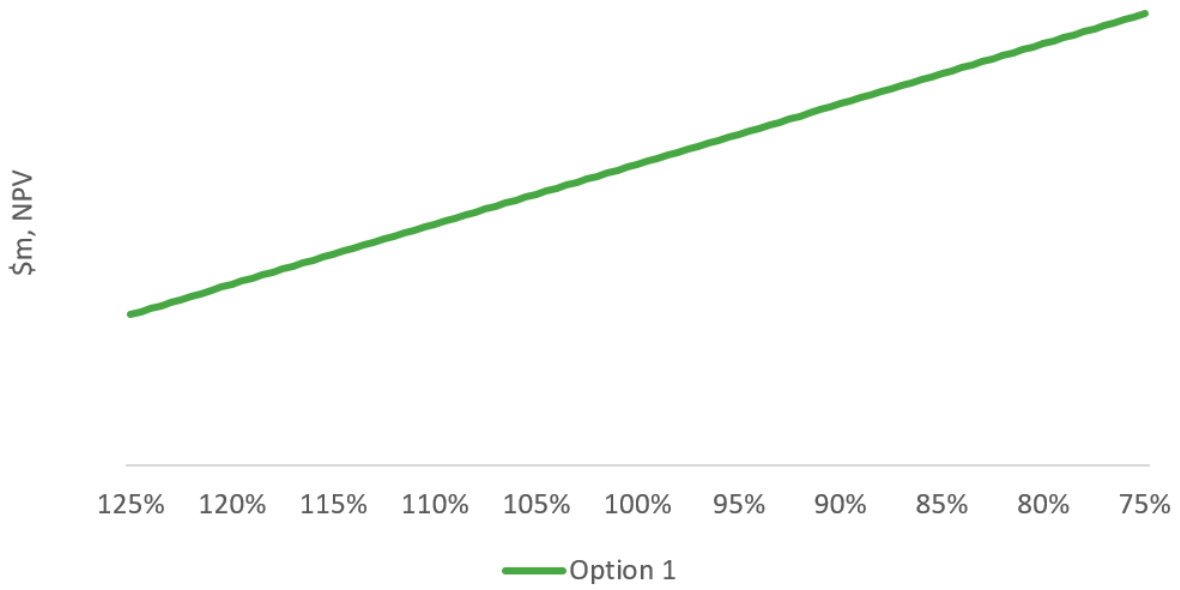


Figure 7-4 Risk costs sensitivity

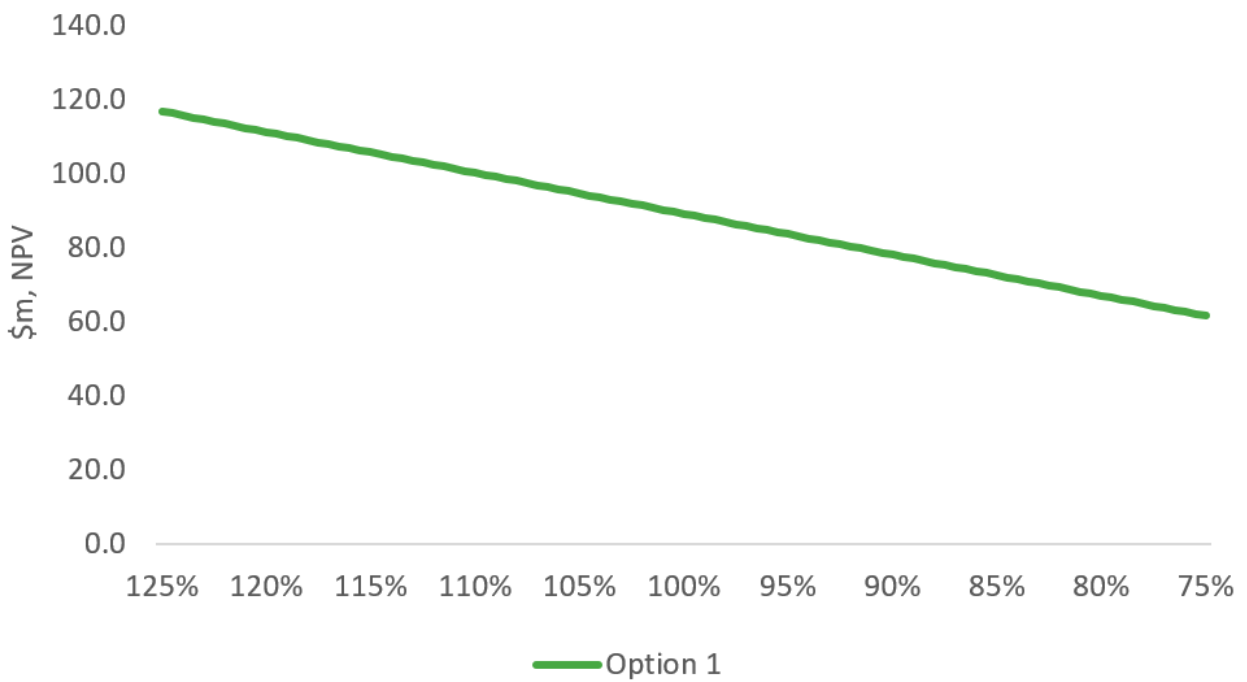
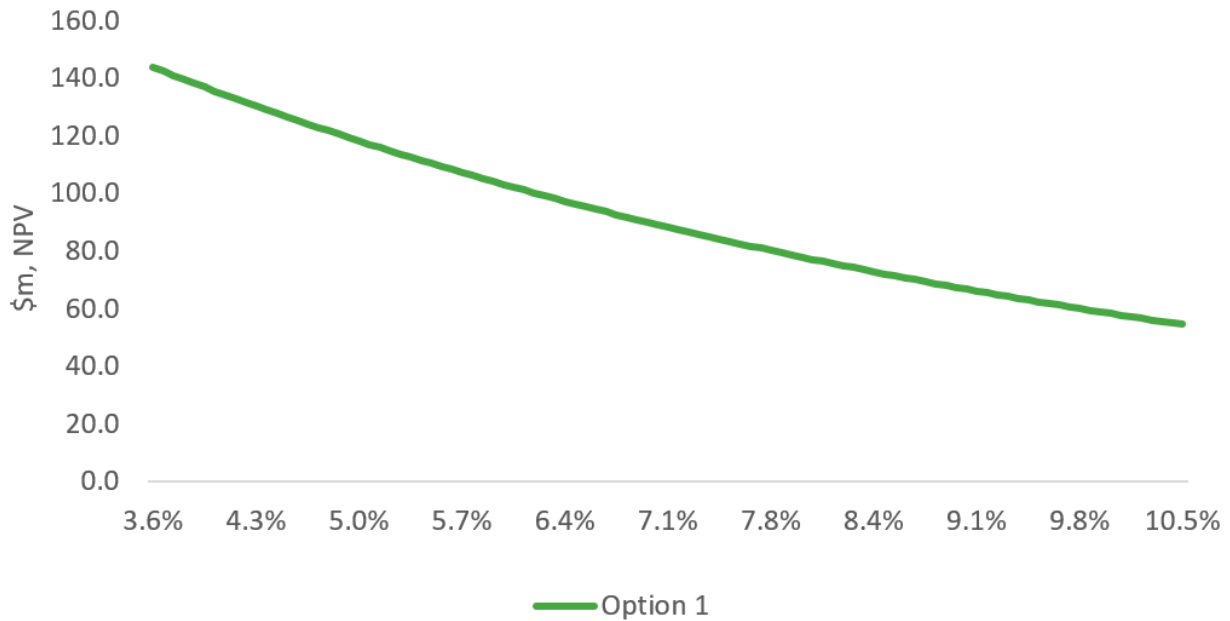


Figure 7-5 Commercial discount rate sensitivity



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

- assumed network capital costs (for all options) would need to increase by 416 per cent;
- the estimated risk costs (in aggregate) would need to fall by 81 per cent; and
- a discount rate would need to be greater than 29 per cent.

These boundaries where Option 1 would not exhibit net benefits are extreme and are unlikely to eventuate. We therefore consider the finding that Option 1 is expected to provide positive net benefits is robust.

8. Draft conclusion and exemption from preparing a PADR

This PSCR has found that Option 1 is the preferred option at this draft stage of the RIT-T. Option 1 involves remediation of all identified condition issues for components of lines 8C/8J and 8C/8E. Moving forward with this option is the most prudent and economically efficient solution to manage the deteriorating asset risks to ALARP.

The estimated capital expenditure associated with this option is \$31.35 million in \$2023/24 over the assessment period. Routine operating and maintenance costs are estimated at \$40,096 per year. Option 1 is found to have positive net benefits under all scenarios investigated and, on a weighted basis, will deliver \$89.22 million in net economic benefits. The works would be completed by 2026/27.

All works will be completed in accordance with the relevant standards and components shall be replaced to have minimal modification to the wider transmission network. Necessary outages of relevant assets in service will be planned appropriately to complete the works with minimal network impact.

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 the preferred option 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. In those circumstances, 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, we intend to produce a 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.

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 214.

Rules clause	Summary of requirements	Relevant section
5.16.4(b)	<p>A RIT-T proponent must prepare a report (the project specification consultation report), which must include:</p>	–
	(1) a description of the identified need;	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) the technical characteristics of the identified need that a non-network option would be required to deliver, such as: <ul style="list-style-type: none"> (i) the size of load reduction of additional supply; (ii) location; and (iii) operating profile 	4 ³⁶
	(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 Integrated System 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, alternative transmission options, interconnectors, generation, system strength services, demand side management, market network services or other network options;	3
	(6) for each credible option identified in accordance with subparagraph (5), information about: <ul style="list-style-type: none"> (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 & 5

³⁶ There are no credible non-network options

5.16.4(z1)	<p>A RIT-T proponent is exempt from [preparing a PADR] (paragraphs (j) to (s)) if:</p> <ol style="list-style-type: none"> 1. the estimated capital cost of the proposed preferred option is less than \$35 million³⁷ (as varied in accordance with a cost threshold determination); 2. the relevant Network Service Provider has identified in its project specification consultation report: <ol style="list-style-type: none"> (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; 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 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. 	8
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³⁷ Varied to \$46m based on the AER Final Determination: Cost threshold review November 2021.4. Accessed 17 April 2024 <https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/cost-thresholds-review-for-the-regulatory-investment-tests-2021>

Appendix B Risk Assessment Methodology

Summary of methodology

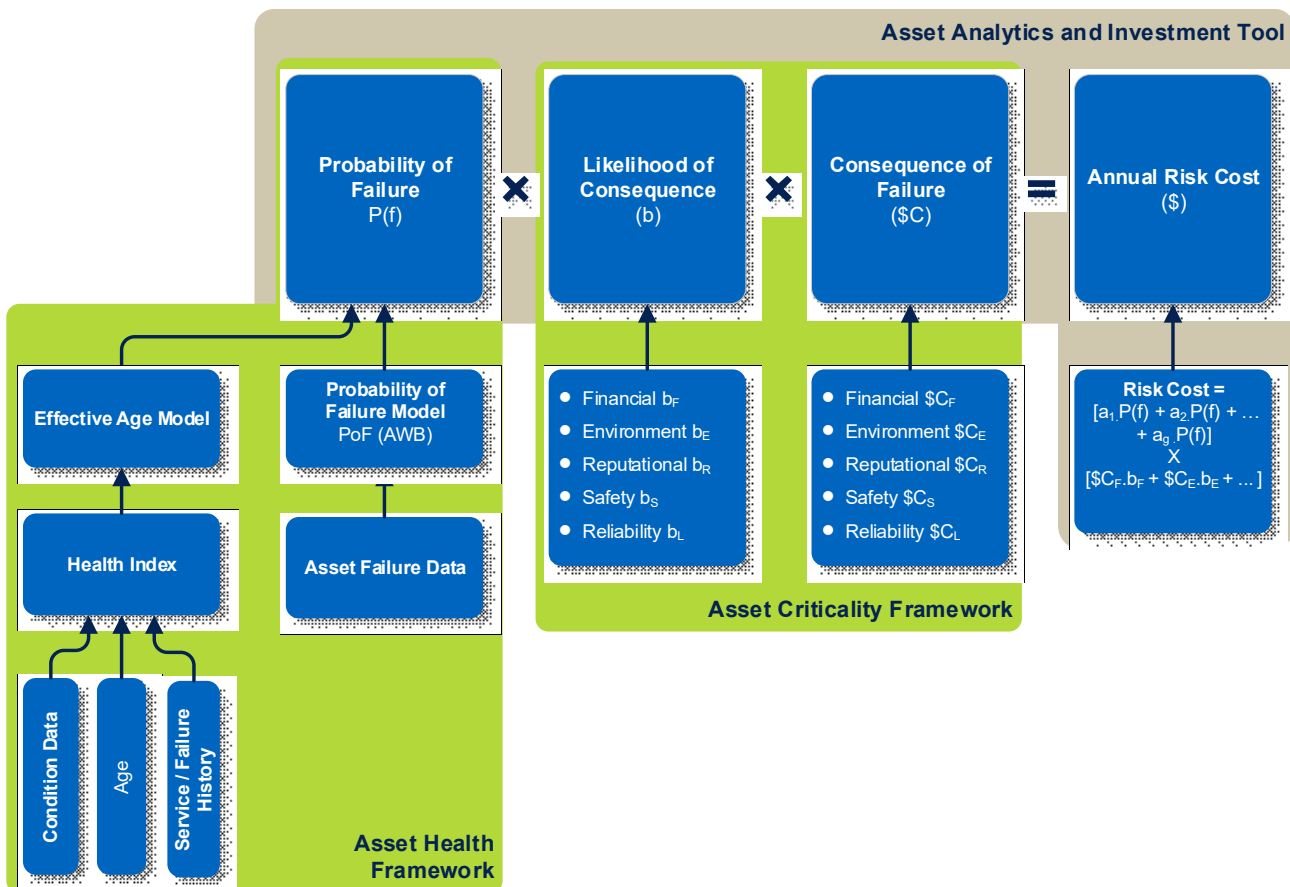
This appendix summarises our network risk assessment methodology that underpins the identified need for this RIT-T. Our risk assessment methodology is aligned with the AER’s Asset Replacement Planning guideline³⁸ and its principles.

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).

The figure 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-1 Risk cost calculation



³⁸ 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 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 2.3.

Further details are available in our [Network Asset Risk Assessment Methodology](#).

Asset health and probability of failure

The first step in calculating the PoF of an asset is determining the asset health and associated effective age,³⁹ which considers that:

- 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, where 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; and
- ‘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 PoF is the likelihood that an asset will fail during a given period resulting in a particular adverse event, e.g., equipment failure, pole failure, broken overhead conductor.

The outputs of the 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 transmission line components are summarised in Table B-1 below.

³⁹ Apparent age of an asset based on its condition.

Further details are available in our [Network Asset Health Methodology](#).

Table B-1 Weibull parameters for asset components

Asset component	Weibull parameters	
	η	β
Insulators – Non Ceramic Insulators	26.55	3.232

Appendix C Structure with condition issues by asset category

The table below details the assets identified by this need and the condition issues of the structure that is proposed to be refurbished under the preferred solution (Option 1).

Asset component category	Cause	Effect	Consequence	No. of structures with condition issues	
				Line 8C/8J	Line 8C/8E
Conductor Fittings	Corrosion of fittings.	Fallen conductor	<ul style="list-style-type: none"> Bushfire resulting in potential loss of property and/or life Safety incident resulting in potential injury or death Line outage with potential network reliability impacts 	1	6
Conductor Spacers	Minor repair required, damaged spacer.	Fallen conductor	<ul style="list-style-type: none"> Bushfire resulting in potential loss of property and/or life Safety incident resulting in potential injury or death Line outage with potential network reliability impacts 	1	-
Earthwire Bonding	Minor repair required, earth bond has broken strands.	Uncontrolled discharge or contact with electricity	<ul style="list-style-type: none"> Safety incident resulting in potential injury or death Line outage with potential network reliability impacts 	6	5
Insulator	Non-ceramic insulators (NCI) have reached end of serviceable life.	Fallen conductor	<ul style="list-style-type: none"> Bushfire resulting in potential loss of property and/or life Safety incident resulting in potential injury or death Line outage with potential network reliability impacts 	140	280
Public Safety – Aerial Marker Balls	Deteriorated.	Uncontrolled discharge or contact with electricity	<ul style="list-style-type: none"> Safety incident resulting in potential injury or death Line outage with potential network reliability impacts 	1	26
Public Safety – Climbing Deterrents	Deteriorated.	Unauthorised access	<ul style="list-style-type: none"> Safety incident resulting in potential injury or death Line outage with potential network reliability impacts 	1	91
Public Safety – Danger Signs	Deteriorated.	Unauthorised access	<ul style="list-style-type: none"> Safety incident resulting in potential injury or death Line outage with potential network reliability impacts 	136	254
Public Safety – Structure Earthing	Erosion of ground has exposed earth strap.	Uncontrolled discharge or contact with electricity	<ul style="list-style-type: none"> Bushfire resulting in potential loss of property and/or life Safety incident resulting in potential injury or death 	4	-
Public Safety – Structure ID Signs	Deteriorated.	Unauthorised access	<ul style="list-style-type: none"> Safety incident resulting in potential injury or death Line outage with potential network reliability impacts 	-	1