Managing risk on the George Town – TEMCO transmission line

RIT-T Project Assessment Conclusion Report

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Public

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TasNetworks acknowledges the palawa (Tasmanian Aboriginal community) as the original owners and custodians of lutruwita (Tasmania). TasNetworks, acknowledges the palawa have maintained their spiritual and cultural connection to the land and water. We pay respect to Elders past and present and all Aboriginal and Torres Strait Islander peoples.

Contents

Glossary

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AFL	Available Fault Level (methodology)
EOI	Expression of Interest
GWh	Gigawatt hours
HVDC	High Voltage Direct Current
ISP	Integrated System Plan
NEM	National Electricity Market
NEO	National Electricity Objective
NER	National Electricity Rules (Version 212 referenced throughout this document)
OSM	Operational Security Mechanism
PACR	Project Assessment Conclusions Report
PADR	Project Assessment Draft Report
PSCR	Project Specification Consultation Report
REZ	Renewable Energy Zone
RIT-T	Regulatory Investment Test for Transmission
SF6	Sulphur Hexaflouride
SSN	System Strength Node
SSSP	System Strength Service Provider
tbc	To be confirmed
TNSP	Transmission Network Service Provider

Disclaimer

Executive Summary

This Project Assessment Conclusions Report (**PACR**) represents the final step in the application of the Regulatory Investment Test for Transmission (**RIT-T**) to options for addressing reliability, bushfire, financial and safety risks caused by age-related condition issues of the George Town to Tasmanian Electro Metallurgical Company (**TEMCO**) transmission line (**GT-TE**).

The GT-TE 110 kilovolt (**kV**) transmission line was constructed in 1962 to supply the TEMCO (now Liberty Bell Bay) manganese processing plant via a connection to the neighbouring aluminium smelter. In subsequent years the line was reconfigured to supply the plant directly from George Town substation. The 3.1 kilometre (**km**) line consists of galvanised steel towers supporting mainly aluminium conductor steel reinforced (**ACSR**) conductors, with a short section of the original 19/.116 hard drawn copper conductors (**HdCu**).

The combination of the line's relatively short length, its location in a primarily industrial area and TasNetworks' planned inspection and maintenance programs has meant it has experienced very few faults or reliability issues over its 60-year technical life. However, recent inspections have highlighted numerous corrosion issues on the steel towers increasing the probability that one of the structures of the line will fail, particularly as these assets continue to age.

The GT-TE line is the only source of supply to the Liberty manganese alloy processing plant at Bell Bay, meaning its failure would result in significant volumes of unserved energy. Further, the line traverses areas of bushland and as such, in the event of a failure of the line's structure there is the potential for the ignition of a bushfire.

Identified need: Managing risk on the GT-TE line

If action is not taken the condition of the GT-TE line will expose us and our customers to increasing levels of risk going forward, as deterioration increases the likelihood of failure.

Under the 'do nothing' base case line failure could occur. Such incidents pose significant reliability risk due to unserved energy since the line is the only supply to Liberty Bell Bay.

Addressing the condition issues of the GT-TE line will enable us to manage reliability and other risks in the George Town area. TasNetworks expects that addressing these issues will result in significant market benefits and, as such, we consider the identified need for this investment to be market benefits under the RIT-T.

No submissions or material developments in response to, and since, the PSCR

We published a Project Specification Consultation Report (PSCR) on 19 July 2024 and invited written submissions on the material presented within the document by 14 October 2024.

No submissions were received in response to the PSCR, and we have also not identified any additional credible options or material changes that would impact which option was identified as the preferred option since the PSCR.

Four credible options have been considered

We consider that there are four credible options from a technical, commercial, and project delivery perspective that can be implemented in sufficient time to meet the identified need. The options that we have considered, and their capital costs, are summarised in Table 1.

Table 1: Summary of capital expenditure for credible options, $2023/24m

Option	Description of works	Capital expenditure
Option 1	Augmenting an existing nearby line – the George Town-Starwood 110kV transmission line – by stringing a second circuit on the existing steel pole line to a point where it runs close to the existing GT-TE line	$8.7
Option 2	Defer the complete replacement of the GT-TE line until the 2029-34 regulatory control period, maintaining the existing transmission line assets until this point in time	$5.6
Option 3	Refurbish the existing GT-TE line components to extend its service life through tower painting, insulator and conductor replacement and foundation works	$5.9
Option 4	Renew the transmission line through complete replacement with a new double circuit 110kV transmission line within the existing corridor	$5.6

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, since non-network options will not substantially mitigate the reliability, bushfire, financial and safety risks posed as a result of asset deterioration.

The options have been assessed against three reasonable scenarios

The credible options have been assessed under three scenarios as part of this PACR 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 assume the most likely scenario for the 2024 Integrated System Plan (ISP) (ie, the 'Step Change' scenario). The scenarios differ by the assumed level of risk costs, given that these are the key parameters that may affect the ranking of the credible options. Risk cost assumptions do not form part of the Australian Energy Market Operator's (AEMO) ISP assumptions and therefore have been based on TasNetworks' analysis. Table 2 provides a summary of the scenarios assessed.

Table 2: Summary of scenarios

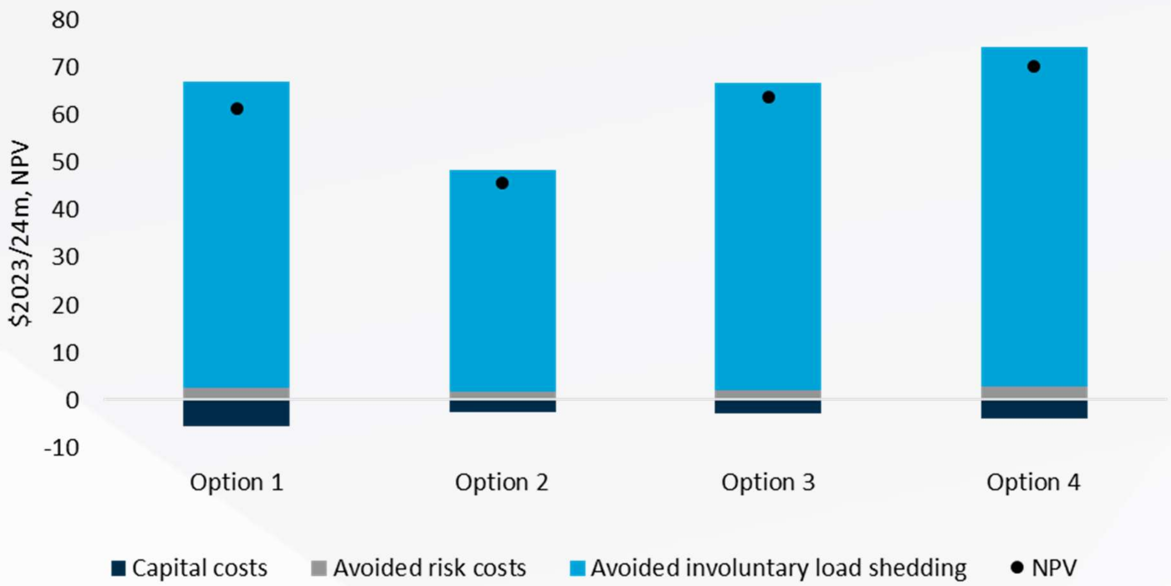
Variable / Scenario	Central	Low demand scenario	High demand cost scenario
Scenario weighting	*1/3*	*1/3*	*1/3*
Discount rate	7.0%	7.0%	7.0%
Network capital costs	Base estimate	Base estimate	Base estimate
Risk costs	Base estimate	Base estimate -25%	Base estimate +25%

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

Option 4 delivers the greatest estimated net benefits

All four credible options are found to have positive benefits for all scenarios investigated. All scenarios find that Option 4 will deliver the greatest net economic benefits. On a weighted basis, the net economic benefits of Option 4 are approximately $70 million, principally driven by avoided unserved energy. Figure 1 below shows a breakdown of the weighted net economic benefits for each option.

Figure 1: Weighted net economic benefits



Conclusion

This PACR has found that Option 4 is the preferred option at this stage of the RIT-T. Option 4 involves completely replacing the 110kV transmission line. Specifically, a new double circuit 110kV transmission line will be constructed within the existing corridor to TasNetworks' design standards. This standard design uses double circuit steel pole support structures with conductor strung at 75°C. This design will ensure that the current customer load can be supplied with no operational constraints.

The estimated capital expenditure associated with Option 4 is $5.6 million (in 2023/24 dollars). The works are estimated to take 24 months to complete with project completion expected in 2026/27.

Next steps

This PACR represents the final step of the RIT-T consultation process undertaken by TasNetworks.

Parties wishing to raise a dispute notice with the AER may do so prior to 21st November 2024 (30 days after publication of this PACR). The AER will address any dispute notices raised during this period within 40 to 120 days, after which the formal RIT-T process will conclude.

Further details on this RIT-T can be obtained by emailing our Regulation team via regulation@tasnetworks.com.au. In the subject field, please reference 'Geroge Town - TEMCO PACR'.

Introduction

This PACR represents the final step in the application of the RIT-T to options for addressing reliability, bushfire, financial and safety risks caused by age-related condition issues of the GT-TE transmission line.

The GT-TE 110 kV transmission line was constructed in 1962 to supply the TEMCO (now Liberty Bell Bay) manganese processing plant via a connection to the neighbouring aluminium smelter. In subsequent years the line was reconfigured to supply the plant directly from George Town substation. The 3.1 km line consists of galvanised steel towers supporting mainly ACSR conductors, with a short section of the original 19/.116 HdCu.

The combination of the line's relatively short length, its location in a primarily industrial area and TasNetworks' planned inspection and maintenance programs has meant it has experienced very few faults or reliability issues over its 60-year technical life. However, recent inspections have highlighted numerous corrosion issues on the steel towers due to:

- the coastal location of the line;
- the exposure of the line to industrial pollution throughout its operation; and
- the total breakdown of the structure's protective coatings.

These corrosion issues serve to increase the probability that one of the structures of the line will fail and, as these assets continue to age, this probability will continue to increase. The GT-TE line is the only source of supply to the Liberty manganese alloy processing plant at Bell Bay, meaning that its failure would result in significant volumes of unserved energy. Further, the line traverses areas of bushland and as such, in the event of a failure of the line's structure there is the potential for the ignition of a bushfire.

TasNetworks has therefore examined options for addressing the age-related condition issues of the GT-TE line so that it continues to operate in a safe and reliable manner. We expect that addressing these issues will significantly reduce reliability, bushfire, financial and safety risks, resulting in significant market benefits. Consequently, we consider the identified need for this investment to be market benefits under the RIT-T.

No submissions or material developments in response to, and since, the PSCR

We published a Project Specification Consultation Report (PSCR) on 19 July 2024 and invited written submissions on the material presented within the document by 14 October 2024.

No submissions were received in response to the PSCR, and we have also not identified any additional credible options or material changes that would impact which option was identified as the preferred option since the PSCR.

Purpose of this report

The purpose of this PACR is to:[1]

- describe why action needs to be taken (the 'identified need');
- present credible options that we consider capable of addressing the identified need;
- present the economic assessment of all credible options, as well as the assumptions feeding into the analysis; and
- identify a preferred option at this final stage of the RIT-T.

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 the RIT-T process, 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.

Next steps

This PACR represents the final step of the RIT-T consultation process undertaken by TasNetworks.

The second step of the RIT-T process, production of a Project Assessment Draft Report (PADR), was not required as part of the RIT-T process under NER clause 5.16.4(z1). Specifically, it was not required due to:

- the estimated capital cost of the preferred option being less than $46 million;
- the PSCR stating:
  - the proposed preferred option, together with the reasons for the proposed preferred option;
  - that TasNetworks is exempt from producing a PADR for this RIT-T; and
  - that the proposed preferred option (and the other credible options) will not have a material market benefit associated with any of the classes of market benefit specified in clause 5.15A.2(b)(4), with the exception of market benefits arising from changes in involuntary load shedding; and
- there being no PSCR submissions that identified additional credible options that could deliver a material market benefit; and
- the PACR addressing any issues raised in relation to the proposed preferred option during the PSCR consultation (noting that no issues have been raised).

Parties wishing to raise a dispute notice with the Australian Energy Regulator (**AER**) may do so prior to 21st November 2024 (30 days after publication of this PACR). The AER will address any dispute notices raised during this period within 40 to 120 days, after which the formal RIT-T process will conclude.

Further details on this RIT-T can be obtained by emailing our Regulation team via regulation@tasnetworks.com.au. In the subject field, please reference 'Geroge Town - TEMCO PACR'.

[1] See appendix A.1 for the National Electricity Rules requirements. Note that the National Electricity Rules version 217 was referenced during the preparation of this document.

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 GT-TE line.

Background to the identified need

The GT-TE line is located in an industrial area in the central-north of Tasmania. It is a 110 kV transmission line and was constructed in 1962 to supply the TEMCO (now Liberty Bell Bay) manganese processing plant via a connection to the neighbouring aluminium smelter. In subsequent years the line was reconfigured to supply the plant directly from the George Town substation. Figure 2 provides an overview of the GT-TE line and surrounding transmission infrastructure.

Figure 2: Bell Bay 110kV transmission network

The 3.1km line consists of galvanised steel towers supporting mainly ACSR conductors and a short section of the original 19/.116 HdCu. The combination of the line's relatively short length, its location in a primarily industrial area and TasNetworks' planned inspection and maintenance program has meant it has experienced very few faults or reliability issues over its 60-year technical life.

However, TasNetworks has identified through regular asset inspections that the GT-TE line has numerous corrosion issues on the steel towers, and is approaching end of life. This condition, which will continue to deteriorate over time, will affect the reliability of the line's performance now and into the future.

Consistent with the age of these assets and their usage since commissioning, these condition issues are due to:

- the coastal location of the line;
- the exposure of the line to industrial pollution throughout its operation; and
- the total breakdown of the structure's protective coatings.

Examples of the corrosion are depicted in Figure 3 below.

Figure 3: Typical tower condition

If the corrosion issues on the GT-TE line are not addressed in sufficient time, then the asset will operate with increasing risk of failure as it continues to deteriorate, and the level of reactive maintenance needed to keep the line operating within required standards may increase. When asset failure ultimately occurs, supply may be cut off, leading to potential unserved energy for up to two days while the line is repaired or a temporary circuit restoration is established. Bushfire and safety risks also increase significantly with asset failure, as do financial risks due to the cost of the emergency remediation works.

TasNetworks notes that while the GT-TE line currently only services one customer – Liberty Bell Bay – it is grandfathered as a shared network asset under clause 11.6.11(c) of the NER. We have therefore had regard to the continuing need for the line over the economic life of any refurbished or replaced line. As a commercial entity, Liberty Bell Bay's ongoing use of the line is inherently uncertain. However, based on connection enquiries received, TasNetworks considers that the line could be used by other customers going forward should Liberty Bell Bay no longer use the line. We therefore consider that the GT-TE line is likely to continue to be used over the economic life of any refurbished or replaced line.

Description of the identified need

If action is not taken the condition of the GT-TE line will expose us and our customers to increasing levels of risk going forward, as deterioration increases the likelihood of failure.

Under the 'do nothing' base case, line failure could occur. Such incidents pose significant reliability risk due to unserved energy since the line is the only supply to Liberty Bell Bay, as well as bushfire and safety risks.

Addressing the condition issues of the GT-TE line will enable us to manage reliability and other risks in the George Town area. TasNetworks expects that addressing these issues will result in significant market benefits and, as such, we consider the identified need for this investment to be market benefits under the RIT-T.

Assumptions underpinning the identified need

TasNetworks has applied an asset 'risk cost' evaluation framework to quantify the risks caused by the deteriorating condition of the GT-TE line and the risk cost reductions resulting from addressing the condition issues. Risks are assessed against TasNetworks' risk framework using the AER's risk-cost assessment methodology outlined in its Industry practice Application Note: Asset Replacement Planning 2019.[2]

The risk costs have been calculated by reference to the following formula:

$$TQR = \sum_{n=0}^{n} (PoF \times No) \times (LoC \times CoC)$$

where:

- TQR is the total quantified risk/risk cost per year of the event happening;
- PoF is the annual asset probability of failure, which is obtained from our asset performance records, as well as being benchmarked against national and international standards where applicable;
- No is the number of assets;
- CoC is the cost of consequence of the failure event, which is evaluated by an external consultant to align with contemporary methodologies of risk-based asset management; and
- LoC is the likelihood of consequence of failure event, which is determined using both actual (as observed by both TasNetworks and its peers) and estimated data.

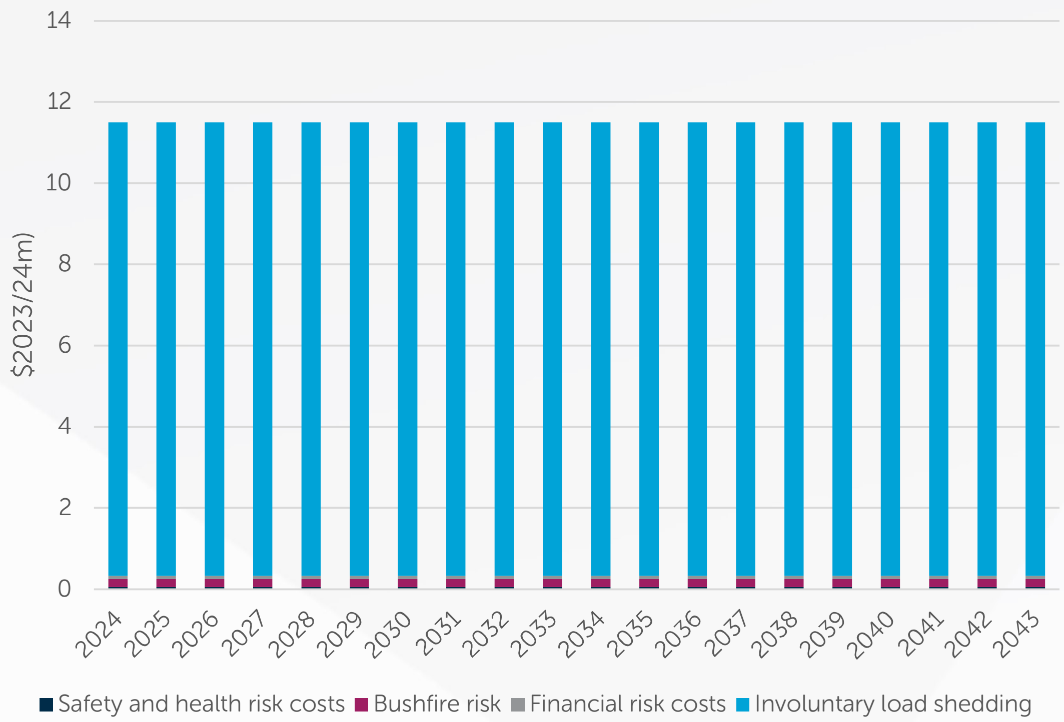
The key risks considered as part of this RIT-T are:

- network performance risk, ie, involuntary load shedding;
- bushfire risk;
- direct financial costs risk, eg, reactive maintenance upon failure of the asset; and
- safety risk.

The remainder of this section describes the assumptions underpinning our assessment of the risk costs, ie, the value of the risk avoided by undertaking each of the credible options. Figure 4 summarises the risk costs over the assessment period under the base case.

[2] See: https://www.aer.gov.au/system/files/D19-2978%20-%20AER%20-Industry%20practice%20application%20note%20Asset%20replacement%20planning%20-%2025%20January%202019.pdf .

Figure 4: Estimated risk costs under the base case



The aggregate risk cost under the base case is currently estimated at around $11.5 million per year, which reflects TasNetworks' conservative assumption that the probability of failure will not increase over time despite the asset condition worsening.

The risk costs for each year of the assessment period under the base case can be summarised as:

- approximately 97.2 per cent attributed to reliability risk;
- approximately 1.7 per cent attributed to environmental (bushfire) risk;
- less than 1 per cent attributed to safety risk; and
- less than 1 per cent attributed to financial risk.

Asset health and the probability of failure

Our asset health modelling aligns with Chapter 3.2 and 5.2 of the AER's Asset replacement planning guideline. Condition information for each asset is assessed to generate an asset health index and assets approaching their end of life, as identified through the asset health index, are candidates for a replacement or refurbishment intervention. The asset health ratings determine a health based PoF in line with industry standard.

Structures are inspected on an annual basis, with any defects raised and an overall condition score assigned on the basis of TasNetworks' defect and condition guidelines. The purpose of this inspection process is to identify and fix localised defects, ie, a damage state, while also detecting an overall deterioration in condition prior to the structure entering a failure state. These condition assessments are used to calculate health-based probability of failures for our assets using accepted engineering techniques such as the Weibull curve.

The asset health issues identified on the GT-TE line are summarised in Table 3.

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Table 3: Asset health issues along the George Town-TEMCO line and their consequences

Issue	Consequences if not remediated
Corrosion of towers structural members, bolts, insulator assemblies, step bolts.	Safety incident resulting in potential injury or death Line outage with potential network reliability impacts Safety incident resulting in potential injury or death Reduced line reliability
Lead based paint	Safety incident resulting in reduced quality of life
Corrosion of anti-climbing devices	Safety incident resulting in potential injury or death Line outage with potential network reliability impacts

Reliability risk

This risk refers to the consequence arising from a reduction in reliability of electricity supply for customers that results in involuntary load shedding and is valued using the AER's 2023 estimated Values of Customer Reliability (VCR) for Tasmania, weighted by load connected to the GT-TE line. Since Liberty Bay Bell is the only connected load, we have used the VCR of $23.28/kWh, which corresponds to a very large business customer – metals. The likelihood of impact has been calculated by TasNetworks based on our best analytical estimates, with the magnitude of load at risk determined by our analysis of average demand and the credible restoration time following a structure failure.

Reliability risk is the largest of all risks quantified under the base case for this RIT-T, making up 97.2 per cent of the total estimated risk cost in present value terms. It is estimated at approximately $11.5 million per year if action is not taken.

Bushfire risk

This risk refers to the consequence to the community of an asset failure that results in a bushfire starting. TasNetworks models bushfire risk using data provided by the University of Melbourne. Their study performed bushfire simulations across all of Tasmania where TasNetworks' assets are located. These simulations account for environmental determinants such as vegetation type and condition, terrain, and weather. This is then used to estimate key fire properties such as intensity, rate of spread and flame height in a spatially explicit manner. Their simulations also account for variations in the Forest Fire Danger Index (FFDI) across the seasons in Tasmania according to historical data from 2001 to 2020 and applies the respective proportions of each FFDI category (severity) to compute the total annual cost of consequence for a fire start.

The bushfire consequence in the area that the GT-TE line traverses has been assessed as minor. While the cost of consequence is not reduced by the removal or refurbishment of the existing GT-TE line, the likelihood is reduced from possible to rare by addressing the condition issues of the structure.

Bushfire risk is the second largest of all risks quantified under the base case for this RIT-T, making up 1.7 per cent of the total estimated risk cost in present value terms. It is estimated at approximately $0.2 million per year if action is not taken.

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 be required under emergency conditions. Our estimation of financial risk for this RIT-T does not include the expected escalating cost of reactive maintenance associated with the aging line. It follows that our financial risk cost estimate is conservative and understates the true financial risk cost.

Financial risk is the third largest of all risks quantified under the base case for this RIT-T, making up 0.7 per cent of the total estimated risk cost in present value terms. It is estimated at less than $0.1 million per year if action is not taken.

Safety risk

This risk refers to the safety consequence to our workforce, contractors and/or members of the public of an asset failure whose failure modes can create harm. The main safety risk associated with the GT-TE line is the requirement to maintain supply while containing lead contaminates in the existing tower. 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.

Safety risk is the smallest of all risks quantified under the base case for this RIT-T, making up 0.4 per cent of the total estimated risk cost in present value terms. It is estimated at less than $0.1 million per year if action is not taken.

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 are four credible options from a technical, commercial, and project delivery perspective that can be implemented in sufficient time to meet the identified need.

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

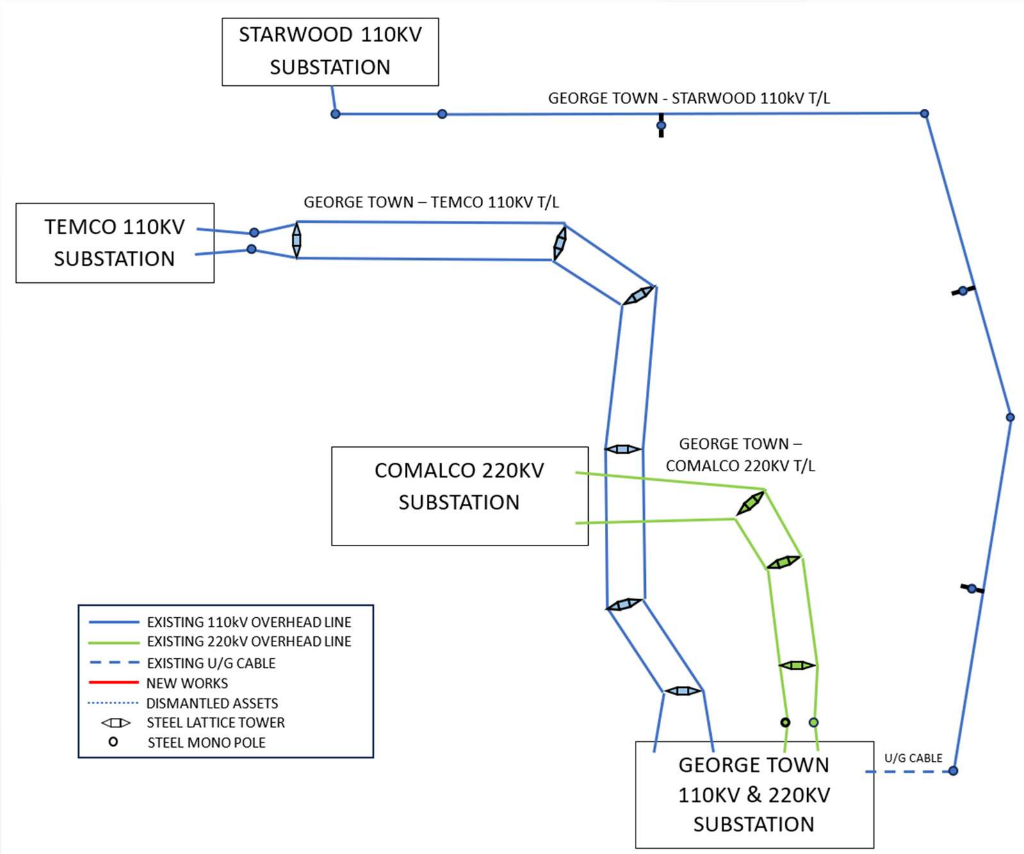
Base case

The costs and benefits of each option in this PACR are compared against those of a base case. Under this base case, no proactive capital investment is made to remediate the deterioration of the structures supporting the GT-TE line and they are left in service until they fail and require replacement.

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.

Figure 5 provides an overview of the existing network, as a background to the following discussion of investment options

Figure 5: Overview of existing network



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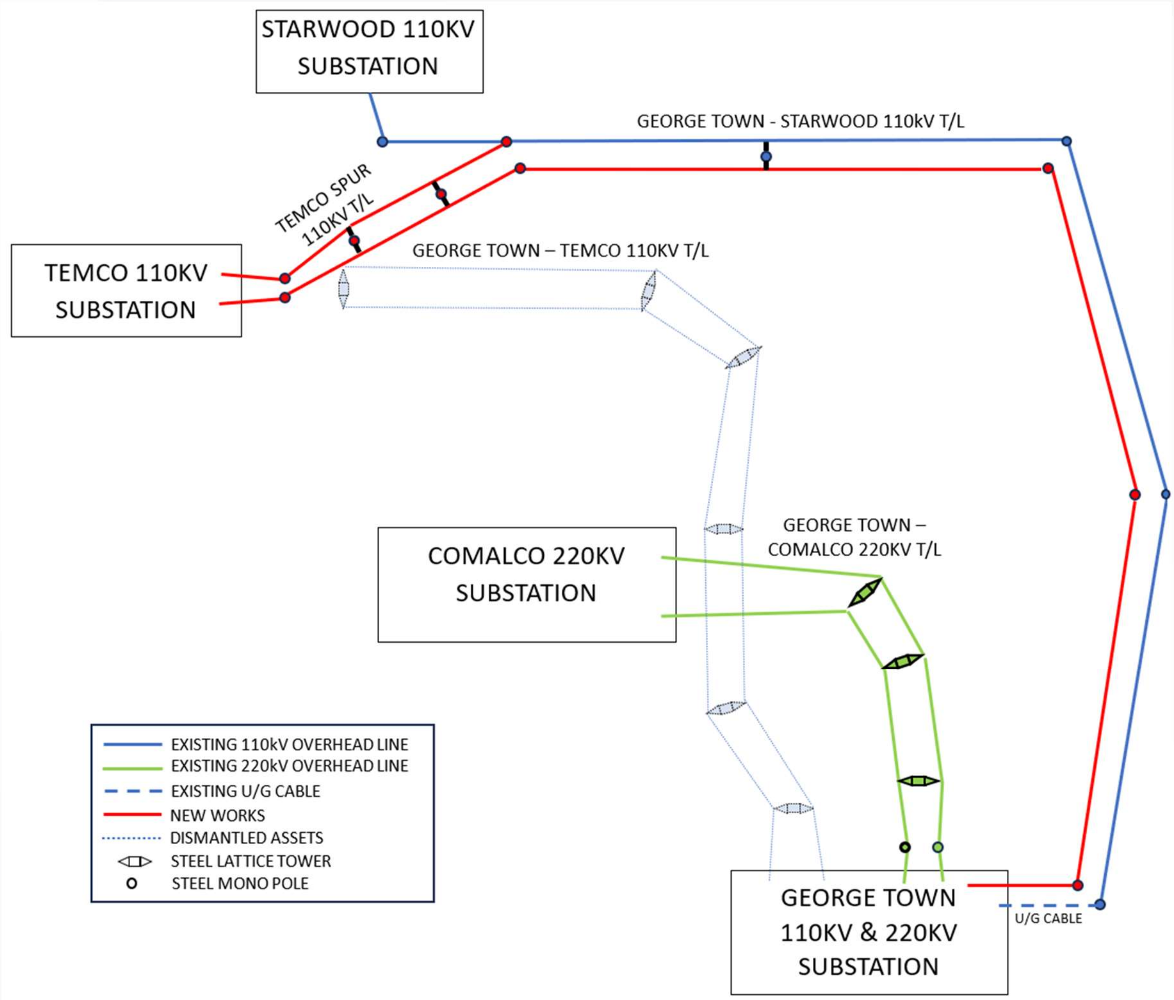
Option 1 – Augment Starwood transmission line

Option 1 involves augmenting an existing nearby line – the George Town-Starwood 110kV transmission line – by stringing a second circuit on the existing steel pole line to a point where it runs close to the existing GT-TE line. To enable the line to supply the connected load it will be augmented with larger underground cables and overhead conductor, as well as stronger steel poles. The remaining sections of line that connect it to the TEMCO substation will then be refurbished or renewed. This will effectively supply the major industrial customer via one three ended transmission circuit (George Town–Starwood–TEMCO) and one two ended circuit (George Town–TEMCO).

A network diagram of this option is shown in Figure 6 below.

Figure 6: Diagram of potential augmentation to the George Town-Starwood transmission line



The works are estimated to take 24 months to complete. Project completion is assumed in 2027/28.

The estimated capital cost of this option is approximately $8.7 million. Table 4 provides a breakdown of these capital costs by category of expenditure.

Table 4: Breakdown of Option 1's capital cost, $2023/24m

Component	Procurement	Installation	Design	TasNetworks	Total
Starwood augmentation	2.6	4.6	0.9	0.6	8.7

Table 5 shows the expected expenditure profile of this option.

Table 5: Annual breakdown of Option 1's expected capital cost, $2023/24m

Item	Capital expenditure
2025/26	4.6
2026/27	4.1
Total capital cost	**8.7**

Option 2 – Defer renewal of transmission line

Option 2 involves deferring the complete replacement of the 110kV transmission line until the 2029-34 regulatory control period, maintaining the existing transmission line assets until this point in time. This option involves limited foundation, bolt and tower member replacements in the 2024-29 regulatory period to ensure the reliable operation of the transmission line until renewal in 2029-34.

The works are estimated to take 24 months to complete. Project completion is assumed in 2030/31.

The estimated capital cost of this option is approximately $5.6 million. Table 6 provides a breakdown of these capital costs by category of expenditure.

Table 6: Breakdown of Option 2's capital cost, $2023/24m

Component	Procurement	Installation	Design	TasNetworks	Total
Line renewal	1.6	2.8	0.7	0.5	5.6

Table 7 shows the expected expenditure profile of this option.

Table 7: Annual breakdown of Option 2's expected capital cost, $2023/24m

Item	Capital expenditure
2028/29	3.7
2029/30	1.9
Total capital cost	**5.6**

Option 3 – Refurbish transmission line

Option 3 involves refurbishing the existing double circuit 110kV transmission line components to extend its service life. This is achieved by programmed tower painting, insulator and conductor replacement, and foundation works. The tower painting and insulator replacement will be conducted in 2025/26, with the conductor replacement and foundation works to be done in 2026/27. Repainting has an expected life of 10-15 years, so will need to be repeated periodically in the future. The cost of repainting the towers in 2041/42 has been included in the expenditure breakdown below.

The works are estimated to take 24 months to complete. Project completion is assumed in 2027/28.

The estimated capital cost of this option is approximately $5.9 million. Table 8 provides a breakdown of these capital costs by category of expenditure.

Table 8: Breakdown of Option 3's capital cost, $2023/24m

Component	Procurement	Installation	Design	TasNetworks	Total
Line refurbishment	0.6	4.6	0.2	0.5	5.9

Table 9 shows the expected expenditure profile of this option.

Table 9: Annual breakdown of Option 3's expected capital cost, $2023/24m

Item	Capital expenditure
2025/26	2.1
2026/27	2.2
2041/42	1.7
Total capital cost	**5.9**

Option 4 – Renew transmission line

Option 4 involves completely replacing the 110kV transmission line. Specifically, a new double circuit 110kV transmission line will be constructed within the existing corridor, to TasNetworks current design standards. This design standard uses double circuit steel pole support structures with conductor strung at 75°C. This design will ensure that the current customer load can be supplied with no operational constraints.

The works are estimated to take 24 months to complete. Project completion is assumed in 2026/27.

The estimated capital cost of this option is approximately $5.6 million. Table 10 provides a breakdown of these capital costs by category of expenditure.

Table 10: Breakdown of Option 4's capital cost, $2023/24m

Component	Procurement	Installation	Design	TasNetworks	Total
Line renewal	1.6	2.8	0.7	0.5	5.6

Table 11 shows the expected expenditure profile of this option.

Table 11: Annual breakdown of Option 4's expected capital cost, $2023/24m

Item	Capital expenditure
2024/25	3.7
2025/26	1.9
Total capital cost	**5.6**

Options considered but not progressed

No other options are considered as potentially credible to address the identified need and remediate the GT-TE line.

No material inter-network impact is expected

We have considered whether the credible option above is expected to have material inter-regional impact.[3] A 'material inter-network impact' is defined in the NER as:

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

[3] As per NER clause 5.16.4(b)(6)(ii).

(b) an adverse impact on the quality of supply in another Transmission Network Service Provider's network."

In determining whether a proposed transmission augmentation can be expected to have a material inter-network impact, the AEMO screening test can be applied which describes the following considerations:[4]

- 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 all of the credible options satisfy these conditions as it does not modify any aspect of electrical or transmission assets. By reference to AEMO's screening criteria, there is therefore no material inter-network impacts associated with any of the credible options considered.

[4] 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 14 May 2020. https://www.aemo.com.au/-/media/Files/PDF/170-0035-pdf

Materiality of market benefits

The NER requires that RIT-T proponents consider a number of different classes of market benefits that could be delivered by a credible option.[5] Further, the NER requires that a RIT-T proponent consider all classes of market benefits as material unless it can provide reasons why:[6]

- a particular class of market benefit is likely not to materially affect the outcome of the assessment of the credible options under the RIT-T; or
- the estimated cost of undertaking the analysis to quantify the market benefit is likely to be disproportionate to the scale, size and potential benefits of each credible option being considered.

We note also that there has been a law change to introduce an emissions reduction objective into the national energy objectives[7] and that the NER have consequently been updated to add a new category of market benefit to the RIT-T: changes in Australia's greenhouse gas emissions.[8] While we acknowledge this important change to the RIT-T, the credible options for this RIT-T are not expected to affect the dispatch of generation in the wholesale market nor materially impact Australia's greenhouse gas emissions in any other way, including through changes in SF6 emissions. This new category of market benefit is therefore not expected to be material for this RIT-T and so has not been estimated.

Changes in involuntary load shedding is material

We consider that remediating the condition on the GT-TE line will significantly reduce the risk of asset failure and associated involuntary load shedding, thereby providing a material market benefit.

In the base case, involuntary load shedding is expected to occur following any failure of the GT-TE line that requires the asset being taken out of service. We expect this unserved energy to be significant, according to forecasts based on probabilistic planning studies of failure rates and repair times. The probability of asset failure and thereby the frequency of outages is expected to increase over time as the condition of the GT-TE line continues to deteriorate. However, due to the substantial volume of energy at risk, TasNetworks has made the conservative assumption that the probability of failure will not increase over time despite worsening asset condition. We consider this to be a proportionate approach for this RIT-T.

The avoided unserved energy for a credible option is calculated as the difference between the expected unserved energy under the base case and the expected unserved energy under the credible option, with the associated market benefit calculated using a reasonable forecast of the value of electricity to consumers.

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[5] NER clause 5.15A.2(b)(4).

[6] NER clause 5.15A.2(b)(6).

[7] On 12 August 2022, Energy Ministers agreed to fast track the introduction of an emissions reduction objective into the national energy objectives, consisting of the National Electricity Objective (NEO), National Gas Objective and National Energy Retail Objective. On 21 September 2023, the Statutes Amendment (National Energy Laws) (Emissions Reductions Objectives) Act 2023 (the Act) received Royal Assent.

[8] AEMC, Harmonising the electricity network planning and investment rules and AER guidelines with the updated energy objectives, Rule determination, 1 February 2024, p. i.

We consider that reductions in involuntary load shedding are expected to be material for all credible options outlined in this PACR. All credible options mitigate a large proportion of asset failure risk, with the extent to which they do varying due to differences in timing and the extent of line remediation.

Wholesale electricity market benefits are not material

The AER has recognised that if the credible options considered would 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.[9]

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

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

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 also consider two further classes of market benefits, as set out in the table below. We consider that neither of these classes of market benefits will be material for this RIT-T assessment for the reasons in Table 12.

[9] 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-%20RITT%20guidelines%20-%20final%20amendments%20%28clean%29%20-%206%20October%202023_0.pdf

Table 12: Reasons why other non-wholesale electricity market benefits are considered immaterial

Market benefits	Reason
Difference in the timing of unrelated expenditure	The investment is specific to one line 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.[10] The options considered in this RIT-T do not exhibit this flexibility. In particular, each option is focused on proactively replacing deteriorating assets ahead of when they fail. We do not therefore consider that option value is a material benefit category for this RIT-T.

[10] 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-%20RITT%20guidelines%20-%20final%20amendments%20%28clean%29%20-%206%20October%202023_0.pdf

Overview of 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.

Description of the base case

The costs and benefits of each option are compared against the base case. Under this base case, no proactive investment is undertaken, we incur regular and reactive maintenance costs, and the line will continue to operate with an increasing level of risk.

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.[11]

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 options.

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 long-lived options 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 7.0 per cent has been adopted as the central assumption for the NPV analysis, consistent with AEMO's latest Input Assumptions and Scenarios Report (**IASR**).[12] 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.[13] We have also adopted an upper bound discount rate of 10.5 per cent (ie, the upper bound in the latest IASR).[14]

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.

[11] 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

[12] AEMO *'2023 Inputs, Assumptions and Scenarios Report'*, July 2023, p 123.

[13] This is equal to WACC (pre-tax, real) in the latest final decision for a transmission business in the NEM (TasNetworks) as of the date of this analysis. See: https://www.aer.gov.au/industry/registers/determinations/tasnetworks-determination-2024-29

[14] See footnote 12.

Specifically, we apply a bottom-up approach whereby the cost of each component within an option is individually estimated, and the cost of each of these components is then aggregated to provide a total central capital cost estimate for the option. This tool draws upon the latest quotes that we have received from our suppliers for the relevant equipment and the associated unit costs.

TasNetworks considers the cost estimate for the GT-TE line options to have a cost accuracy of 20 per cent, which reflects a level two estimate. TasNetworks utilises three levels of project estimating. As the level of project definition improves the level of uncertainty may reduce and the cost accuracy may improve. As such, selection of the estimate level is primarily driven by the stage of the project. The three levels of estimate and their respective normal application are:

- level one, which is used for the project concept stage, to perform feasibility and options analysis – considering scope and time risks;
- level two, which is used for the project development stage and to evaluate the preferred option – considering scope, time and contingent risk; and
- level three, which is used for the project implementation stage and to support business case approval – considering all management elements.

TasNetworks' estimating process was developed with consideration of the Association for Advancement of Cost Engineering International guidelines and Guide to the Project Management Body of Knowledge.

No specific contingency allowance has been included in the cost estimates for the options evaluated in this RIT-T.

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 from the point at which they have been estimated.

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 PACR 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 expected most likely scenario for the final 2024 ISP (ie, the 'Step Change' scenario). The scenarios differ by the assumed risk costs, given that this is the key parameter that may 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).[15,16]

A summary of the scenarios modelled is set out in Table 13 below.

Table 13: Summary of scenarios

Variable / Scenario	Central	Low demand scenario	High demand 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.

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 PACR are:

- lower and higher assumed capital costs;
- lower and higher weighted VCR;
- lower and higher estimated reliability, bushfire, financial and safety risks; and
- alternate commercial discount rate assumptions.

The above list of sensitivities focuses on the key variables that could impact the identified preferred option.

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.

[15] AER, Regulatory investment test for transmission Application guidelines, October 2023, pp. 44-46.

[16] 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.

Assessment of credible options

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

Estimated gross benefits

Table 14 below summarises the present value of the gross benefit estimates for each credible option relative to the base case under the three scenarios. The benefits included in this assessment consist of avoided risk, ie, a reduction in reliability, bushfire, financial and safety risks.

Table 14: Estimated gross benefits from credible options 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*	
Option 1	67.1	66.5	67.7	67.1
Option 2	48.5	48.0	48.9	48.5
Option 3	66.7	66.2	67.2	66.7
Option 4	74.2	73.5	74.9	74.2

Estimated gross costs

Table 15 below summarises the costs of the options, relative to the base case, in present value terms.

The costs consist of the direct capital costs for each option, relative to the base case.

Table 15: Costs of credible options relative to the base case, $m PV

Option/scenario	All scenarios
Option 1	5.6
Option 2	2.7
Option 3	2.9
Option 4	4.0

Estimated net market benefits

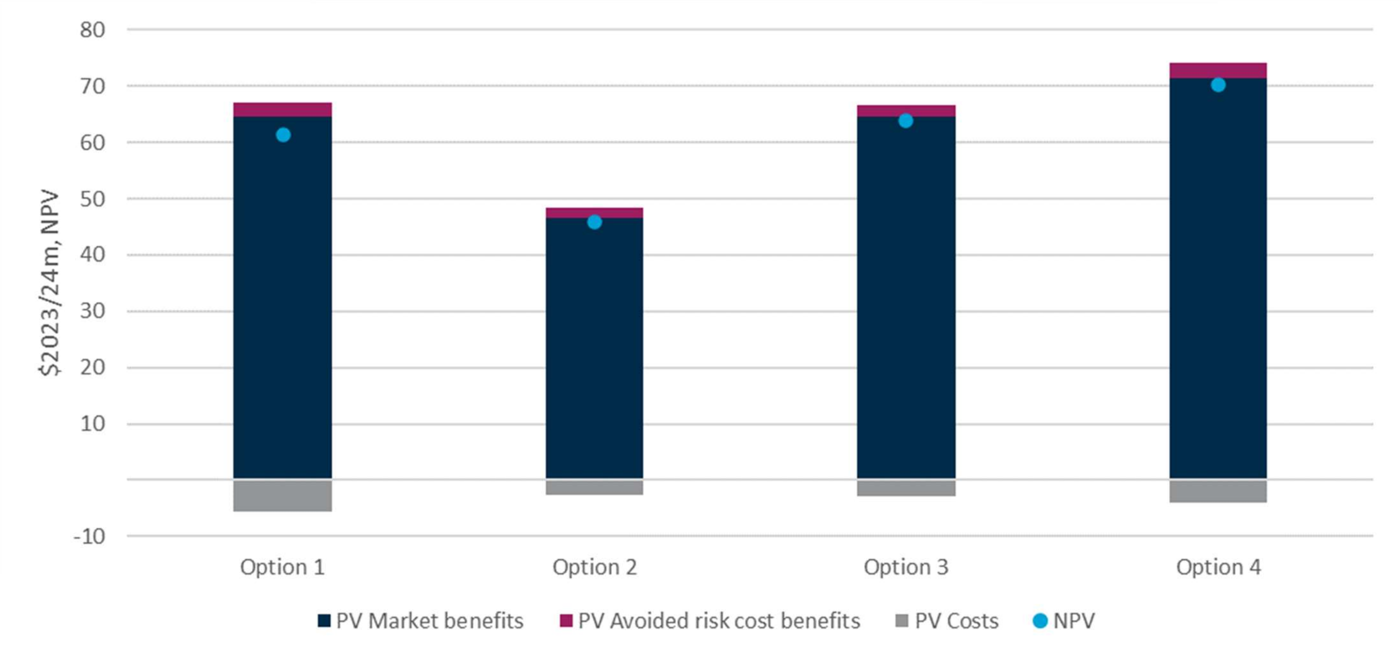
The net economic benefits are the differences between the estimated gross benefits less the estimated costs. Table 16 below summarises the present value of the net economic benefits for each credible option across the three scenarios and the weighted net economic benefits.

Table 16: Net economic benefits for credible options 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*	
Option 1	61.5	60.8	62.1	61.5
Option 2	45.8	45.3	46.2	45.8
Option 3	63.8	63.3	64.3	63.8
Option 4	70.2	69.5	70.9	70.2

All options are found to have positive net benefits for all scenarios investigated. On a weighted basis, Option 4 is found to deliver the highest net benefits of approximately $70.2 million. Figure 7 shows a breakdown of the weighted net economic benefits for each option, with avoided unserved energy (ie, market benefits) accounting for the vast majority of the NPV.

Figure 7: Breakdown of weighted NPV results, $m PV



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.

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 4 is found to be invariant to the assumptions of:

- a 20 per cent increase/decrease in the assumed network capital costs (in line with the assumed accuracy of the cost estimates for this RIT-T);
- a 30% lower (or higher) weighted average VCR;
- lower (or higher) assumed reliability, bushfire, financial and safety risks ; and
- lower discount rate of 3.63 per cent as well as a higher rate of 10.50 per cent.

Specifically, Figure 8 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 4 is 2026/27.

Figure 8: Optimal timing for Option 4

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 2024/25 and completion in 2026/27. Specifically, we have investigated the following same sensitivities under this step as in the first step:

- a 20 per cent increase/decrease in the assumed network capital costs (in line with the assumed accuracy of the cost estimates for this RIT-T);
- a 30% lower (or higher) weighted average VCR;
- lower (or higher) assumed reliability, bushfire, financial and safety risks ; and
- lower discount rate of 3.63 per cent as well as a higher rate of 10.50 per cent.

The figures below illustrate the estimated net economic benefits for each option if the separate key assumptions in the central scenario are varied individually. Each option delivers positive benefits under all scenarios. The sensitivity testing focuses on the central scenario given the ranking of the options is found to be the same across all three scenarios investigated and there are significant expected net market benefits under each scenario. That is, we do not expect the key findings to change for this RIT-T if the sensitivity testing was expanded to cover the low and high risk scenarios.

Figure 9 shows that the NPV of each option decreases only marginally as the capital costs increase from 80 per cent to 120 per cent. At no point does the ranking of options changes as the capital cost changes.

Figure 9: Capital cost sensitivity

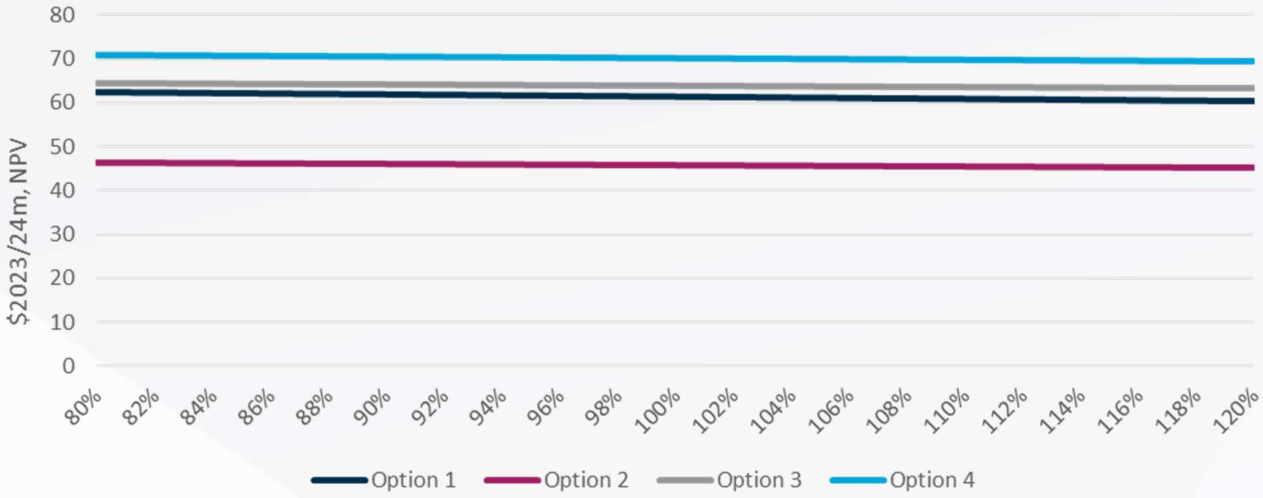


Figure 10 shows that the NPV of each option increases by between approximately $30 million and $40 million as the VCR increases from $16.30 to $30.26. At no point does the ranking of options change as the VCR changes.

Figure 10: VCR sensitivity

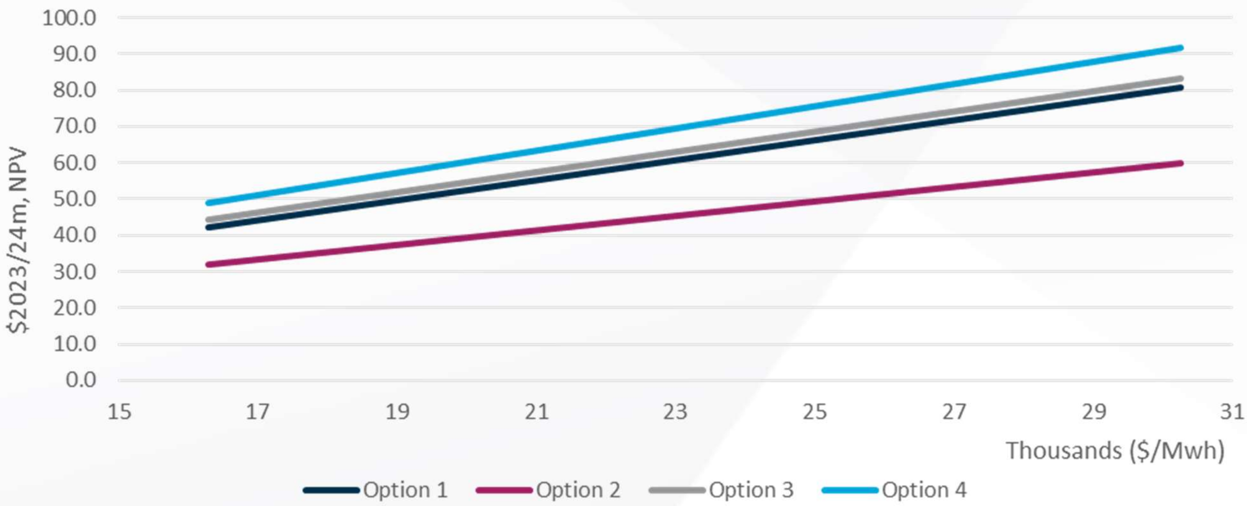


Figure 11 shows that the NPV of each option increases only marginally as the risk costs increase from 70 per cent to 130 per cent. At no point does the ranking of options change as the risk costs change.

Figure 11: Risk cost sensitivity

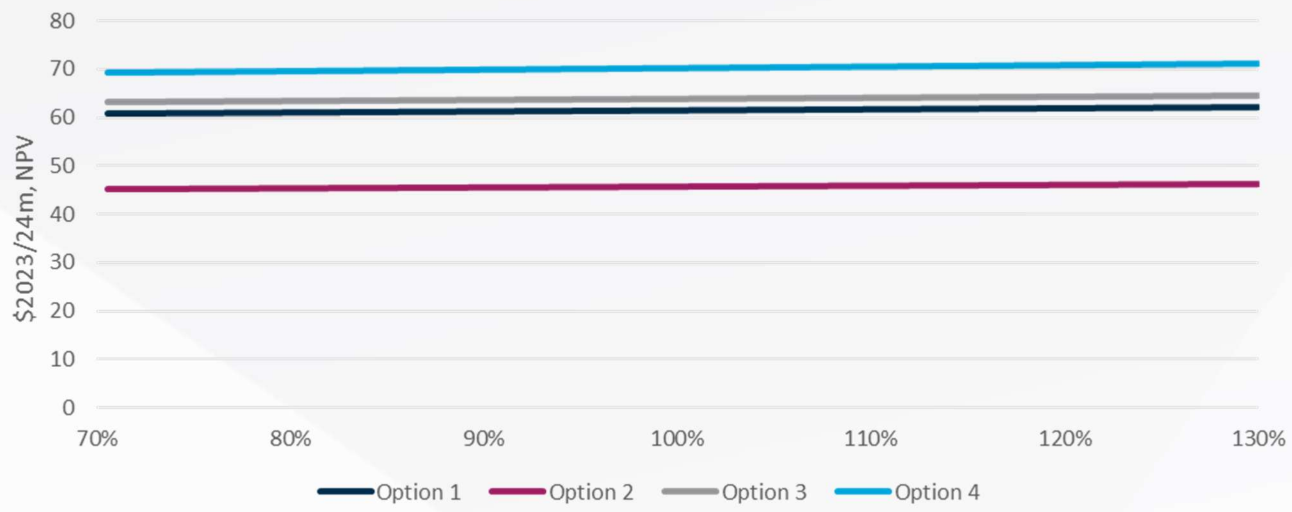
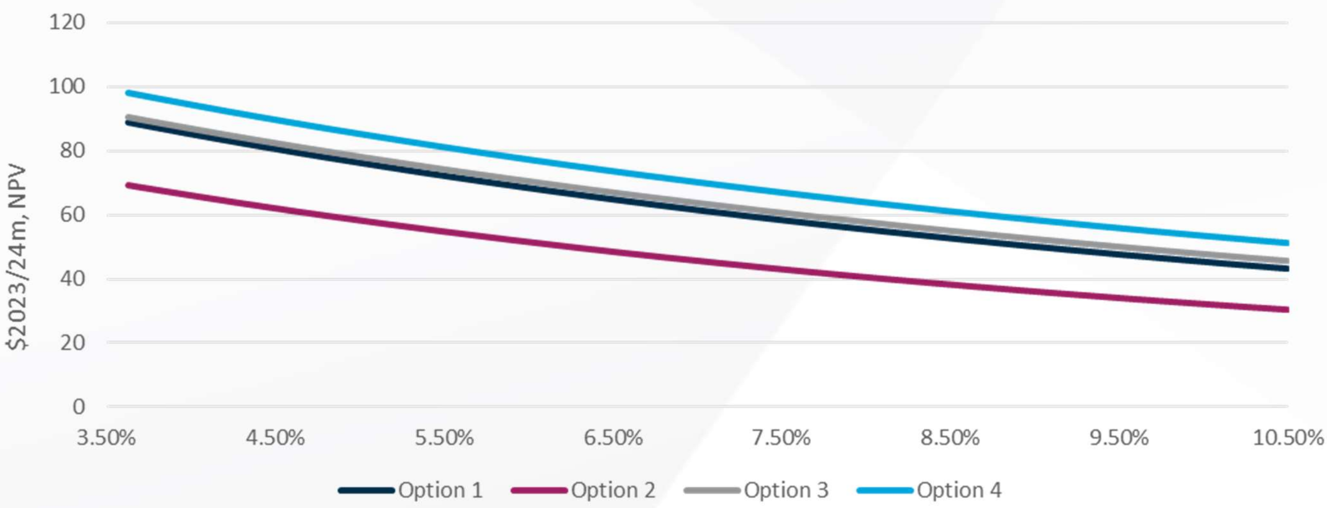


Figure 12 shows that the NPV of each option decreases as the discount rate increases from 3.5 per cent to 10.5 per cent. At no point does the ranking of options change as the discount rate changes.

Figure 12: Discount rate sensitivity



In terms of boundary testing, we find that the following will need to occur for Option 4 to no longer be the preferred option, ie, have the same net benefits equal to Option 3 (the option with the second highest net benefits):

- assumed network capital costs would need to increase by a factor of approximately 6 times;
- the VCR would need to decrease by more than 90 per cent.
- the estimated risk costs (in aggregate) would need to fall by a factor of approximately 9 times; and
- the discount rate would need to be greater than 75 per cent.

We therefore consider the finding that Option 4 being the preferred option is robust to the key underlying assumptions.

Final conclusion

This PACR has found that Option 4 is the preferred option (consistent with the draft conclusion in the earlier PSCR). Option 4 involves completely replacing the 110kV transmission line. Specifically, a new double circuit 110kV transmission line will be constructed within the existing corridor to TasNetworks' design standards. This standard design uses double circuit steel pole support structures with conductor strung at 75°C. This design will ensure that the current customer load can be supplied with no operational constraints.

The estimated capital expenditure associated with Option 4 is $5.6 million (in 2023/24 dollars). On a weighted basis, Option 4 is found to deliver net benefits of approximately $70.2 million. The works are estimated to take 24 months to complete with project completion expected in 2026/27.

Option 4 maximises the net present value of the net economic benefit to all those who produce, consume and transport electricity in the market, and is therefore the preferred option in accordance with NER clause 5.15A.2(b)(12). The analysis undertaken and the identification of Option 4 as the preferred option satisfies the RIT-T.

TasNetworks considers this conclusion to be robust to changes in capital cost inputs, changes in the value of customer reliability, estimated risk costs and underlying discount rates. Boundary testing indicates that these key assumptions would need to vary unrealistically for there to be no expected net benefits. That said, TasNetworks will monitor these key assumptions and notify the AER if such changes do occur (or appear likely), as this would constitute a material change in circumstance.

A.1 Project Assessment Conclusions Report compliance checklist

This appendix sets out a checklist which demonstrates the compliance of this PACR with the requirements of the National Electricity Rules version 217.

Rules clause	Summary of requirements		Relevant section
5.16.4 (k)	The project assessment draft report must include:		–
	(1)	a description of each credible option assessed;	Credible options
	(2)	a summary of, and commentary on, the submissions to the project specification consultation report;	N/A
	(3)	a quantification of the costs, including a breakdown of operating and capital expenditure, and classes of material market benefits for each credible option;	Credible options and Materiality of market benefits
	(4)	a detailed description of the methodologies used in quantifying each class of material market benefit and cost;	Materiality of market benefits, Overview of assessment approach and Reliability risk
	(5)	reasons why the RIT-T proponent has determined that a class or classes of market benefit are not material;	Materiality of market benefits
	(6)	the identification of any class of market benefit estimated to arise outside the region of the Transmission Network Service Provider affected by the RIT-T project, and quantification of the value of such market benefits (in aggregate across all regions);	Materiality of market benefits
	(7)	the results of a net present value analysis of each credible option and accompanying explanatory statements regarding the results;	Assessment of credible options
	(8)	the identification of the proposed preferred option;	Assessment of credible options and Final conclusion
	(9)	for the proposed preferred option identified under subparagraph (8), the RIT-T proponent must provide: (i) details of the technical characteristics; (ii) the estimated construction timetable and commissioning date; (iii) if the proposed preferred option is likely to have a material inter-network impact and if the Transmission Network Service Provider affected by the RIT-T project has received an augmentation technical report, that report; and (iv) a statement and the accompanying detailed analysis that the preferred option satisfies the regulatory investment test for transmission.	Credible options and No material inter-network impact is expected and Final conclusion

5.16.4(v)	The project assessment conclusions report must set out:	–
	(1) the matters detailed in the project assessment draft report as required under paragraph (k); and	See above
	(2) a summary of, and the RIT-T proponent's response to, submissions received, if any, from interested parties sought under paragraph (q)	NA

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