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People. Power. Possibilities.

Managing the risk of disconnector failure

RIT-T Project Specification Consultation Report

Issue date: 6 August 2024

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Executive summary

High voltage disconnectors and associated earth switches (henceforth collectively referred to as disconnectors) earth and provide visible isolation for sections of Transgrid's high voltage network. Disconnectors are required within the network to facilitate maintenance of other high voltage equipment such as circuit breakers and transformers.

The purpose of this PSCR is to examine and consult on options to address the deteriorating condition of the identified disconnectors to ensure the safe and secure operation of our network. We consider it prudent and cost effective to manage this risk through an asset replacement program during the 2023/24 and 2027/28 regulatory period.

Identified need: Ensure the safe and reliable operation of our transmission network by managing the risk of disconnector and earth switch failure

The identified need for this project is to ensure the safe and reliable operation of our transmission network by addressing the risk of failure of certain disconnectors that are approaching the end of their technical life.

There are 5180 disconnectors installed in Transgrid's network. Of this population, 30% will be over the nominal expected life of 40 years by 2027-28. With such a large ageing population, a strategic approach is required to plan investments over the coming years to manage these assets effectively and efficiently.

The disconnectors considered for replacement under this need are older disconnectors that have already reached their end of life (see Appendix C for further detail). The failure of a disconnector is expected to result in additional equipment outages to isolate the failed disconnector for repair. In case of bus disconnectors this additional outage is significant due to the isolation of all other services from the affective bus bar. The potential outages are expected to disrupt customer and distributor supplies and increase corrective maintenance costs.

Addressing the condition of the identified assets provides the economic benefit of avoided involuntary load shedding to the NEM. We have classified this RIT-T as a 'market benefits' driven RIT-T as the economic assessment is not being progressed specifically to meet a mandated reliability standard but by the net benefits that are expected to be generated for end-customers. This means that options assessed within this RIT-T must provide net economic benefits compared to the base case if they are to be pursued.

Credible options considered

We consider that there is one credible network option that can meet the identified need. This sole credible option is summarised below:

Table E-1 Summary of the credible options

Option	Description	Capital costs ($m, 2023/24)
Option 1	This option fully addresses the identified need by replacing and refurbishing 136 disconnectors.[1]	21.2

[1] While

See Appendix C for a full list of assets to be replaced and refurbished under Option 1.

Non-network options are not expected to be able to assist in 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. Non-network options are not able to mitigate the risks from disconnector assets having reached or approaching the end of their technical life.

Credible options are assessed against three reasonable scenarios

The credible options are assessed against three different scenarios within this Project Specification Consultation Report (PSCR). The scenarios differ by the assumed level of risk (involuntary load shedding) costs, given that these are the key parameters that may affect the ranking of the credible options. As wholesale market benefits are not relevant for this RIT-T, the three scenarios assume the most likely scenario from AEMO's Integrated System Plan (ISP, i.e. the 'Step Change' scenario). Risk cost assumptions do not form part of AEMO's ISP assumptions and have been based on Transgrid's analysis.

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%
VCR ($2023/24)	51,086/MWh	51,086/MWh	51,086/MWh
Network capital costs	Base estimate	Base estimate	Base estimate
Avoided unserved energy	Base estimate	Base estimate – 25%	Base estimate + 25%

Draft Conclusion

Option 1 (disconnector replacement program) 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 the disconnector risks due to the assets having reached or are approaching the end of their technical life. The estimated capital expenditure associated with this option is $21.2 million in $2023/24 over the assessment period. Option 1 is found to have positive net benefits under all scenarios investigated and, on a weighted basis, will deliver $1,377 million in net economic benefits[2]. The works would be undertaken from 2024 to 2028.

All works will be completed in accordance with the relevant standards and components shall be replaced and refurbished 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.

[2] Reliability risk makes up 100 per cent of the total estimated risk cost in present value terms. The relative size of this risk is due to probability of someone experiencing a serious injury from a disconnector failure is very low and the potential of adverse impact on the environment is also very remote. In the event of a failure, the field personnel may be able to put stop gap measures to restore the continuity of supply, but these measures can take time to implement resulting in an extended period of outage than planned. Hence, the impact of a disconnector failure is mostly comprised of loss of service arising from higher reliability risk.

Exemption from preparing a Project Assessment Draft Report

Subject to the identification of additional credible options during the consultation period, publication of a Project Assessment Draft Report (PADR) is not required for this RIT-T as we consider that the conditions in clause 5.16.4(z1) of the NER exempting RIT-T proponents from providing a PADR have been met.

Specifically, production of a PADR is not required because:

- the estimated capital cost of the preferred option is less than $46 million;[3]
- we have identified in this PSCR our preferred option and the reasons for that option, and noted that we will be exempt from publishing the PADR for our preferred option; and
- we consider that the preferred option and any other credible options do not have a material market benefit (other than benefits associated with changes in voluntary load curtailment and involuntary load shedding).

If an additional credible option that could deliver a material market benefit is identified during the consultation period, then we will produce a PADR that includes an assessment of the net economic benefit of each additional credible option.

If no additional credible options with material market benefits are identified during the consultation period, then the next step in this RIT-T will be the publication of 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.[4]

Submissions and next steps

We welcome written submissions on materials contained in this PSCR.

Submissions are due on 6 November 2024[5] and should be emailed to our Regulation team via regulatory.consultation@Transgrid.com.au.[6] In the subject field, please reference 'Disconnector Replacement Program 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 PACR that addresses all submissions received including any issues in relation to the proposed preferred option raised during the consultation period. Subject to additional credible options being identified, we anticipate publication of a PACR by December 2024.

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3 Varied from $43m to $46m based on the AER Final Determination: Cost threshold review, November 2021.
4 In accordance with NER clause 5.16.4(z2).
5 Consultation period is for 12 w eeks, additional days have been added to cover public holidays
6 Transgrid is bound by the Privacy Act 1988 (Cth). In making submissions in response to this consultation process, Transgrid will collect and hold your personal information such as your name, email address, employer and phone number for the purpose of receiving and following up on your submissions. 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.

Contents

1. Introduction

We are applying the Regulatory Investment Test for Transmission (RIT-T) to options for ensuring the safe and reliable operation of our transmission network by managing the risk of disconnector and earth switch (henceforth collectively referred to as disconnectors) failure. Publication of this Project Specification Consultation Report (PSCR) represents the first step in the RIT-T process.

Disconnectors are required for the isolation of network elements to perform required routine and corrective maintenance. Ageing, along with a corrosive environment, has resulted in several disconnectors failing or having difficulty in performing their required function of opening and closing.

The purpose of this PSCR is to examine and consult on options to address risks tied to disconnector failure. As this economic assessment is not being progressed to meet a reliability standard, this RIT-T is classified as a 'market benefits driven RIT-T'.

1.1 Purpose of this report

The purpose of this PSCR[7] is to:

- set out the reasons why we propose that action be taken (the 'identified need')
- present the options that we currently considers to address the identified need
- outline the technical characteristics that non-network options would need to provide[8]
- summarise how we have assessed the options for addressing the identified need
- present the cost benefit assessment of all options for meeting the identified need
- identify the preferred option under the RIT-T assessment, and
- allow interested parties to make submissions and provide input to the RIT-T assessment.

1.2 Exemption from producing a Project Assessment Draft Report

Subject to the identification of additional credible options during the consultation period, publication of a Project Assessment Draft Report (PADR) is not required for this RIT-T as we consider that the conditions in clause 5.16.4(z1) of the NER exempting RIT-T proponents from providing a PADR have been met.

Specifically, production of a PADR is not required because:

- the estimated capital cost of the preferred option is less than $46 million;[9]
- we have identified in this PSCR our preferred option and the reasons for that option, and noted that we will be exempt from publishing the PADR for our preferred option; and
- we consider that the preferred option and any other credible options do not have a material market benefit (other than benefits associated with changes in voluntary load curtailment and involuntary load shedding).

If an additional credible option that could deliver a material market benefit is identified during the consultation period, then we will produce a PADR that includes an NPV assessment of the net economic benefit of each additional credible option.

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7 See Appendix A for the National Electricity Rules requirements.

8 Although we note that non-network options are considered unlikely to be able to contribute to meeting the identified need for this RIT-T.

9 Varied from $43m to $46m based on the AER Final Determination: Cost threshold review, November 2021.

If no additional credible options with material market benefits are identified during the consultation period, then the next step in this RIT-T 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.[10]

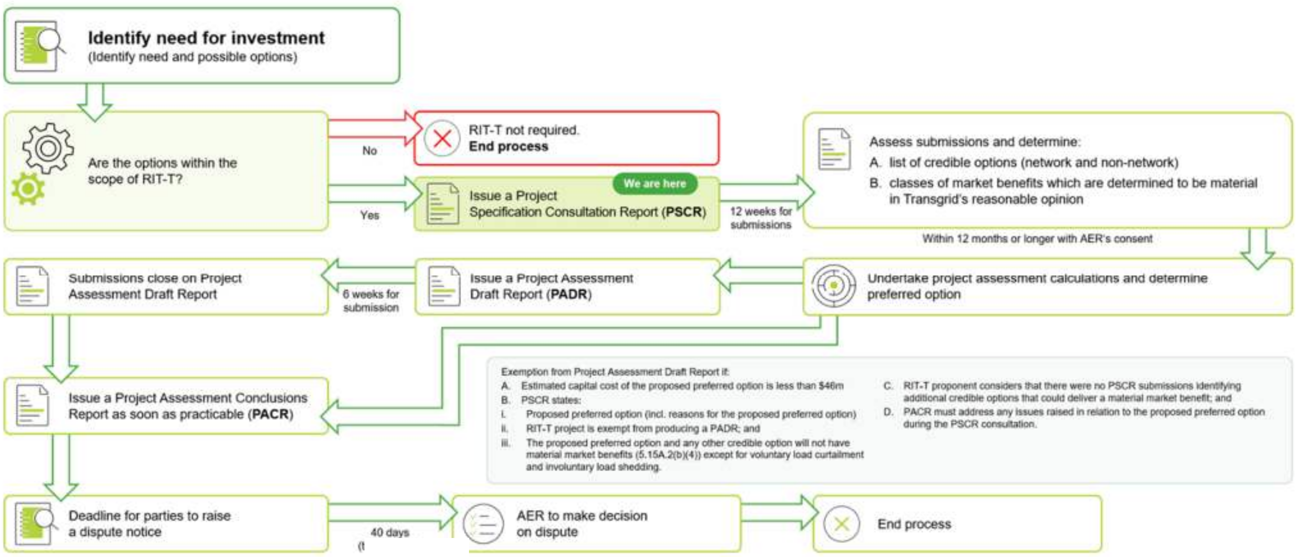
1.3 Submissions and next steps

We welcome written submissions on materials contained in this PSCR.

Submissions are due on 6 November 2024[11] and should be emailed to our Regulation team via regulatory.consultation@Transgrid.com.au.[12] In the subject field, please reference 'Disconnector Replacement Program 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 PACR that addresses all submissions received including any issues in relation to the proposed preferred option raised during the consultation period. Subject to additional credible options being identified, we anticipate publication of a PACR by December 2024.

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



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

[11] Consultation period is for 12 weeks, additional days have been added to cover public holidays

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

2. The identified need

2.1 Background to the identified need

There are 5180 disconnectors installed in Transgrid's network. Of this population, 30% will be over the nominal expected life of 40 years by 2027-28. With such a large ageing population, a strategic approach is required to plan investments over the coming years to manage these assets effectively and efficiently.

The disconnectors considered for replacement under this need are older disconnectors that have already reached their end of life (see Appendix C for further detail). The following inputs are considered in decision making for end-of-life replacement:

- Age;
- Selective condition assessments[13];
- Location-based corrosive vs non-corrosive;
- Known type and site issues;
- Defect data with consideration of accuracy and cost of defects;
- Engineering assessment and field staff's experience of working with these disconnectors.

The scope of the condition assessments included a sample of disconnectors which will be over 40 years of age by 2027-28. They are ALM, Essantee, ASEA and Stanger type disconnectors at various voltage levels, which are common types of disconnectors in Transgrid's network.

2.2 Description of the identified need

Disconnectors are required for the isolation of network elements to perform required routine and corrective maintenance. Ageing, along with a corrosive atmosphere, has resulted in disconnectors often failing or having difficulty in performing their required function of opening and closing. The failure of a disconnector is expected to result in additional equipment outages to isolate the failed disconnector for repair. In case of bus disconnectors this additional outage is significant due to the isolation of all other services from the affective bus bar. The potential outages are expected to disrupt customer and distributor supplies and increase corrective maintenance costs.

We have classified this RIT-T as a 'market benefits' driven RIT-T as the economic assessment is not being progressed specifically to meet a mandated reliability standard but by the net benefits that are expected to be generated for end-customers. Given the high population of disconnectors that have been identified for replacement, we consider it prudent and cost effective to manage this risk through a single asset replacement program. This replacement will help limit the amount of in-service failures that occur (along with the associated interruptions to customer load, and safety and environmental consequences).

2.3 Assumptions underpinning the identified need

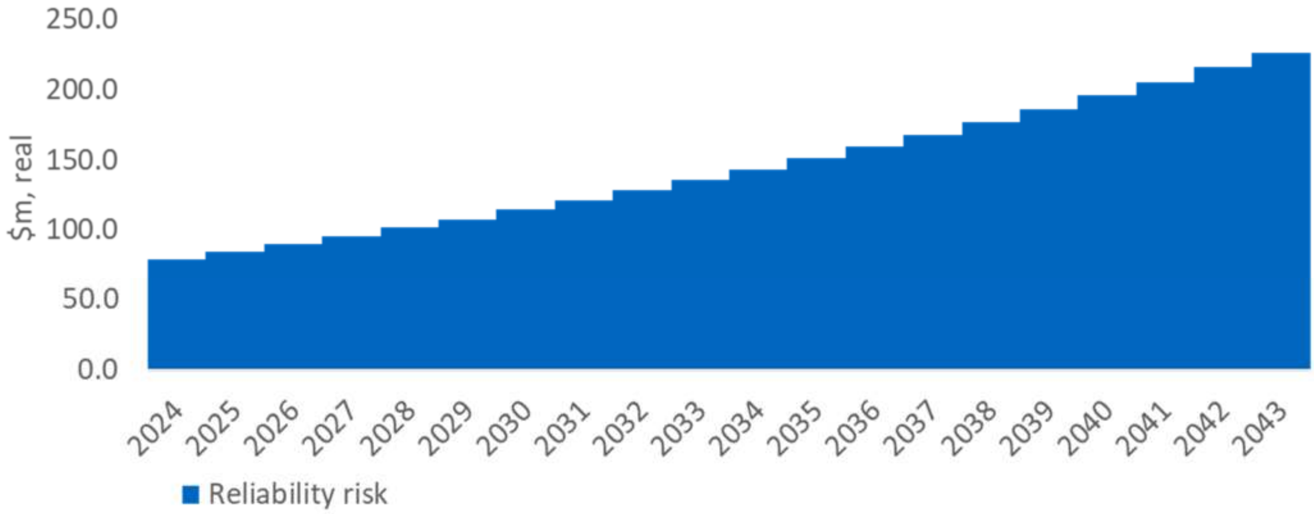
We adopt a risk cost framework to quantify and evaluate the risks and consequences of increased failure rates. Appendix B provides an overview of our Risk Assessment Methodology. We note that the risk cost estimating methodology aligns with that used in our Revised Revenue Proposal for the 2023-28 period. It

[13] Completed as part of a separate need.

reflects feedback from the Australian Energy Regulator (AER) on the methodology initially proposed in our initial Revenue Proposal.

Figure 2-1 summarises the increasing risk costs over the under the base case and our central scenario of asset failure risk.

Figure 2-1 Estimated risk costs under the base case (Central scenario)



This section describes the assumptions underpinning our assessment of the risk costs, i.e., the value of the risk avoided by undertaking each of the credible options. The aggregate risk cost under the base case is currently estimated at around $78.96m in 2024, and it is expected to increase going forward if action is not taken (reaching approximately $226.01m in 2043 by the end of the 20-year assessment period).

2.3.1 Assessment of asset health

The health index score for a disconnector is dependent on the asset serviceability factors outlined below.

Spares and Support: Due to the proprietary nature of disconnector assets, an evaluation of manufacturer support and/or spares availability is critical for ensuring the continuing operability of these assets. This figure represents the ability to repair or replace an in-service failed asset.

Historical defect rates: A key factor into asset health is the historical rate of defects experienced across individual models. A 3-year average is utilised to minimise bias to peaks and troughs. This figure represents the potential underlying issues with a particular model.

Asset type: The type of technology on which the asset is based affects the overall health index of the asset. Older technologies such as electromechanical and discrete component assets suffer from degradation over time, being effectively mechanical devices. These also lack self-monitoring capabilities and as such can fail between maintenance testing cycles. Modern microprocessor-based devices do not suffer from degradation in a similar manner and have the ability to self-monitor and alarm on failure (watchdog).

Natural age: A disconnector asset's natural age is calculated from its first install date. This age contributes to the overall health index.

2.3.2 Reliability risk

We have considered the risk of unserved energy for customers following a failure of the disconnectors identified in this PSCR. The likelihood of a consequence considers the likelihood of contingent planned/unplanned outages, the anticipated load restoration time (based on the expected time to undertake repair), and the load at risk (based on forecast demand). The monetary value is based on an assessment of the value of lost load, which measures the economic impact to affected customers of a disruption to their electricity supply.

Reliability risk makes up 100 per cent of the total estimated risk cost in present value terms. As the assets continue to age the probability of one or more disconnectors failing increases. This increased probability of failure combined with a long load restoration time and the interruption to large industrial loads, means that there is likely to be significant amounts of unserved energy over the assessment period without replacement of the assets.

3. Options that meet the identified need

This section describes the option(s) that we explore to address the identified need, including the scope of each option and the associated costs.

We consider that there are one credible network options that can meet the identified need. These options are summarised in Table 3-1. We do not consider non-network options to be commercially and technically feasible to assist with meeting the identified need for this RIT-T.

Table 3-1: Summary of the credible options

Option	Description	Capital costs ($m, 2023/24)
Option 1	This option fully addresses the identified need by replacing and refurbishing disconnectors	21.2

3.1 Base case

Consistent with the RIT-T requirements, the assessment undertaken in this PSCR compares the costs and benefits of each credible option to a 'do nothing' base case. The base case is the (hypothetical) projected case if no action is taken, i.e:[14]

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

Under the base case, no replacement strategy is implemented for the assets evaluated under this need. This is a 'run to fail' scenario that involves an increase in the identified risks, the eventual failure of the assets and the realisation of the expected consequences. This case is only considered as a last resort should neither credible option be deemed viable through the economic evaluation process.

Increased operating and maintenance activity costs are included as an opex cost against the assets in the base case. This increased cost is modelled based on historical breakdown (corrective) repair costs and represents an avoided operating cost increase benefit when mitigated through replacement.

3.2 Option 1 – Disconnector replacement and refurbishment

Option 1 considers the replacement and refurbishment of an existing disconnector with a new unit. This option fully addresses the identified need by replacing and refurbishing disconnectors.

The replacement and refurbishment work may include the following, and detailed in Appendix C:

- High voltage and civil design work
- Secondary system design work
- Plant procurement and transportation
- Civil work (e.g. footing replacement or modifications as required)
- Site work and commissioning

[14] AER, *Regulatory Investment Test for Transmission Application Guidelines,* October 2023, p. 22.

The work will be undertaken over a 5-year period with all works expected to be completed by 2028. The capital cost of this option is approximately $21.2m (in $2023/24). This capital cost is comprised of:

- $14.9m in labour costs;
- $3.5m in materials costs; and
- $2.8m in expenses

There are no annual routine operating and maintenance costs tied to the replacement program.

Table 3-2 Option 1 Capital Cost ($m, 2023/24)

Year	Capital expenditure ($m, 2023/24)
2024	4.24
2025	4.24
2026	4.24
2027	4.24
2028	4.24
2029	-
2030	-
2031	-
2032	-
2033	-
2034	-
2035	-
2036	-
2037	-
2038	-
2039	-
2040	-
2041	-

All works will be completed in accordance with the relevant standards and components shall be replaced and refurbished 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.

Following the implementation of Option 1, the costs associated with reliability risks are significantly reduced.

3.3 Options considered but not progressed

We have also considered whether other options could meet the identified need. Reasons why these other options were not progressed are summarised in Table 3-3.

Table 3-3: 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 maintenance or inspections, and therefore is not technically feasible or financially sustainable to address the need.
Elimination of all associated risk	This can only be achieved by retiring the assets, which is not technically feasible due to the requirement to maintain the existing network reliability.
Non-network solution	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 not able to mitigate the risks from disconnector assets having reached or approaching the end of their technical life.

3.4 No material inter-network impact is expected

We have considered whether the credible options listed above is expected to have material inter-regional impact[15]. 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.*"

By reference to AEMO's screening test for an inter-network impact,[16] a material inter-regional impact may arise if a credible option:

- is expected to change power transfer capability between transmission networks or in another TNSP's network by more than the minimum of 3 per cent of the maximum transfer capability and 50 MW
- is expected to result in an increase in fault level by more than 10 MVA at any substation in another TNSP's network; or
- involves either a series capacitor or modification in the vicinity of an existing series capacitor.

As none of these criteria are satisfied for this RIT-T, we consider that there are no material inter-network impacts associated with any of the credible options considered.

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

[16] 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 23 June 2021. https://aemo.com.au/-/media/files/electricity/nem/network_connections/transmission-and-distribution/170-0035-pdf.pdf

4. Technical characteristics for non-network options

As mentioned in Table 3-3, we do not consider non-network options to be commercially or technically feasible for this RIT-T. For non-network options to assist, they would need to provide greater net economic benefits than the network options. That is, non-network options are not able to mitigate the risks from disconnector assets having reached or approaching the end of their technical life.

We do not expect that non-network options are able to meet the identified need, irrespective of their type, size, operating profile and location. Any non-network solution for this need is expected to only add to the costs of this option without providing any net benefits.

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.[17]

Many of the expected benefits associated with the credible options are captured in the expected costs avoided by the options (i.e., the avoided expected costs compared to the base case). These include avoided costs associated with routine maintenance and risk costs. Of these avoided costs, only unserved energy through involuntary load shedding is considered a market benefit category under the NER, as discussed further below.

5.1 Avoided unserved energy is material

We consider that changes in involuntary load shedding are expected to be material for the credible options outlined in this RIT-T assessment. In the base case, involuntary load shedding would be expected to occur following a disconnector failure on our network. The probability of asset failure is expected to increase over time as the condition of disconnectors continue to deteriorate.

We have estimated expected load shedding under the base case and Option 1. These forecasts are based on probabilistic planning studies of failure rates and repair times. The avoided unserved energy for each credible option is calculated as the difference between the expected load shedding under the base case and the expected load shedding under Option 1.

5.2 Wholesale electricity market benefits are not material

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

We determine that the credible options in this RIT-T will not affect 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 Transgrid
- changes in ancillary services costs
- competition benefits

[17] The NER requires that all classes of market benefits identified in relation to the RIT-T are included in the RIT-T assessment, unless the TNSP can demonstrate that a specific class (or classes) is unlikely to be material in relation to the RIT-T assessment for a specific option – NER clause 5.15A.2(b)(6). See Appendix A for requirements applicable to this document.

5.3 No other classes of market benefits are material

In addition to the classes of market benefits listed above, NER clause 5.15A.2(b)(6) requires us to 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 in Table 5-1.

Table 5-1: Reasons non-wholesale electricity market benefits categories are considered not material

Market benefits	Reason
Differences in the timing of unrelated network expenditure	The credible options considered are unlikely to affect decisions to undertake unrelated expenditure in the network. Consequently, material market benefits will neither be gained nor lost due to changes in the timing of expenditure from any of the options considered.
Option value	We note the AER's view that option value is likely to arise where there is uncertainty regarding future outcomes, the information that is available is likely to change in the future, and the credible options considered by the TNSP are sufficiently flexible to respond to that change. We also note the AER's view that appropriate identification of credible options and reasonable scenarios captures any option value, thereby meeting the NER requirement to consider option value as a class of market benefit under the RIT-T. We do not consider there to be any option value with the options considered in this RIT-T. Additionally, a significant modelling assessment would be required to estimate the option value benefits but it would be disproportionate to potential additional benefits for this RIT-T. Therefore, we have not estimated additional option value benefit.
Changes in network losses	We do not expect any material difference in transmission losses between options.
Changes in Australian greenhouse gas emissions	The credible option assessed within this RIT-T is not expected to induce a material change in Australia's greenhouse gas emissions.

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 Assessment against the base case

Under the base case, no replacement strategy is implemented for the disconnector assets evaluated under this need. This is a 'run to fail' scenario that involves an increase in the identified risks, the eventual failure of the assets and the realisation of the expected consequences.

The condition of the disconnectors that have been identified for replacement will continue to deteriorate and age, increasing the probability of a failure in the transmission network. This is expected to result in unserved energy of approximately 1546 MWh in 2024 and 4424 MWh in 2043.[18]

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.[19]

6.2 Assessment period and discount rate

A 20-year assessment period from 2024 to 2043 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 PACR, consistent with AEMO's Inputs Assumptions and Scenarios Consultation Report[20] and the assumptions adopted in AEMO's 2024 Integrated System Plan (ISP).[21] 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.[22] We have also adopted an upper bound discount rate of 10.5 per cent (ie, AEMO's 2023 Inputs Assumptions and Scenarios Report).[23]

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18 Yearly figures for unserved energy

19 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. (See: AER, Application guidelines Regulatory Investment Test for Transmission, October 2023)

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

21 AEMO, *2024 Integrated System Plan, June 2024*, p 92.

22 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: [Final decision | Australian Energy Regulator (AER)]

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

6.3 Approach to estimating option costs

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

The cost estimates are developed using our 'MTWO' cost estimating system. This system utilises historical average costs, updated by the costs of the most recently implemented project with similar scope. All estimates in MTWO are developed to deliver a 'P50' portfolio value for a total program of works (i.e., there is an equal likelihood of over- or under-spending the estimate total).[24]

All work is within existing substations. No allowance for additional access or special foundations have been made.

We estimate that the actual cost is within +/- 25 per cent of the central capital cost. An accuracy of +/-25 per cent 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.

Routine operating and maintenance costs are based on works of similar nature. Given that there is an incremental routine operating and maintenance costs saving in the options compared to the base case, this is a net benefit in the assessment.

6.4 Value of customer reliability

We have applied a NSW-wide VCR value based on the estimates developed and consulted on by the AER.[25] The options considered involve the replacement of disconnectors across our network. As a result, we consider that a state-wide VCR is likely to reflect the weighted mix of customers that will be affected by these options.

6.5 Three different scenarios have been modelled to address uncertainty

The credible options are assessed against three different scenarios within this PSCR. 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. As wholesale market benefits are not relevant for this RIT-T, the three scenarios assume the most likely scenario from AEMO's Integrated System Plan (ISP, i.e. the 'Step Change' scenario). Risk cost assumptions do not form part of AEMO's ISP assumptions and have been based on Transgrid's analysis.

Table 6-1 Summary of scenarios

Variable / Scenario	Central	Low risk cost scenario	High risk cost scenario
Scenario weighting	1/3	1/3	1/3
Discount rate	7%	7%	7%
VCR ($2023/24)	51,086/MWh	51,086/MWh	51,086/MWh
Network capital costs	Base estimate	Base estimate	Base estimate

24 For further detail on our cost estimating approach refer to section 6 of our Repex Overview Paper submitted with our 2023-28 Revenue Proposal.

25 This VCR is equal to the $49,216 within AEMO's July 2023 2023 Inputs, Assumptions and Scenarios Report inflated to June 2024.

Variable / Scenario	Central	Low risk cost scenario	High risk cost scenario
Avoided unserved energy	Base estimate	Base estimate – 25%	Base estimate + 25%

7. Assessment of credible options

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

7.1 Estimated gross benefits

The table below summarises the present value of the gross benefit estimates for each credible option relative to the base case. The results have been presented separately for each reasonable scenario, and on a weighted basis. The sole benefit included within this assessment is avoided involuntary load shedding.

Table 7-1: NPV of gross economic benefits relative to the base case ($2023/24 m)

Option	Central	Low risk costs scenario	High risk costs scenario	Weighted scenario
Scenario weighting	1/3	1/3	1/3	
Option 1	1392.64	1044.48	1740.80	1392.64

7.2 Estimated costs

The table below summarises the present value of capital costs of each credible option relative to the base case. The results have been presented separately for each reasonable scenario, and on a weighted basis.

Table 7-2: NPV of capital relative to the base case ($2023/24 m)

Option	Central	Low risk costs scenario	High risk costs scenario	Weighted scenario
Scenario weighting	1/3	1/3	1/3	
Option 1	15.23	15.23	15.23	15.23

7.3 Estimated net economic benefits

The net economic benefits calculated as the estimated gross benefits less the estimated costs plus the terminal value. The table below summarises the present value of the net economic benefits for each credible option relative to the base case. The results have been presented separately for each reasonable scenario, and on a weighted basis. The table also shows a ranking of the options, where options with a higher net economic benefit under the weighted scenario are accorded a higher rank.

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 scenario
Scenario weighting	1/3	1/3	1/3	
Option 1	1377.41	1029.25	1725.57	1377.41

7.4 Sensitivity testing

We have considered the robustness of the RIT-T assessment by undertaking a range of sensitivity testing. The purpose of this testing is to examine how the net economic benefit of the credible options changes with respect to changes in key modelling assumptions. The factors tested as part of the sensitivity analysis for this PSCR are:

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

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

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

7.4.1 Optimal timing of the project

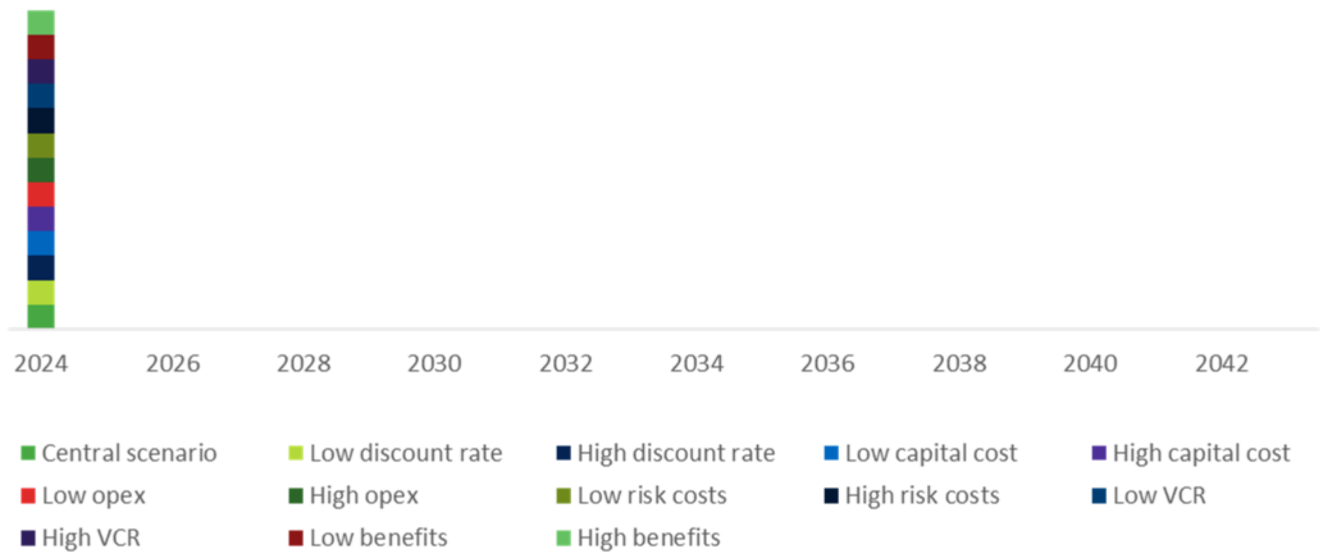
We have estimated the optimal timing for the preferred option. The optimal timing of an investment is the year when the annual benefits (avoided risk costs) from implementing the option become greater than the annualised investment costs. The analysis was undertaken under the central set of assumptions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

The sensitivities we considered are:

- a 25% increase / decrease in capital costs
- a 25% increase / decrease in demand
- a lower discount rate of 3% and a higher discount rate of 10.5%
- a 30% increase / decrease in the VCR
- a 25% increase / decrease in safety, environmental and financial risk costs

Figure 7-1 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 2024 for the balance of sensitivities investigated.

Figure 7-1 Distribution of optimal timing under a range of different key assumptions



7.4.2 Scenario weights

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

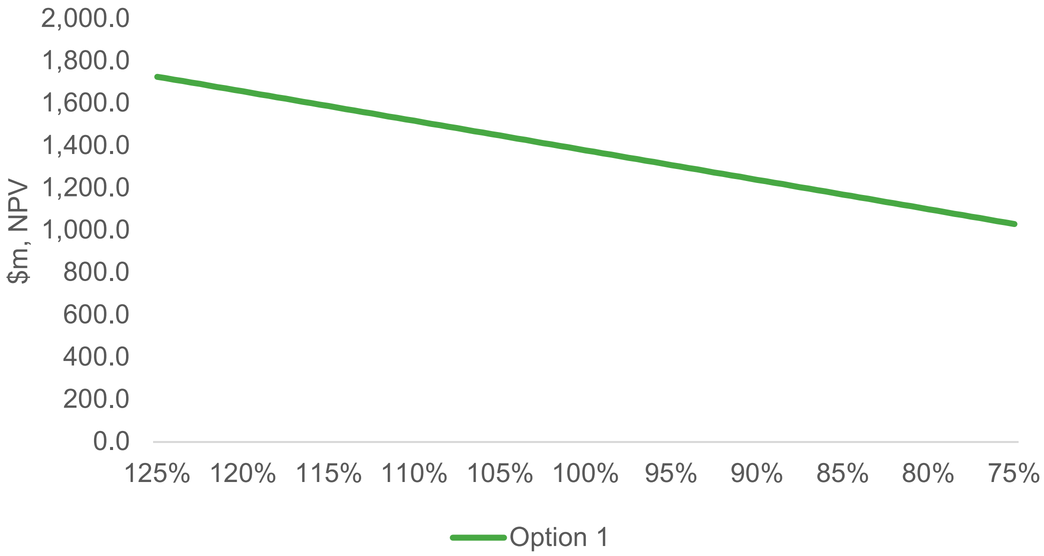
7.4.3 Sensitivity analysis on the VCR

We estimated the net economic benefit of the option by adopting a VCR that is 25% higher (the 'High VCR' scenario) and 25% lower (the 'Low VCR' scenario) than the estimate of VCR adopted in our central scenario. The results of this analysis are presented in the table and figure below.

Table 7-4: NPV of net economic benefits relative to the base case under a lower and higher VCR ($2023/24 m)

Option/scenario	Low VCR	High VCR
Sensitivity	*Central estimate - 25%*	*Central estimate + 25%*
Option 1	1029.25	1725.57

Figure 7-2 NPV of net economic benefits relative to the base case under a lower and higher VCR ($2023/24 m)



We have also undertaken a threshold analysis to identify the change in risk costs that would need to occur for the one credible option to have a zero net benefit. The result of this analysis was that risk costs for Option 1 would need to decrease by more than 99 per cent for the net benefits to become negative. Such a change in risk costs is outside the expected range of costs and, as such, this result of Option 1 being expected to provide positive net benefits is robust to reasonable risk cost sensitivities.

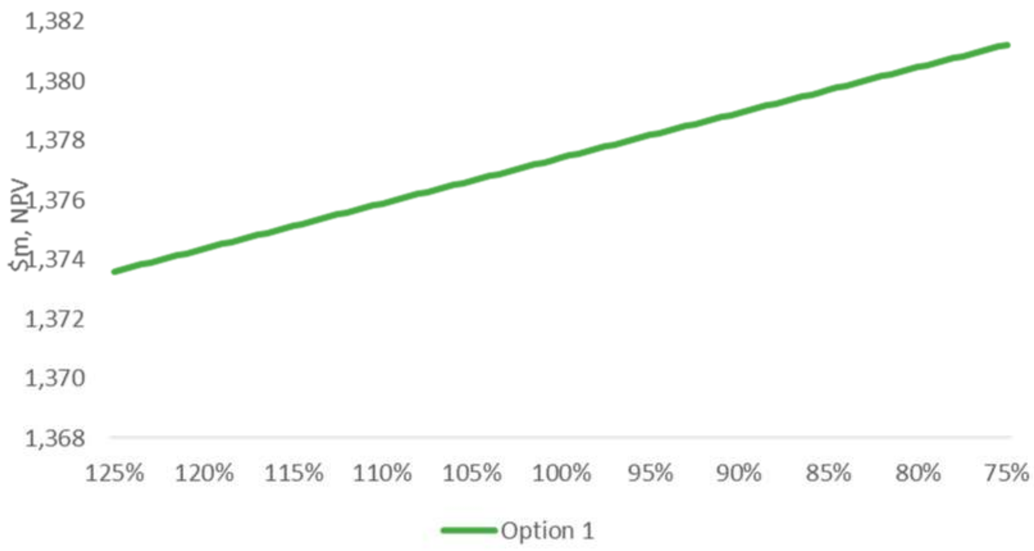
7.4.4 Sensitivity analysis on network capital costs

We estimated the net economic benefit of the option by adopting a capital cost that is 25% higher (the 'High capex' scenario) and 25% lower (the 'Low capex' scenario) than the estimate adopted in our central scenario. The results of this analysis are presented in the table and figure below.

Table 7-5: NPV of net economic benefits relative to the base case under lower and higher capital costs ($2023/24 m)

Option/scenario	Low capex	High capex
Sensitivity	*Central estimate - 25%*	*Central estimate + 25%*
Option 1	1381.22	1373.60

Figure 7-3: NPV of net economic benefits relative to the base case under lower and higher capital costs ($2023/24 m)



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

7.4.5 Sensitivity on the discount rate

We estimated the net economic benefit of the option by adopting a low discount rate of 3.63% which is consistent with the AER's latest final determination for a TNSP (the 'Low discount rate' scenario),[26] and a high discount rate of 10.5% which aligns with the high discount rate scenario in the 2023 IASR (the 'High discount rate' scenario).[27] The results of this analysis are presented in the table and figure below.

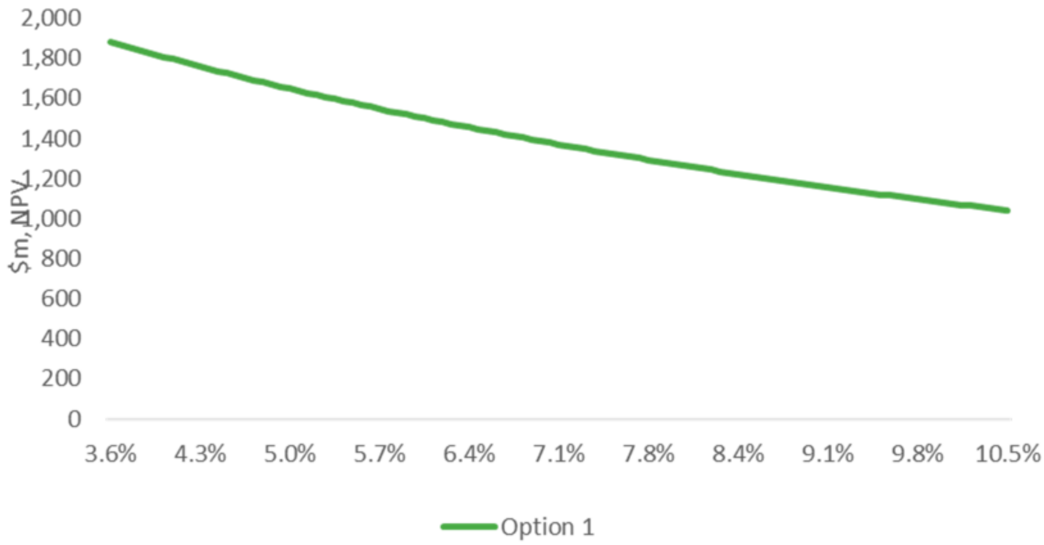
Table 7-6: NPV of net economic benefits relative to the base case under a lower and higher discount rates ($2023/24 m)

Option/scenario	Low discount rate	High discount rate
Sensitivity	*3.63%*	*10.5%*
Option 1	1878.59	1042.50

[26] 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: Final decision | Australian Energy Regulator (AER)https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/transgrid-determination-2023–28/final-decision

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

Figure 7-4 Net economic benefits relative to the base case under a lower and higher discount rates ($2023/24 m)



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

8. Draft conclusion and exemption from preparing a PADR

Option 1 (disconnector replacement program) 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 the disconnector risks to ALARP.

The estimated capital expenditure associated with this option is $21.2 million in $2023/24 over the assessment period. Option 1 is found to have positive net benefits under all scenarios investigated and, on a weighted basis, will deliver $1377.41 million in net economic benefits. The works would be undertaken from 2024 to 2043.

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.

Subject to the identification of additional credible options during the consultation period, publication of a Project Assessment Draft Report (PADR) is not required for this RIT-T as we consider that the conditions in clause 5.16.4(z1) of the NER exempting RIT-T proponents from providing a PADR have been met.

Specifically, production of a PADR is not required because:

- the estimated capital cost of the preferred option is less than $46 million;[28]
- we have identified in this PSCR our preferred option and the reasons for that option, and noted that we will be exempt from publishing the PADR for our preferred option; and
- we consider that the preferred option and any other credible options do not have a material market benefit (other than benefits associated with changes in voluntary load curtailment and involuntary load shedding).

If an additional credible option that could deliver a material market benefit is identified during the consultation period, then we will produce a PADR that includes an NPV assessment of the net economic benefit of each additional credible option.

If no additional credible options with material market benefits are identified during the consultation period, then the next step in this RIT-T 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.[29]

[28] Varied from $43m to $46m based on the AER Final Determination: Cost threshold review, November 2021.
[29] In accordance with NER clause 5.16.4(z2).

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)	A RIT-T proponent must prepare a report (the project specification consultation report), which must include:	–
	(1) a description of the identified need;	2
	(2) 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: (i) the size of load reduction of additional supply; (ii) location; and (iii) operating profile	4[30]
	(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, alterative 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: (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) (v) to the extent practicable, the total indicative capital and operating and maintenance costs.	3 & 5
5.16.4(z1)	A RIT-T proponent is exempt from [preparing a PADR] (paragraphs (j) to (s)) if:	8

[30] Non-network options are considered unlikely to be able to contribute to meeting the identified need of this RIT-T.

	1. the estimated capital cost of the proposed preferred option is less than $35 million[31] (as varied in accordance with a cost threshold determination); 2. the relevant Network Service Provider has identified in its project specification consultation report: (i) its proposed preferred option; (ii) its reasons for the proposed preferred option; and (iii) that its RIT-T project has the benefit of this exemption; 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.	

[31] 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 framework

Summary of methodology

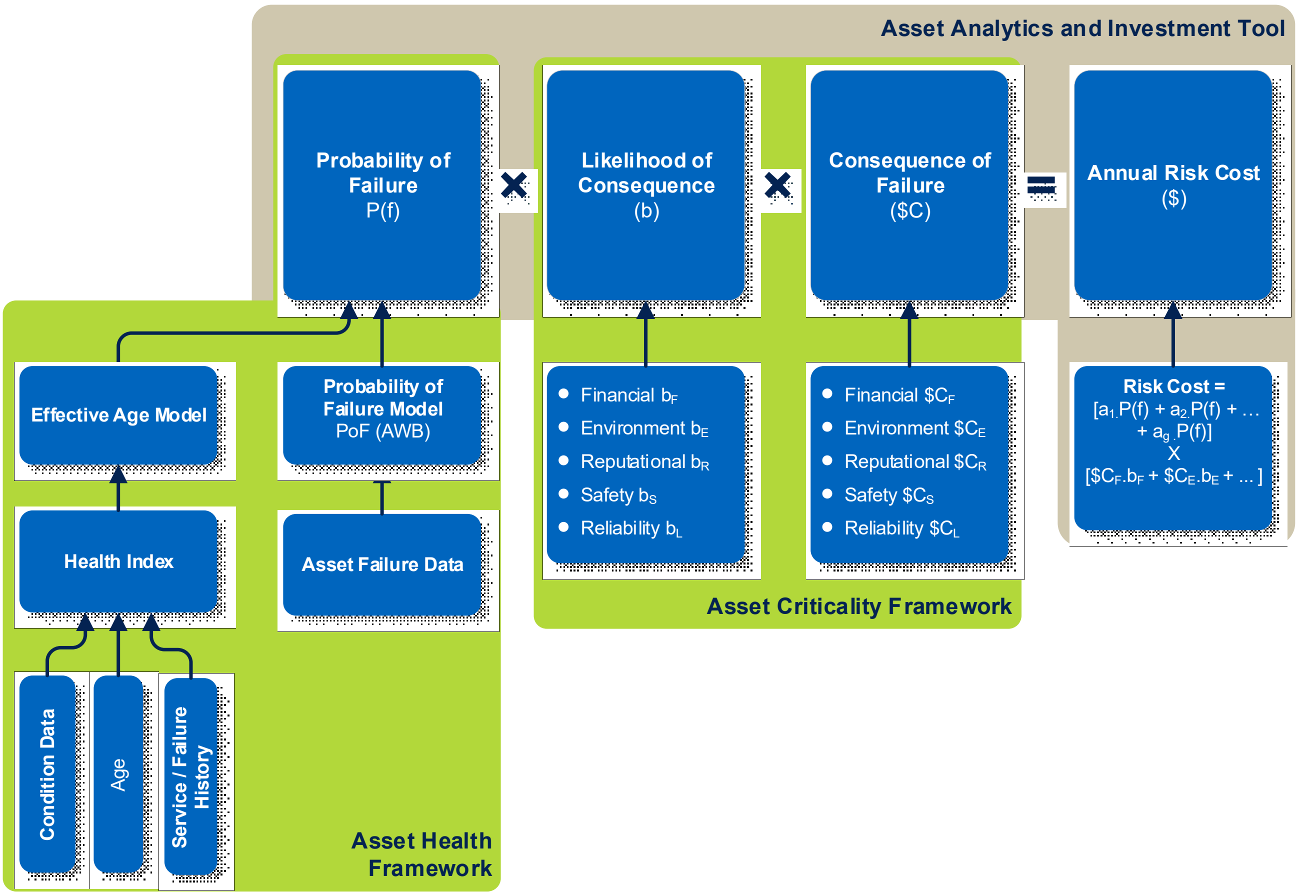
This appendix summarises our network risk assessment methodology that underpins the identified need for this RIT-T. Our risk assessment methodology is aligned with the AER's Asset Replacement Planning guideline[32] and its principles.

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

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

Figure B-1 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



[32] 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:

- safety risk;
- bushfire risk;
- environmental risk;
- reliability risk; and
- financial risk.

The risk categories relevant to this RIT-T are explained in Section 0.

Further details are available in our [Network 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,[33] 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, eg, 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.

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

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

Table B-1 Weibull parameters for asset components

Asset component	Weibull parameters	
	η	β
Disconnectors	67	4.8

Asset criticality

Asset criticality is the relative risk of the consequences of an undesired outcome. Asset criticality considers the severity of the consequences of the asset failure occurring and the likelihood the consequence will eventuate. Our approach to determining these factors for each relevant risk category is set out in our Network Asset Criticality Framework. The analysis leverages data from past events, relevant research / publications and technical insights, to determine an economic value of the impact.

Appendix C Identified ageing disconnectors

The table below details the disconnectors identified by this need and the proposed replacement and refurbishment approach under the preferred solution (Option 1).

Substation Name	Disconnector	Option 1 Replacement / Refurbishment
ARMIDALE	EC00008297	Refurbishment
BERYL	B01309/3	Replacement
BERYL	B01309/5	Replacement
BERYL	B01309/6	Replacement
BERYL	B01309/7	Replacement
BERYL	B01309/8	Replacement
BROKEN HILL	EC00017710	Replacement
CANBERRA	EC00001373	Replacement
CANBERRA	EC00001379	Replacement
COWRA	A01124/2	Replacement
COWRA	A01124/4	Replacement
COWRA	A01124/5	Replacement
COWRA	A01124/6	Replacement
COWRA	A01134/1	Replacement
COWRA	A01134/2	Replacement
COWRA	A01134/3	Replacement
COWRA	A01134/4	Replacement
COWRA	A01134/5	Replacement
COWRA	A01134/6	Replacement
COWRA	A01134/7	Replacement
COWRA	A01134/9	Replacement
COWRA	A01135/2	Replacement
COWRA	A01135/4	Replacement
COWRA	A01135/5	Replacement
COWRA	A01135/6	Replacement
COWRA	A01135/8	Replacement
FORBES	A01202/5	Replacement
FORBES	A01202/7	Replacement
FORBES	A01202/8	Replacement
FORBES	A01203/1	Replacement
FORBES	A01203/2	Replacement
FORBES	A01203/3	Replacement
FORBES	A01203/4	Replacement
FORBES	A01203/5	Replacement
FORBES	A01203/6	Replacement
FORBES	A01203/7	Replacement
FORBES	A01204/2	Replacement
FORBES	A01223/1	Replacement
FORBES	A01223/2	Replacement

Substation Name	Disconnector	Option 1 Replacement / Refurbishment
FORBES	A01223/3	Replacement
FORBES	A01223/4	Replacement
FORBES	A01223/5	Replacement
FORBES	EC00009953	Replacement
MURRUMBURAH	EC00012063	Refurbishment
MURRUMBURAH	EC00012064	Refurbishment
MURRUMBURAH	EC00012065	Refurbishment
MURRUMBURAH	EC00012066	Refurbishment
MURRUMBURAH	EC00012067	Refurbishment
MURRUMBURAH	EC00012068	Refurbishment
SYDNEY EAST	A02025/1	Refurbishment
SYDNEY EAST	A02025/4	Refurbishment
SYDNEY EAST	A02027/2	Refurbishment
SYDNEY EAST	A02027/4	Refurbishment
SYDNEY EAST	A02027/5	Refurbishment
SYDNEY EAST	A02027/6	Refurbishment
SYDNEY EAST	A02027/8	Refurbishment
SYDNEY EAST	A02028/1	Refurbishment
SYDNEY EAST	A02028/3	Refurbishment
SYDNEY EAST	A02028/4	Refurbishment
SYDNEY EAST	A02029/3	Refurbishment
SYDNEY EAST	A02029/7	Refurbishment
SYDNEY EAST	A02029/9	Refurbishment
SYDNEY EAST	A02030/7	Refurbishment
SYDNEY EAST	A02031/1	Refurbishment
SYDNEY EAST	A02031/3	Refurbishment
SYDNEY EAST	A02031/7	Refurbishment
SYDNEY SOUTH	EC00001458	Refurbishment
SYDNEY SOUTH	H70591/1	Replacement
SYDNEY SOUTH	H70599/1	Replacement
SYDNEY SOUTH	H70601/2	Replacement
SYDNEY SOUTH	H70603/1	Replacement
SYDNEY SOUTH	H70613/1	Replacement
SYDNEY SOUTH	H70614/1	Replacement
SYDNEY SOUTH	H70618/1	Replacement
SYDNEY SOUTH	H70619/1	Replacement
SYDNEY SOUTH	H70620/1	Replacement
SYDNEY SOUTH	H70623/1	Replacement
SYDNEY SOUTH	H70628/3	Replacement
SYDNEY SOUTH	H70629/1	Replacement
SYDNEY SOUTH	H70629/2	Replacement
SYDNEY SOUTH	H70630/3	Replacement
SYDNEY SOUTH	H70631/2	Replacement

Substation Name	Disconnector	Option 1 Replacement / Refurbishment
SYDNEY SOUTH	H70632/1	Replacement
SYDNEY SOUTH	H70632/3	Replacement
SYDNEY SOUTH	H70633/1	Replacement
SYDNEY WEST	A03010/6	Replacement
SYDNEY WEST	A03011/1	Replacement
SYDNEY WEST	A03063/3	Replacement
SYDNEY WEST	A03063/4	Replacement
SYDNEY WEST	A03064/1	Replacement
SYDNEY WEST	A03080/5	Replacement
SYDNEY WEST	A03080/7	Replacement
SYDNEY WEST	A03082/1	Replacement
SYDNEY WEST	A03082/3	Replacement
SYDNEY WEST	EC00007668	Refurbishment
TAMWORTH	EC00003047	Refurbishment
TAMWORTH	EC00003051	Refurbishment
TUGGERAH	EC00009225	Refurbishment
TUGGERAH	EC00009226	Refurbishment
TUGGERAH	EC00009227	Refurbishment
TUGGERAH	EC00009247	Replacement
TAREE	A09069/1	Refurbishment
TAREE		Replacement
TAREE	A09069/2	Replacement
TAREE	A09069/6	Replacement
TAREE	A09069/8	Replacement
TAREE	A09069/9	Replacement
TAREE	A09070/1	Replacement
TAREE	A09070/2	Replacement
TAREE	A09070/3	Replacement
TAREE	A09070/7	Replacement
TAREE	A09071/1	Replacement
TAREE	A09071/2	Replacement
TAREE	A09071/3	Replacement
TAREE	A09071/5	Replacement
TAREE	A09072/4	Replacement
TAREE	EC00014254	Replacement
TUMUT	A07248/2	Replacement
TUMUT	A07248/3	Replacement
TUMUT	A07248/4	Replacement
TUMUT	A07248/6	Replacement
TUMUT	A07248/7	Replacement
TUMUT	A07248/8	Replacement
TUMUT	A07248/9	Replacement
TUMUT	A07249/1	Replacement

Substation Name	Disconnector	Option 1 Replacement / Refurbishment
TUMUT	A07249/2	Replacement
TUMUT	A07249/4	Replacement
TUMUT	A07249/5	Replacement
TUMUT	A07249/8	Replacement
TUMUT	A07252/2	Replacement
TUMUT	A07252/3	Replacement
TUMUT	A07252/4	Replacement
TUMUT	A07252/5	Replacement
TUMUT	A07252/6	Replacement
TUMUT	A07252/8	Replacement
TUMUT	A07252/9	Replacement
YANCO	A07440/5	Replacement