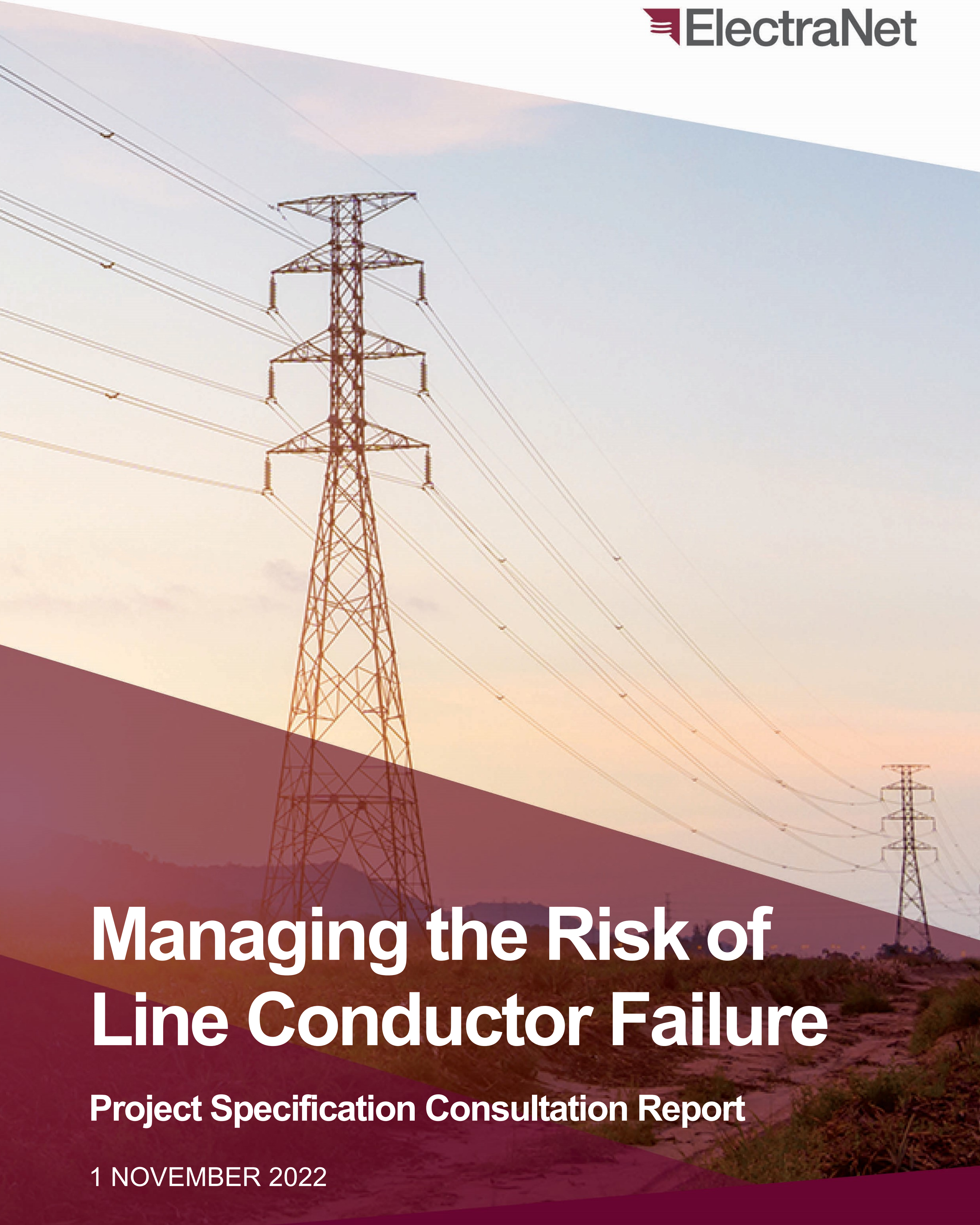


Managing the Risk of Line Conductor Failure

Project Specification Consultation Report

1 NOVEMBER 2022

EXECUTIVE SUMMARY

We are proposing to replace the line conductors on seven 132 kV transmission lines on South Australia's transmission network in the Mid North and Riverland regions to maintain safe and efficient supply to customers.

This Project Specification Consultation Report (PSCR) identifies the need to replace line conductors on seven transmission lines as the most efficient solution to manage the risk of failure of these assets based on their assessed condition.

Line conductors are essential to the task of transmitting electricity. Without them, no power can be transmitted between generators and customers. The line conductors in question for this PSCR are in poor condition and pose a risk to public safety and continuity of customer supply.

The 'identified need' is to efficiently manage the risk of asset failure.

The identified need for this project is to continue to provide electricity transmission services in South Australia at a prudent and efficient cost. Specifically, the identified need for this Regulatory Investment Test for Transmission (RIT-T) is to efficiently manage the risk of failure of line conductors across seven 132 kV transmission lines that are in poor condition and have reached the end of their useful lives. It also allows us to continue to meet the reliability standards of the Electricity Transmission Code at the relevant connection points on the network.

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 mandatory reliability standard, but rather to deliver positive net benefits to customers.

A full cost benefit assessment has been undertaken, comparing the risk cost reduction benefits of line conductor replacement with the cost of a base case 'do nothing' option, together with options considered but not being progressed.

Line conductor replacement is the only credible option.

The analysis has identified that there is only one economically feasible option, which is to replace the end-of-life line conductors on the identified transmission lines.

The estimated capital cost of this option is approximately $25.6 million.

There is no feasible role for network support solutions in addressing the identified need for this RIT-T.

Network support solutions cannot credibly meet the identified need for this RIT-T. This is due to the unique and specific role that the line conductors play in transmitting electricity.

Nevertheless, for completeness and consistent with the requirements of the RIT-T this PSCR sets out the required technical characteristics a network support option would have to meet.

Three different 'scenarios' have been modelled to deal with uncertainty.

We have developed three reasonable scenarios for the economic assessment as shown in Table 1 below:

- a 'central' scenario reflecting our base case set of key assumptions;
- a 'low benefits' scenario – reflecting a pessimistic set of assumptions, which represents a lower bound on potential market benefits that could be realised; and
- a 'high benefits' scenario – reflecting an optimistic set of assumptions, which represents an upper bound on potential market benefits that could be realised.

Table 1 - Summary of the three scenarios

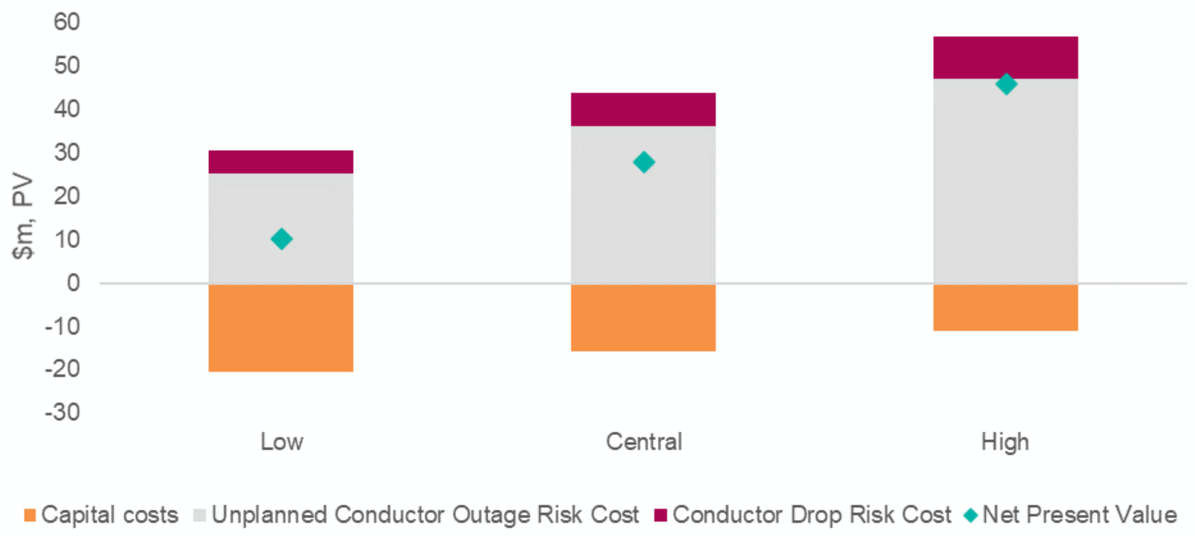
Key variable/parameter	Low benefits scenario	Central scenario	High benefits scenario
Capital costs	130 per cent of base case estimate	Base case estimate	70 per cent of base case estimate
Commercial discount rate[1]	7.5%	5.5%	2.0%
Risk cost of unplanned conductor outage	70 per cent of base case estimates	Base case estimates	130 per cent of base case estimates
Risk cost of conductor drop	70 per cent of base case estimates	Base case estimates	130 per cent of base case estimates

Completing the identified line conductor replacements across seven 132 kV transmission lines within the 2024-2028 regulatory period is the preferred option[2].

The preferred option that has been identified in this assessment for addressing the identified need is Option 1, which is to replace the line conductors across seven 132 kV transmission lines between 2024 and 2028.

Most of the expected benefits are derived from the avoided risk of line conductor drop and unplanned outages, and the reduced time and cost taken to resolve such failures. Other significant benefits are from avoiding increasing additional maintenance costs that will be incurred if the line conductors are not replaced.

Figure 1 - Breakdown of present value gross economic benefits of the preferred option



On a weighted basis (i.e., weighted across the three scenarios investigated), the preferred option is expected to deliver approximately $23.4 million in net market benefits.

[1] Expressed on a real, pre-tax basis

[2] The preferred option is defined as the option that maximises net market benefits under the RIT-T framework.

We have also undertaken a thorough sensitivity testing exercise to understand the robustness of the RIT-T assessment to underlying assumptions about each of the key variables.

In particular, we have tested the optimal timing and the sensitivity of this timing to key variables. Under most sensitivities investigated, we find it optimal for the preferred option to be undertaken as soon as possible and the estimated net market benefits to be robust.

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Glossary

AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
CBL	Conductor Breaking Load
ESCOSA	Essential Services Commission of South Australia
ETC	Electricity Transmission Code
NPV	Net Present Value
NEM	National Electricity Market
NER, Rules	National Electricity Rules
PACR	Project Assessment Conclusions Report
PADR	Project Assessment Draft Report
PSCR	Project Specification Consultation Report
RET	Renewable Energy Target
RIT-T	Regulatory Investment Test for Transmission
TNSP	Transmission Network Service Provider
USE	Unserved Energy
VCR	Value of Customer Reliability

1. Introduction

This Project Specification Consultation Report (PSCR) represents the first step in the application of the Regulatory Investment Test for Transmission (RIT-T) to addressing the risk of line conductor failure on seven 132 kV transmission lines located in the Mid North and Riverland regions of the South Australian transmission network.

This report:

- describes the identified need that we are seeking to address, together with the assumptions used in identifying this need;
- sets out the technical characteristics that a network support option would be required to deliver to address this identified need;
- outlines the credible option that we consider addresses the identified need;
- discusses specific categories of market benefit that, in the case of this RIT-T assessment, are unlikely to be material;
- presents the results of our economic assessment of the credible option and identifies the preferred option and the reasons for the preferred option; and
- sets out our basis for exemption from a Project Assessment Draft Report (PADR).

1.1. Why we consider this RIT-T is necessary

The National Electricity Rules (NER) require the application of the RIT-T to replacement capital expenditure where there are credible options costing more than $7 million.[3]

Accordingly, we have initiated this RIT-T to consult on proposed expenditure related to replacing the transmission line conductors, noting that none of the exemptions listed in NER clause 5.16.3(a) apply.

The credible option discussed in this PSCR has not been foreshadowed in AEMO's Integrated System Plan (ISP) as the works involved do not impact on the main transmission flow paths between the NEM regions.

1.2. Submissions and next steps

We welcome written submissions on this PSCR. Submissions are due on or before Friday, 10 February 2023. Submissions should be emailed to consultation@electranet.com.au.

Submissions will be published on the ElectraNet website. If you do not want your submission to be made publicly available, please clearly specify this at the time of making your submission. Subject to submissions received on this PSCR, a Project Assessment Conclusions Report (PACR) is expected to be published in due course.

Further details in relation to this project can be obtained from:
consultation@electranet.com.au

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[3] NER clause 5.15A.1(c) states that the purpose of the RIT–T is to: identify the credible option that maximises the present value of net economic benefit to all those who produce, consume and transport electricity in the market (the preferred option). For the avoidance of doubt, a preferred option may, in the relevant circumstances, have a negative net economic benefit (that is a net economic cost) to the extent the identified need is for reliability corrective action or the provision of inertia network services required under clause 5.20B.4 or the provision of system strength services required under clause 5.20C.3.

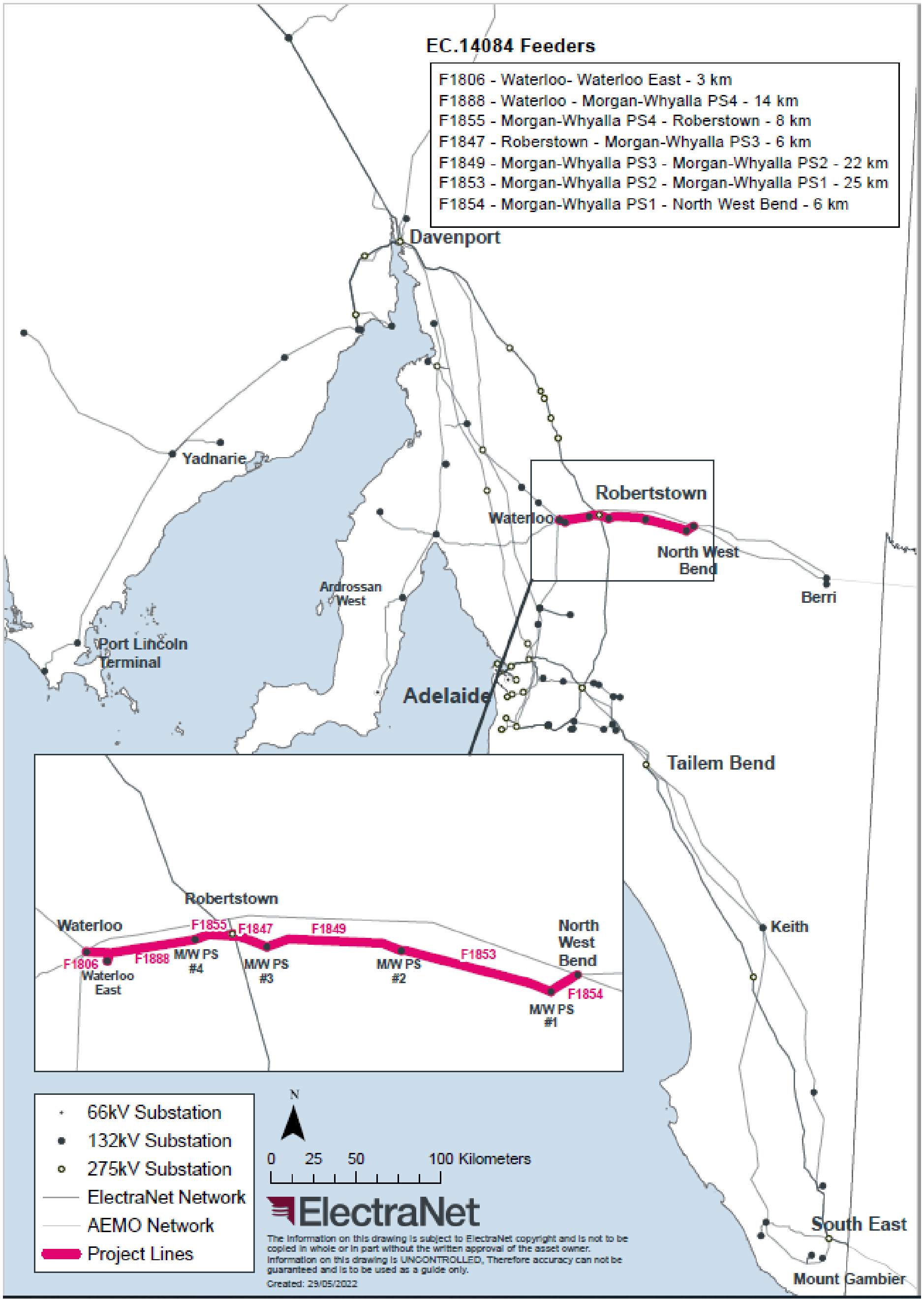
2. The identified need for this RIT-T is to ensure reliable and safe supply of electricity to South Australia

This section outlines the identified need and the assumptions underpinning it. It first provides some background on the identified transmission lines and their role in the wider transmission of electricity in South Australia.

2.1. Background to the identified need

The seven 132 kV transmission lines identified as requiring conductor replacement are located in the Mid North and Riverland regions of South Australia (refer Figure 2).

Figure 2 - Location of the line conductors identified for replacement



The primary role of the line conductors on these transmission lines is to provide electricity to power four SA Water Morgan - Whyalla pump stations that supply water to the local communities and to the cities of Port Pirie, Port Augusta, and Whyalla, located in the upper Mid North and Eyre regions in South Australia. Their secondary role is to provide N-1 line capacity to the North West Bend substation[4] that is a Category 4 connection point under the Electricity Transmission Code (ETC).

The seven transmission lines and line conductor lengths are:

- F1806: Waterloo - Waterloo East - 3 km[5]
- F1888: Waterloo East - Morgan Whyalla PS4 - 14 km
- F1855: Morgan Whyalla PS4 - Robertstown - 8 km
- F1847: Robertstown - Morgan Whyalla PS3 - 6 km
- F1849: Morgan Whyalla PS3 - Morgan Whyalla PS2 - 22 km
- F1853: Morgan Whyalla PS2 - Morgan Whyalla PS1 - 25 km
- F1854: Morgan Whyalla PS1 - North West Bend - 6 km

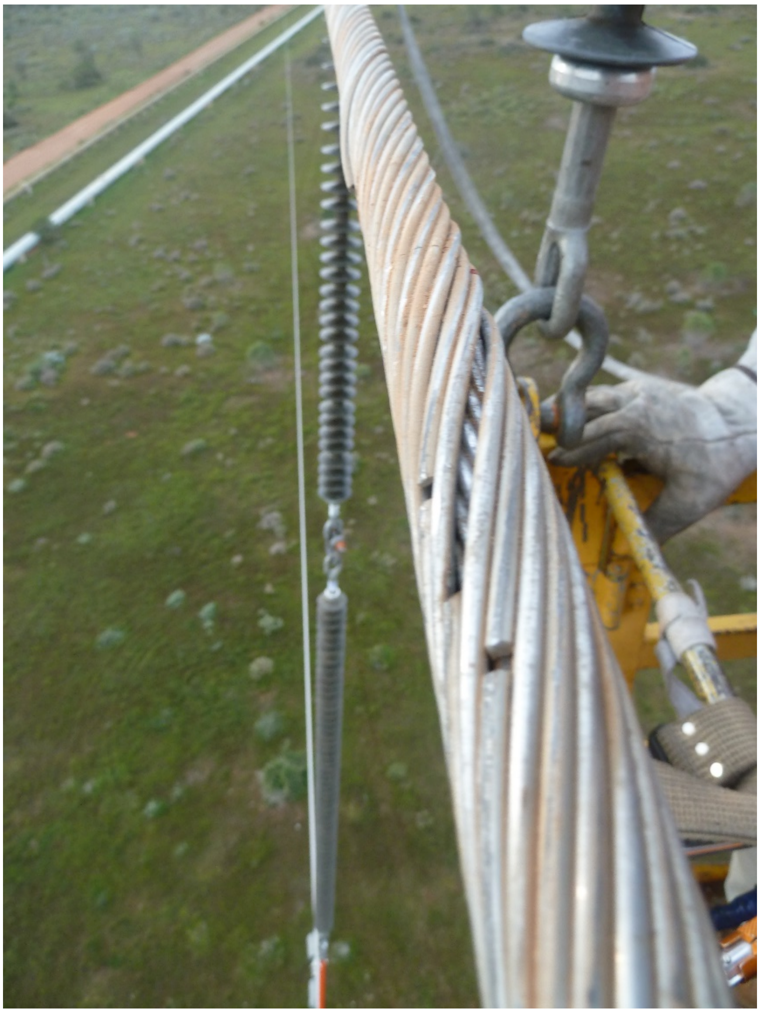
Detailed condition assessment reports completed on the above transmission lines indicate that their line conductors have severe fretting and an excessive number of broken strands (refer Figure 3). This indicates that these conductors are at end of life and are at increased risk of failure.

It is good industry practice to replace the conductor when the remaining tension capacity is less than 80% of its designed capacity (known as Conductor Breaking Load or CBL). All test samples from the above line conductors show remaining tensile strength in a range of 66% to 77% of its CBL.

[4] ESCOSA ETC TC/09.4 24 June 2021, section 2.4 assigns North West Bend Substation as a Category 4 Exit Point, (section 2.8) requiring ElectraNet to provide “N-1” equivalent line capacity for at least 100 percent of the agreed maximum demand.

[5] Excludes built section 1252 on transmission lines F1805 and F1888 as this built section is classified as a negotiated asset

Figure 3 - Transmission Line Conductor with the Morgan-Whyalla pipeline in the background.



The line conductors identified for replacement were all commissioned in 1968 with a design life[6] of 50 years .

If the line conductors in question are not replaced, it is increasingly likely that several will fail with the following four possible consequences:

- loss of supply to one or more of the four SA Water Morgan - Whyalla pump stations, potentially affecting SA Water's ability to supply water to the upper Mid North and Eyre Peninsula regions of South Australia.
- Incurring the higher cost of repairing the transmission line on failure in a reactive fashion.
- risk of fire start from dropped line conductors, with consequent impact on public safety.

[6] It is noted that the AER considers that repex involves replacing an asset or asset component with its modern equivalent where the asset has reached the end of its *economic life*. This takes into account the age, condition, technology and operating environment of an existing asset. We present here the technical / design lives of transmission conductors for context. We note that the assessment of replacing the identified assets, both in the Revenue Proposal and this RIT-T, is consistent with the concept of economic life; ie, the expenditure decision is primarily based on the existing asset's inability to efficiently maintain its service performance requirement.

2.2. Description of the identified need for this RIT-T

The identified need is to manage the risk of failure of line conductors on seven transmission lines efficiently.

We have assessed the condition, and timing for the ultimate replacement of line conductors as part of our ongoing asset management processes. There is an increased likelihood that a number of these line conductors will fail in coming years given their current condition. Failure could result in unplanned customer outages, fire start.

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 mandatory reliability standard, but rather to deliver net benefits to customers.

Nevertheless, the Electricity (General) Regulations (the Regulations) 2012 require that aerial lines (including service lines) must be "operated and maintained to be safe for the electrical service conditions and the physical environment in which they operate."[7]

Further, the Regulations specify, "a system of maintenance must be instituted for aerial lines, their structures and their components, including…managed replacement programs for components approaching the end of their serviceable life. Maintenance programs must be carried out in accordance with the listed standards."[8]

A full cost benefit assessment has been undertaken, comparing the risk cost reduction benefits of asset replacement options with the cost of those options.

2.3. Assumptions underpinning the identified need

This section summarises the key assumptions from the risk cost modelling and other assumptions that underpin the identified need for this RIT-T. Section 6 provides further details on the general modelling approaches applied, including the risk cost modelling framework.

For the purposes of this assessment, the risk cost model focuses on two modes of failure, being:

- Unplanned line conductor outage – where a high priority line conductor defect triggers an urgent unplanned response, impacting on supply, and
- Line conductor drop – where the line conductor fails and falls to the ground.

Each failure mode has different characteristics and consequential likelihoods of occurring, as detailed in the sections below.

2.3.1. The probability of failure

Operation of a transmission line with a reduced cross-sectional area caused by broken strands leads to overheating. This leads to aluminium and steel strands annealing, reducing the tensile strength of the conductor until it fails.

The analysis presented here is based on asset condition assessment of the identified lines.

The modelled benefit of the project is that it will prevent future failures that would otherwise occur. The rate at which these failures are expected to occur in the base case is estimated based on the rate at which minor defects deteriorate to become more serious defects and

7 Electricity (General) Regulations 2012 (SA) s 48

8 Electricity (General) Regulations 2012 (SA) Schedule 1.

the probability that, when this happens, the conductor will require urgent repair, and thus an unplanned outage, and might drop.

The rate at which this deterioration is projected to occur was modelled in the same way as in the previous Eyre Peninsula RIT-T.[9] This was applied to the number of defects that had been identified when the project was first analysed to produce a conservative estimate of the expected number of failures in the base case.

The probability of failure curves, which are the same for each of the identified lines, are shown below as Figure 4, relating to unplanned outages and Figure 5, relating to conductor drops.

Figure 4 - Probability of Failure for an Unplanned Outage

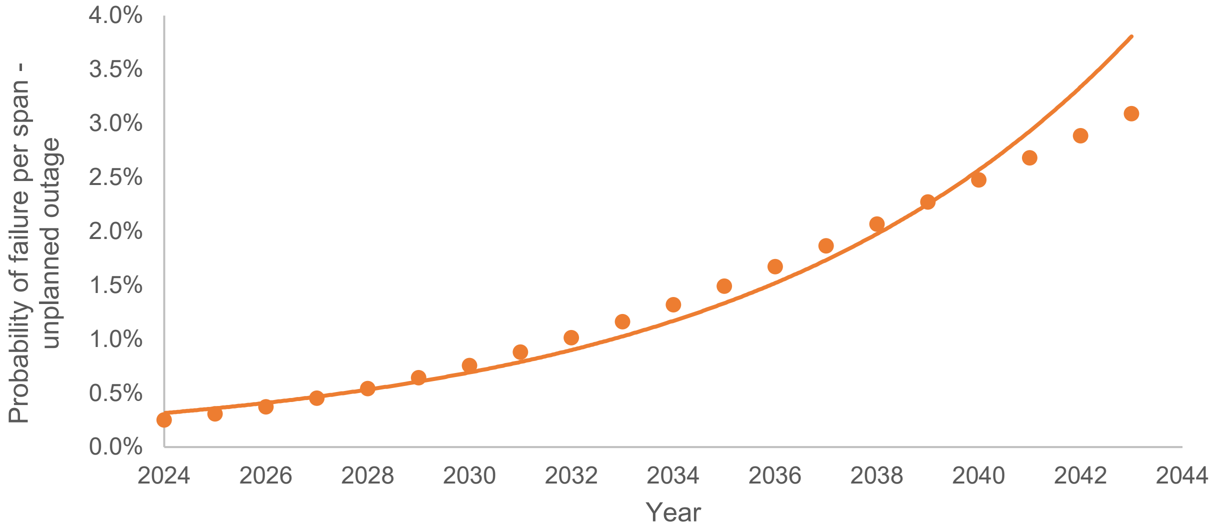
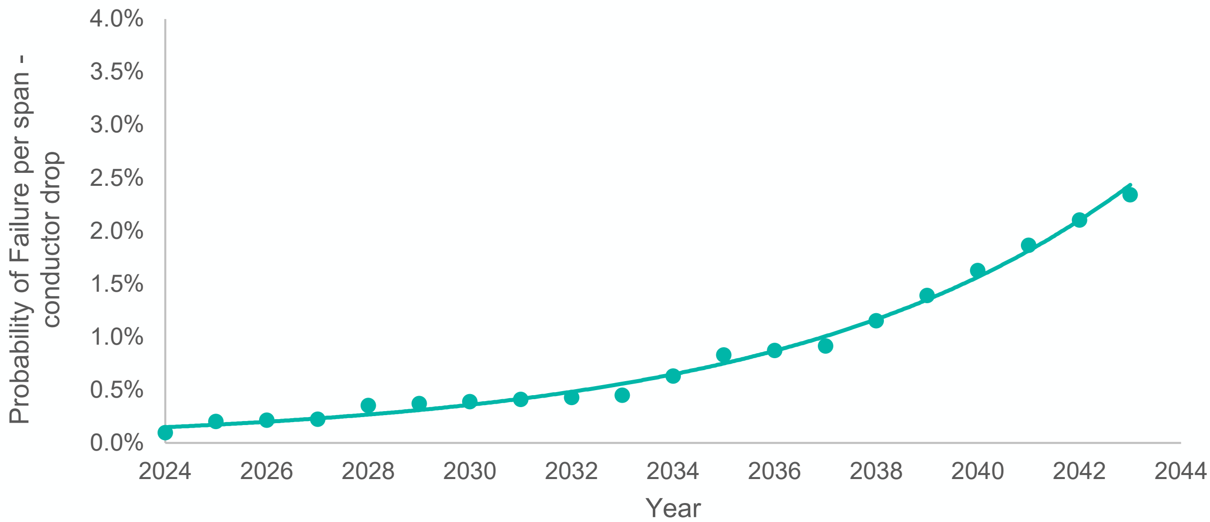


Figure 5 - Probability of failure for Conductor Drop



[9] https://www.electranet.com.au/what-we-do/network/regulatory-investment-test/

2.3.2. The adverse effects of line conductor failure

The potential consequences relating to the conductors on the seven transmission lines in question are listed in section 2.1 above. Broadly, they include:

- unserved energy to electricity customers while a failed conductor is restored or replaced;
- higher corrective maintenance costs associated with having to repair transmission line conductors in an unplanned fashion; and
- potential fire start.

2.3.3. The likelihood and cost of line conductor failure

Our risk cost model analyses the consequences listed in section 2.3.2. It estimates the 'likelihood of consequence' (LoC) and 'cost of consequence' (CoC) of line conductor failures.

Outage duration is based on the typical time to repair a line conductor following a failure.

Outage cost is based on the Australian Energy Regulator's (AER) estimated Value of Customer Reliability (VCR) of a mixed load for South Australia when the connection point is not directly connected to a customer. When the connection point is directly connected to a customer the VCR of a direct connect load has been applied. All loads are based on the average load from 2019-20 which is representative of current loads.

Several additional adverse effects have not been captured in our risk cost modelling but are expected to further increase the net market benefits associated with Option 1. These include:

- Loss of supply of water to customers
- Loss of generation from solar generation at SA Water sites
- A simultaneous failure of line protection when a live line conductor falls to the ground causing a fire start

Chapter 7 demonstrates these additional benefits would not change the preferred option and so they are not considered material in the context of this RIT-T.

3. Potential credible options to address the identified need

There is only one economically feasible option, which is to replace the identified sections of line conductor.

We have however investigated different timings for this work in order to determine the optimal timing. This assessment is presented in section 7.4.

The option is considered to be technically and economically feasible and able to be implemented in sufficient time to meet the identified need.[10]

3.1. Option 1 – Planned replacement of transmission line conductors by 2028

Option 1 involves replacing the line conductors and associated hardware on the seven transmission lines identified in section 2.1.

Replacing these line conductors and associated hardware is planned to occur between 2023 and 2026. Significant landholder engagement will be required to manage easement access and avoid periods of cropping and other seasonal agricultural activities.

The estimated capital cost of this option is approximately $25.6 million.

There is no change in routine maintenance when the assets are replaced under Option 1 compared to the base case.

The estimated construction time is approximately 3 years. We estimate that all line conductors could be replaced and commissioned by 2026 under this option.

3.2. Options considered but not progressed

We have also considered whether there are other credible options that would meet the identified need.

Total line replacement

One conceivable option would be to replace the entire transmission lines, as opposed to just the line conductor. However, the capital cost of this is expected to be in the order of $57.7m and would require an expansion of the existing easements to enable the new lines to be constructed before the old lines are decommissioned. This would be significantly more costly than the option outlined above with no additional benefits.

In addition, the condition of other transmission line components is such that they do not require replacing based on their asset condition. Replacing the line conductors is expected to extend the overall life of the transmission lines by 35 years, increasing the utilisation of the other components of the lines in question.

For these two reasons replacing the lines in question entirely is not economically feasible.

Abandon transmission line and use generation support

Another conceivable option, which is a non-network option, would be to consider local generation support at each of the four SA Water pump stations and retire the transmission lines in question.

While this may provide the electricity supply for the individual pump stations it would be substantially more expensive than replacing the conductors on the lines in question. The non-network solution at North West Bend would need to cater for the full range of the demand

[10] In accordance with those identified in section 3.2.

that includes the maximum positive demand and the maximum negative demand (from onsite solar PV output).

3.3. There is not expected to be a material inter-network impact

We have considered whether the credible option will have a material inter-regional impact.[11].

By reference to AEMO's screening test for an inter-network impact[12], a material inter-regional impact arises if the option:

- involves a series capacitor or modification near an existing series capacitor;
- is expected to result in a change in power transfer capability between South Australia and neighbouring transmission networks; or
- is expected to increase fault levels at any substation in another TNSP's network.

None of these criteria are satisfied for the project discussed here. Therefore, ElectraNet does not consider there are any associated material inter-network impacts.

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11 In accordance with NER clause 5.16.4(b)(6)(ii).

12 AEMO's suggested screening test for a material inter-network impact is set out in Appendix 3 of the Inter-Regional Planning Committee's Final Determination: Criteria for Assessing Material Inter-Network Impact of Transmission Augmentations, Version 1.3, October 2004.

4. Required technical characteristics of network support options

This section sets out the required technical characteristics for a network support option for completeness, consistent with the requirements of the RIT-T.

4.1. Required technical characteristics for a network support option

A network support option that avoids replacement of transmission line conductors would need to be able to provide generation support equal to the maximum positive and negative demand at each of the connected substations.

We estimate that the following substations are likely to incur unserved energy and/or require generation support following the failure of the transmission lines.

- North West Bend substation
- Morgan-Whyalla Pump Station 1
- Morgan-Whyalla Pump Station 2
- Morgan-Whyalla Pump Station 3
- Morgan-Whyalla Pump Station 4

The maximum positive and negative demand for these substations ranges from 27.2 MW and (12.6) MW respectively.

A network support option would be required to be able to meet or offset these loads in full on a continuous basis for the time taken to repair the failed line conductor.

Any network support solution seeking to remove the need for any of the affected transmission lines would also need to ensure ongoing compliance with the applicable reliability standards in accordance with the ETC and must be able to cater for the full range of the maximum positive and negative demand.

While network support options involving generation may be technically possible, such a solution at the scale required is unlikely to be economically feasible.

5. Materiality of market benefits for this RIT-T assessment

The section outlines the categories of market benefits prescribed in the NER and whether they are considered material for this RIT-T.[13]

The bulk of the benefits associated with the preferred option are captured in the expected costs avoided by the option (i.e., the avoided expected costs compared to the base case). These include avoided risk costs as described above.

Of these avoided costs only unserved energy due to involuntary load shedding is considered a market benefit category under the NER.

5.1. Avoided involuntary load shedding is the only relevant market benefit

We consider that the only relevant market benefit for this RIT-T relates to changes in involuntary load shedding. The expected unserved energy under the base case, which is avoided under the preferred option, has been estimated as part of our risk cost modelling.

The benefit associated with the reduction in unserved energy is valued using VCR, expressed in $/MWh. The VCR is the AER's estimate of the value customers place on having reliable electricity supplies. The risk cost modelling has applied VCR values sourced from the AER's 2021 Value of Customer Reliability Annual Adjustment,[14] of $31,440/MWh for residential loads for South Australia, and a VCR of $10,930/MWh for SA Water pumping stations.

5.2. Market benefits relating to the wholesale market are not material

The AER has recognised that a number of classes of market benefits will not be material in a RIT-T assessment if the credible options considered will not have an impact on the wholesale market. In this case the impacts do not need to be estimated.[15]

The preferred option would not affect network constraints between competing generating centres so it would not change dispatch outcomes or wholesale market prices.

Therefore, we consider the following classes of market benefits to be immaterial 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 for ElectraNet (since there will be no deferral of generation investment);
- changes in ancillary services costs;
- competition benefits; and
- Renewable Energy Target (RET) penalties.

[13] The NER requires that all categories of market benefit identified in relation to the RIT-T are included in the RIT-T assessment, unless the TNSP can demonstrate that a specific category (or categories) is unlikely to be material in relation to the RIT-T assessment for a specific option – NER clause 5.16.2(c)(6). Under NER clause 5.16.4(b)(6)(iii), the PSCR should set out the classes of market benefit that the RIT-T proponent considers are not likely to be material for a particular RIT-T assessment.

[14] AER, *2021 VCR Annual Adjustment*, December 2021, p. 2.

[15] AER, *Regulatory Investment Test for Transmission Application Guidelines*, August 2020, p. 29.

5.3. Other classes of market benefits are not expected to be material

In addition to the classes of market benefits listed above, NER clause 5.16.1(c)(4) requires us to consider the following classes of market benefits in relation to each credible option:

- differences in the timing of transmission investment;
- option value; and
- changes in network losses.

We consider that none of these are material for this RIT-T assessment for the reasons set out in Table 2.

Table 2 - Reasons why non-wholesale market benefit categories are considered immaterial

Market benefit category	Reason(s) why it is considered immaterial
Differences in the timing of transmission investment	The preferred option does not affect the timing of other unrelated transmission investments (i.e. transmission investments based on a need that falls outside the scope of that described in section 2). Consequently, the market benefits associated with differences in the timing of unrelated transmission investment are not material to the RIT-T assessment.
Option value	The AER has stated that option value is likely to arise where there is uncertainty regarding future outcomes, the information that is available in the future is likely to change and the credible options considered by the TNSP are sufficiently flexible to respond to that change.[16] None of these conditions apply to the present assessment. The AER has also stated the 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. Changes in future demand levels are not relevant for this RIT-T since the need for and timing of the required investment is being driven by asset condition rather than future demand growth. As a result, it is not relevant to consider different future demand scenarios in undertaking the RIT-T analysis.
Changes in network losses	Given the preferred option maintains the current network capacity at the same location, there are not expected to be any differences in network losses.

[16] AER, *Regulatory Investment Test for Transmission Application Guidelines*, August 2020, p. 52.

6. Description of the modelling methodologies applied

This section outlines the methodologies and assumptions we have applied to undertake this RIT-T assessment.

6.1. Overview of the risk cost modelling framework

We have applied an asset 'risk cost' evaluation framework to quantify the risk cost reduction associated with replacing the identified line conductors.

The 'risk cost reduction' has been calculated as the product of:

- Probability of Failure, which is the probability of a failure occurring based on asset failure history information and industry data;
- Likelihood of Consequence, which is the likelihood of an adverse consequence of the failure event based on historical information and statistical factors; and
- Cost of Consequence, which is the estimated cost of the adverse consequence.

These three variables allow the expected risk cost reduction benefit to be quantified and an assessment against the cost of the project to be undertaken. The risk cost reduction benefit is the difference between risk costs incurred under the base case and the preferred option.

The approach we apply to quantifying risk was presented as part of our Revenue Proposal for the 2024-2028 regulatory control period. In its Draft Decision on that proposal, the AER found it to be consistent with good industry practice and to generally reflect reasonable inputs and assumptions.[17]

More detail on the key inputs and assumptions made for individual asset risk cost evaluations can be found in ElectraNet's asset risk cost modelling guideline.[18]

6.2. The discount rate and assessment period

The RIT-T analysis has been undertaken over a 20-year period from 2024 to 2043. This considers the size, complexity and expected life of each option to provide a reasonable indication of its cost.

We have adopted a real, pre-tax discount rate of 5.5 percent as the central assumption for the analysis presented in this report, consistent with AEMO's most recent Inputs, Assumptions and Scenarios Report – July 2021.[19] We consider that this is a reasonable contemporary approximation of a 'commercial' discount rate (a different concept to a regulatory WACC), consistent with the RIT-T.

The RIT-T requires that sensitivity testing be conducted on the discount rate and that the discount rate scenarios from AEMO's ISP Inputs Assumptions and Scenarios Report should be applied.[20]

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17 AER, *ElectraNet transmission determination 2023 to 2028*, Draft Decision, Attachment 5 – Capital expenditure, September 2022

18 Available at https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/electranet-determination-2018-23/proposal#step-50979.

19 AER, *Regulatory Investment Test for Transmission*, August 2020 p. 6 and AEMO*, Inputs, Assumptions and Scenarios Report*, July 2021, p. 104.

20 AER, *Regulatory Investment Test for Transmission*, August 2020 p. 6.

We have therefore tested the sensitivity of the results to changes in this discount rate assumption, and specifically to the adoption of a lower bound discount rate of 2.0 percent, and an upper bound discount rate of 7.5 percent.[21]

6.3. Description of reasonable scenarios

A RIT-T analysis is required to incorporate a number of different reasonable scenarios, which are used to estimate expected net market benefits. The number and choice of reasonable scenarios must be appropriate to the credible options under consideration.

In a market benefit driven RIT-T such as this, the choice of reasonable scenarios must reflect any variables or parameters that are likely to affect the ranking of the credible options, or whether the net economic benefits of any of the credible options is positive or negative.[22]

We have developed three scenarios for this RIT-T assessment:

- a 'central' scenario reflecting our base set of key assumptions;
- a 'low benefits' scenario – reflecting a more extreme pessimistic set of assumptions, which represents a lower bound on potential market benefits that could be realised; and
- a 'high benefits' scenario – reflecting a more extreme optimistic set of assumptions, which represents an upper bound on potential market benefits that could be realised.

Table 3 summarises the key assumptions making up each scenario.

Given that the low and high benefits scenarios are more unlikely to occur the scenarios have been weighted accordingly; 25% - low benefits scenario, 50% - central benefits scenario, and 25% - high benefits scenario.[23]

Table 3 - Summary of the three scenarios

Key variable/parameter	Low benefits scenario	Central scenario	High benefits scenario
Capital costs	130 per cent of base case estimate	Base case estimate	70 per cent of base case estimate
Commercial discount rate[24]	7.5%	5.5%	2.0%
Risk cost of unplanned conductor outage	70 per cent of base case estimates	Base case estimates	130 per cent of base case estimates
Risk cost of conductor drop	70 per cent of base case estimates	Base case estimates	130 per cent of base case estimates

[21] AEMO, *Inputs, Assumptions and Scenarios Report*, July 2021, p. 104.

[22] AER, *Regulatory Investment Test for Transmission*, August 2020, version 1, paragraph 16, p. 7.

[23] In accordance with paragraph 4(a) of the RIT-T.

[24] Expressed on a real, pre-tax basis

7. Assessment of the credible options

This section outlines the assessment we have undertaken of the credible network option. The assessment compares the option against a base case 'do nothing' option.

7.1. Gross benefits for each credible option

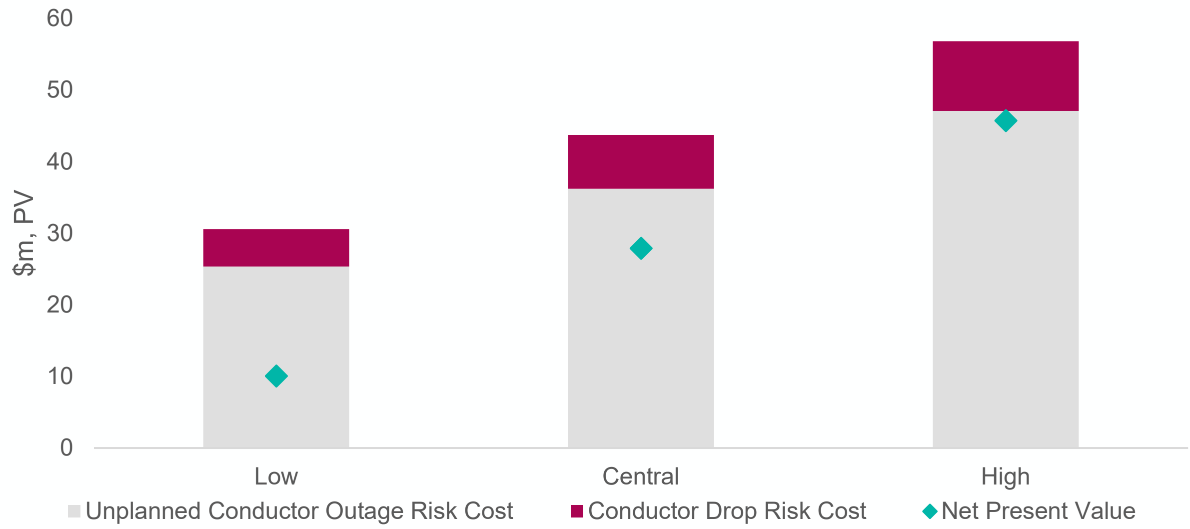
The table below summarises the gross benefit estimated for the preferred option (Option 1) relative to the 'do nothing' base case in present value terms. The gross market benefit has been calculated for each of the three scenarios outlined in Table 4.

Table 4 - Estimated gross market benefit for each option, PV $m

Option	Low benefits scenario	Central scenario	High benefits scenario
Option 1 – Planned replacement of line conductors by 2028	30.6	43.7	56.8

Figure 6 below provides a breakdown of benefits. It shows that the benefits are derived from the avoided risk of line conductor failure and the reduced time taken to resolve such failures.

Figure 6 - Breakdown of present value gross economic benefits of the preferred option



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7.2. Estimated costs for each credible option

Table 5 summarises the capital costs of the preferred option, relative to the base case, in present value terms for the different scenarios as described in Table 3.

Table 5 - Estimated capital cost for each option, PV $m

Option	Low benefits scenario	Central scenario	High benefits scenario
Option 1 – Planned replacement of line conductors by 2028	-20.6	-15.8	-11.1

7.3. Net present value assessment outcomes

Table 6 summarises the net market benefit for Option 1 across the three scenarios, as well as on a weighted basis. The net market benefit is the gross benefit (as set out in section 8.1) minus the cost (as outlined in section 8.2), all expressed in present value terms.

The table demonstrates that Option 1 provides a strong expected net economic benefit on a probability-weighted basis in all scenarios.

Table 6 - Estimated net market benefit for each option, NPV $m

Option	Low benefits scenario	Central scenario	High benefits scenario	Weighted
Option 1 – Planned replacement of line conductors by 2028	10.0	27.9	45.8	23.4

We have been conservative in our approach by not including the additional benefits of this option discussed in section 3.3.

7.4. Sensitivity testing

We have undertaken a thorough sensitivity testing exercise to understand the robustness of the RIT-T assessment to underlying assumptions about key variables.

In particular, we have tested the optimal timing of the project, and the sensitivity of this timing to key variables. We have then tested the sensitivity of the total net market benefit to variations in the key factors underlying the assessment, such as for example the sensitivity of the project to increases in capital costs (all sensitivities tested are presented in Figure 7).

7.4.1. Sensitivity testing of the assumed optimal timing for the credible option

We have estimated the optimal timing for Option 1 based when the expected NPV is maximised. This process was undertaken for both the central set of assumptions and also a range of alternative assumptions for key variables.

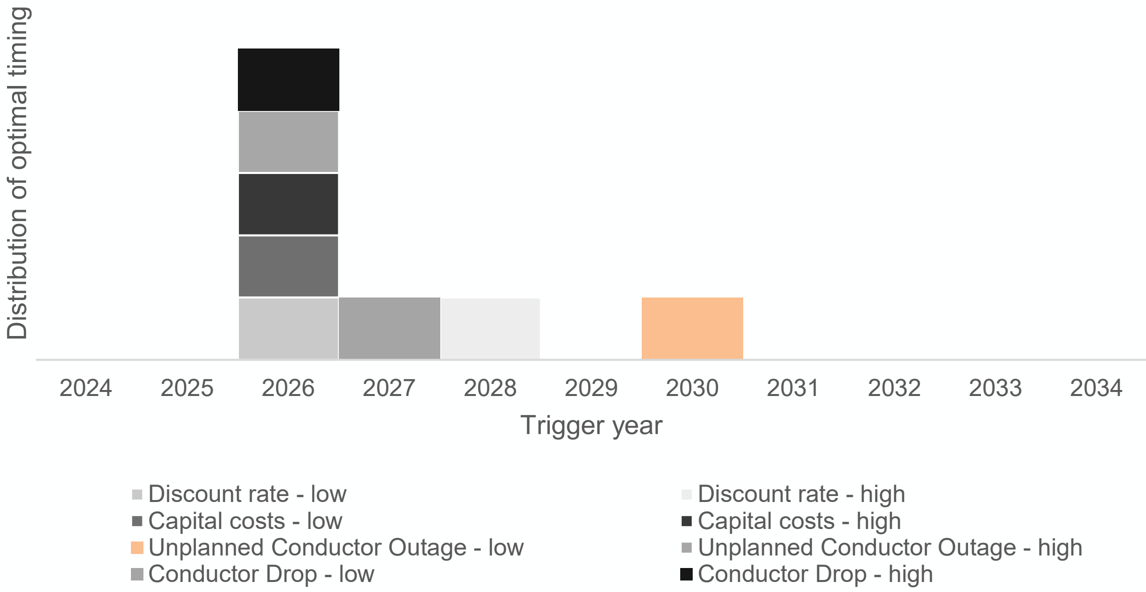
Figure 7 shows the impact on the optimal year to complete the program, under a range of alternative assumptions.

Specifically, it shows, for each sensitivity, the year that results in the highest expected net market benefits. For each sensitivity all other inputs are the same as in the central case.

The optimal completion date is found to be in the year 2026, within the 2024-2028 regulatory period. This indicates that benefits are maximised for a significant majority of the sensitivities investigated if the project is delivered within this time. The exception to this is for the 'Unplanned line conductor outage – low' sensitivity (shown in Figure 7 by the non-grey bars):

This sensitivity delays the optimal timing of the investment as it reduces the benefits that are accrued relatively early in the modelling period. However, as the large majority of sensitivities indicate that the optimal timing is to commence within the 2024-2028 regulatory period, we consider that the investment should proceed to be completed within the 2024-2028 regulatory period.

Figure 7 – Optimal timing of project under a range of different sensitivities



7.4.2. Sensitivity of the overall net market benefit

We have also reviewed the consequences for the preferred option of 'getting it wrong' if the key underlying input assumptions are not accurate.

The four figures in figure 8 below illustrate the estimated net market benefits for each option if the six separate key assumptions in the central scenario are varied individually. Importantly, for all sensitivity tests shown below, the estimated net market benefit of Option 1 is found to be strongly positive.

Table 7 demonstrates the 'threshold' values for each of the key assumptions, i.e., how much would each key assumption need to be changed by for Option 1 to no longer have positive net market benefits.

Figure 8 - Sensitivity testing of the NPV of net market benefits

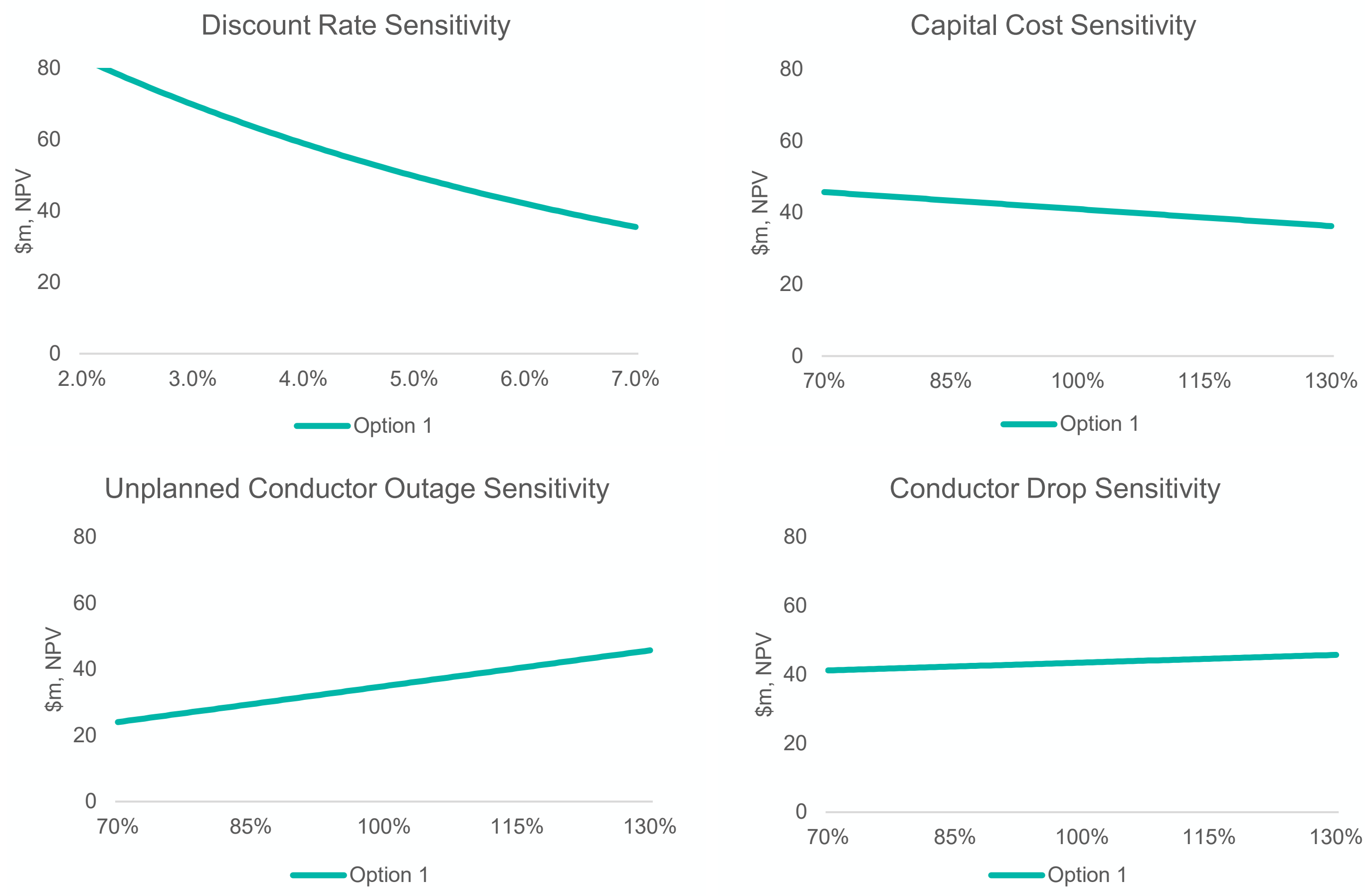


Table 7 - Threshold values for preferred option to no longer have positive net market benefits

Key variable/parameter	Threshold value
Capital cost	414% of central estimate
Discount rate	29% of rate assumed in central scenario
Unplanned Conductor Outage	-97% of central estimate
Conductor Drop	-469% of central estimate

ElectraNet does not consider that any of these threshold values can be reasonably expected and, thus, considers that the expected net market benefits have been demonstrated to be robust to a range of alternate input assumptions.

While we find that the results are most sensitive to the underlying capital costs, we consider that the amount by which costs would need to be increased for there to be negative expected benefits is highly unlikely since these costs have recently been reviewed and considered to be estimated at a higher level of accuracy than +/- 30 per cent.

8. Draft conclusion and exemption from preparing a Project Assessment Draft Report

The preferred option that has been identified in this assessment for addressing the identified need, as detailed in section 7, is Option 1, i.e. replacing line conductor by 2026. This option is described in section 3 and is estimated to have a capital cost of $25.6 million.

Option 1 is the preferred option in accordance with NER clause 5.16.2(c) because it is the credible option that maximises the net present value of the net economic benefit to all those who produce, consume and transport electricity in the market.

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

- if the estimated capital cost of the preferred option is less than $46 million;
- if the TNSP identifies in its PSCR its proposed preferred option, together with its reasons for the preferred option and notes that the proposed investment has the benefit of the clause 5.16.4(z1) exemption; and
- if the TNSP considers that the proposed preferred option and any other credible options in respect of the identified need will not have a material market benefit for the classes of market benefit specified in clause 5.16.2(c)(4), except for market benefits arising from changes in voluntary and involuntary load shedding.

We consider that this assessment is exempt from the requirement for a PADR under NER clause 5.16.4(z1) based on meeting each of the criteria above.

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

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

Should we conclude that no additional credible options were identified during the consultation period, we intend to produce a PACR that addresses all submissions received during the consultation period including any issues in relation to the proposed preferred option.[25]

25 In accordance with NER clause 5.16.4(z2).


City West Substation

Appendices

Appendix A Compliance Checklist

This section sets out a compliance checklist which demonstrates the compliance of this PSCR with the requirements of clause 5.16.4(b) of the NER version 183.

Rules clause	Summary of requirements	Relevant section(s) in PSCR
5.16.4 (b)	A RIT-T proponent must prepare a report (the project specification consultation report), which must include:	–
	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: the size of load reduction of additional supply; location; and operating profile;	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;	1.1
	a description of all credible options of which the RIT-T proponent is aware that address the identified need, which may include, without limitation, alterative transmission options, interconnectors, generation, demand side management, market network services or other network options;	3
	for each credible option identified in accordance with subparagraph (5), information about: the technical characteristics of the credible option; whether the credible option is reasonably likely to have a material inter-network impact; the classes of market benefits that the RIT-T proponent considers are likely not to be material in accordance with clause 5.16.2(b)(6), together with reasons of why the RIT-T proponent considers that these classes of market benefit are not likely to be material; the estimated construction timetable and commissioning date; and to the extent practicable, the total indicative capital and operating and maintenance costs.	3 & 5

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Rules clause	Summary of requirements	Relevant section(s) in PSCR
5.16.4(z1)	A RIT-T proponent is exempt from paragraphs (j) to (s) if: 1. the estimated capital cost of the proposed preferred option is less than $46 million (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.	8

Appendix B Definitions

All laws, regulations, orders, licences, codes, determinations and other regulatory instruments (other than the NER) which apply to Registered Participants from time to time, including those applicable in each participating jurisdiction as listed below, to the extent that they regulate or contain terms and conditions relating to access to a network, connection to a network, the provision of network services, network service price or augmentation of a network.

Definitions	
AEMO	Australian Energy Market Operator
Base case	A situation in which no option is implemented by, or on behalf of the transmission network service provider.
Commercially feasible	An option is commercially feasible if a reasonable and objective operator, acting rationally in accordance with the requirements of the RIT-T, would be prepared to develop or provide the option in isolation of any substitute options. This is taken to be synonymous with 'economically feasible'.
Costs	Costs are the present value of the direct costs of a credible option.
Credible option	A credible option is an option (or group of options) that: address the identified need; is (or are) commercially and technically feasible; and can be implemented in sufficient time to meet the identified need.
Economically feasible	An option is likely to be economically feasible where its estimated costs are comparable to other credible options which address the identified need. One important exception to this Rules guidance applies where it is expected that a credible option or options are likely to deliver materially higher market benefits. In these circumstances the option may be "economically feasible" despite the higher expected cost. This is taken to be synonymous with 'commercially feasible'.
Identified need	The reason why the Transmission Network Service Provider proposes that a particular investment be undertaken in respect of its transmission network.

Definitions	
Market benefit	Market benefit must be: the present value of the benefits of a credible option calculated by: comparing, for each relevant reasonable scenario: the state of the world with the credible option in place to the state of the world in the base case, And weighting the benefits derived in sub-paragraph (i) by the probability of each relevant reasonable scenario occurring. a benefit to those who consume, produce and transport electricity in the market, that is, the change in producer plus consumer surplus.
Net market benefit	Net market benefit equals the market benefit less costs.
Preferred option	The preferred option is the credible option that maximises the net economic benefit to all those who produce, consume and transport electricity in the market compared to all other credible options. Where the identified need is for reliability corrective action, a preferred option may have a negative net economic benefit (that is, a net economic cost).
Reasonable Scenario	Reasonable scenario means a set of variables or parameters that are not expected to change across each of the credible options or the base case.
Technically feasible	An option is technically feasible if there is a high likelihood that it will, if developed, provide the services that the RIT–T proponent has claimed it could provide for the purposes of the RIT–T assessment.

Appendix C Process for implementing the RIT-T

For the purposes of applying the RIT-T, the NER establishes a typically three stage process, i.e.: (1) the PSCR; (2) the PADR; and (3) the PACR. This process is summarised in the figure below (in gold), as well as the criteria for PADR exemption that this RIT-T is seeking to apply (in blue).

Figure 9 - The RIT-T assessment and consultation process