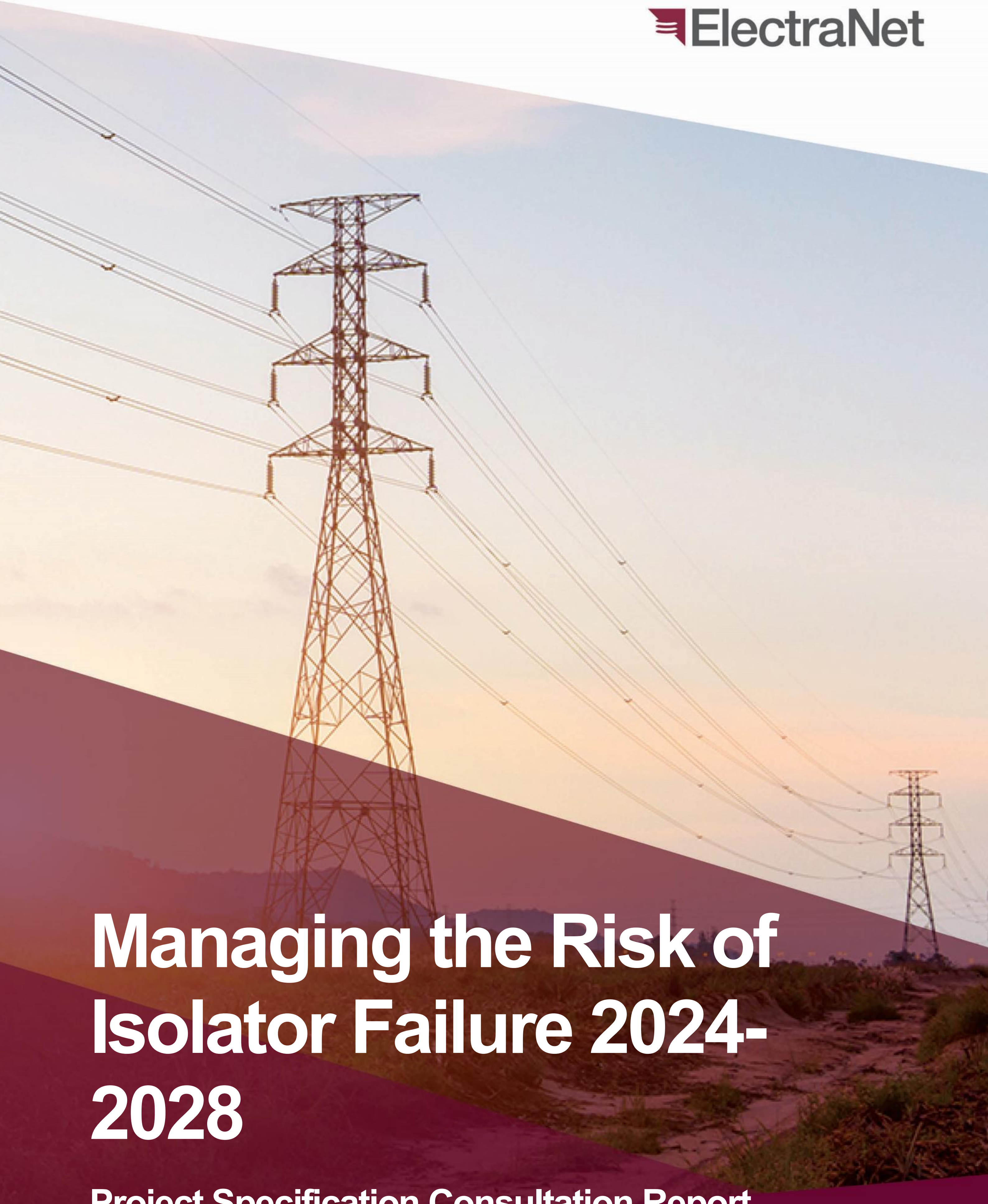


Managing the Risk of Isolator Failure 2024-2028

Project Specification Consultation Report

14 JUNE 2024

EXECUTIVE SUMMARY

We are proposing to replace 25 and refurbish 24 isolators at nine substations to maintain safe and reliable electricity supply to customers.

This Regulatory Investment Test for Transmission (RIT-T) Project Specification Consultation Report (PSCR) identifies the need to replace 25 and refurbish 24 isolators at nine substations as the preferred solution to manage the risk that these assets will fail.

Isolators are mechanically operated switches that isolate a part of an electrical circuit under no-load conditions. They allow circuit breakers, transformers, transmission lines and customer connection points to be safely isolated for work to be performed by field staff. The failure of an isolator may prevent the safe maintenance or return to service of plant and customer connections as the isolator may be unable to open or close when required.

The isolators are selected for replacement to enable the provision of spare components, or remove a known safety risk, or remove remnant end of life isolators.

The isolators are selected for refurbishment are to extend asset life.

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

The identified need for this project is to continue to provide safe and reliable electricity transmission services in South Australia safely and at a prudent and efficient cost. Specifically, the identified need for this Regulatory Investment Test for Transmission (RIT-T) is to efficiently manage the costs associated with creating a spares inventory (i.e. the costs of removing and/or replacing the isolators identified for creating spares) are more than outweighed by cost savings compared to what would need to be incurred under the base case.

We have classified this RIT-T as a 'market benefits' driven RIT-T as it is being progressed to manage the risk of asset failure and thereby deliver positive net benefits to customers.

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

Asset replacement and removal is the only credible option.

The analysis has identified that there is only one technically feasible option, which is a targeted replacement program to create isolator spares.

Two replacement timing options are considered. Option 1 which is to undertake the targeted isolator replacement program in the current regulatory period between 2024 and 2028 and Option 2 which considers a five-year delay.

The estimated capital cost of this option is approximately $22.9 million.

This is below the threshold requiring us to complete a Project Assessment Draft Report (PADR) under NER clause 5.16.4(z1). This RIT-T is therefore exempt from the need to produce a PADR.

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

ElectraNet does not consider that a non-network option can meet the identified need for this RIT-T. This is because of the unique and specific role that the identified isolators play in the transmission of electricity, as well as their relatively low emergency repair cost when spare components are available.

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

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]	3.0%	7.0%	10.5%
Unplanned replacement cost	70 per cent of base case estimates	Base case estimates	130 per cent of base case estimates
Generation support or temporary bypass for extended outages without spares	70 per cent of base case estimates	Base case estimates	130 per cent of base case estimates
Outage cost due to isolator failure	70 per cent of base case estimates	Base case estimates	130 per cent of base case estimates
Additional outages due isolator failure during transformer or line maintenance	70 per cent of base case estimates	Base case estimates	130 per cent of base case estimates
Safety of personnel working on network assets	70 per cent of base case estimates	Base case estimates	130 per cent of base case estimates

Completing the identified isolator replacement and refurbishment at nine substations within the 2024-2028 regulatory period is the preferred option[2].

The preferred option for addressing the identified need is Option 1; i.e. replacing or refurbishing identified isolators, between 2025 and 2028, for use as spares in order to continue to provide reliable electricity transmission services in South Australia at a prudent and efficient level of cost.

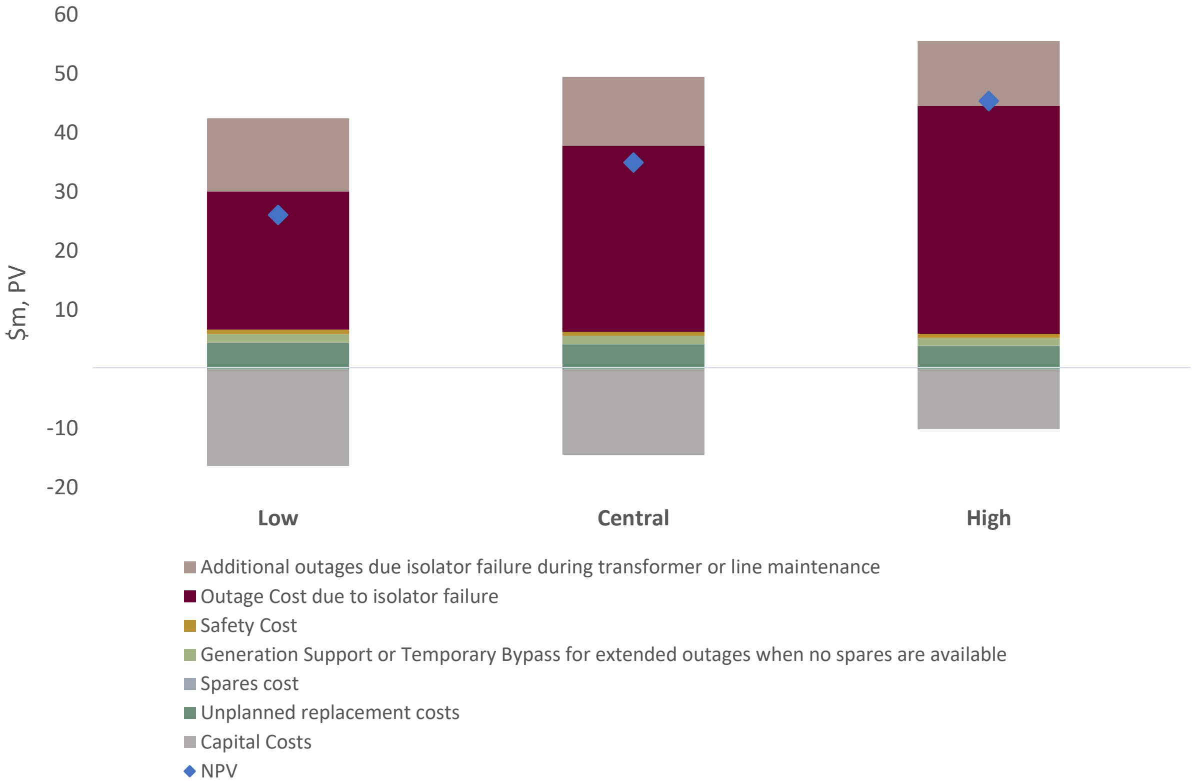
Most of the benefits are attributable to reducing the associated risk costs of isolators failing and avoiding emergency corrective maintenance (functionally emergency replacement).

Both of these categories of benefit are expected to be significantly higher in Option 1 under all scenarios due to the creation of a spares program, allowing for more timely correction of any future isolator failures.

[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.

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 $38.6 million in net market benefits.

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.

ElectraNet
electranet.com.au

Contents

Tables

Figures

Appendices

Glossary

AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ALARP	As Low as Reasonably Practicable
ETC	Electricity Transmission Code
NPV	Net Present Value
NEM	National Electricity Market
NER	National Electricity Rules
PACR	Project Assessment Conclusions Report
PADR	Project Assessment Draft Report
PSCR	Project Specification Consultation Report
RIT-T	Regulatory Investment Test for Transmission
TNSP	Transmission Network Service Provider
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 failure of 49 isolator at nine substations located across 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 non-network 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 isolators, 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, 6 September 2024. 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 it. 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

[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 safe and reliable supply of electricity in South Australia

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

2.1. Background to the identified need

Isolators are mechanically operated switches that isolate a part of an electrical circuit under no-load conditions. They allow circuit breakers, transformers, transmission lines and customer connection points to be safely isolated for work to be performed by field staff.

Replacement of the 25 isolators by this project enables:

1. Spare componentry for each isolator 'make and model' within the transmission high voltage network where spare parts are no longer available from the manufacturer. Spare componentry significantly aids efficient emergency corrective maintenance. (13 of the 25 isolators listed to be replaced by this project).
2. Removal of a known high safety risk that is unable to be lowered by any other action apart from replacement. Refer lay of protection assessment reports. (8 of the 25 isolators listed to be replaced by this project).
3. The removal of high network risk remnant isolators identified as being at end of life. (4 of the 25 isolators listed to be replaced by this project).

Refurbishment of the 24 isolators by this project enables:

1. An extension of life to specific isolators that have superior primary contact components but are affected by high failure rates of the 55+ year old motor drive unit componentry. New motor drive units provide a lower cost solution to these isolators than an alternative whole of isolator replacement option that would also necessitate major switchyard modifications.
2. A safety improvement to isolators that are difficult to manually operate due to the considerable physical strength and experience required to enable a change of state from 'open' to 'closed'. The addition of a suitable new generation motor drive unit will enable safe remote operations and when required, a much lower physical act for manual operations.

An example of a high voltage 132 kV isolator at Hummocks substation that is planned to be replaced is illustrated in Figure 2.

Figure 2 – 132 kV isolator at the Hummocks substation.

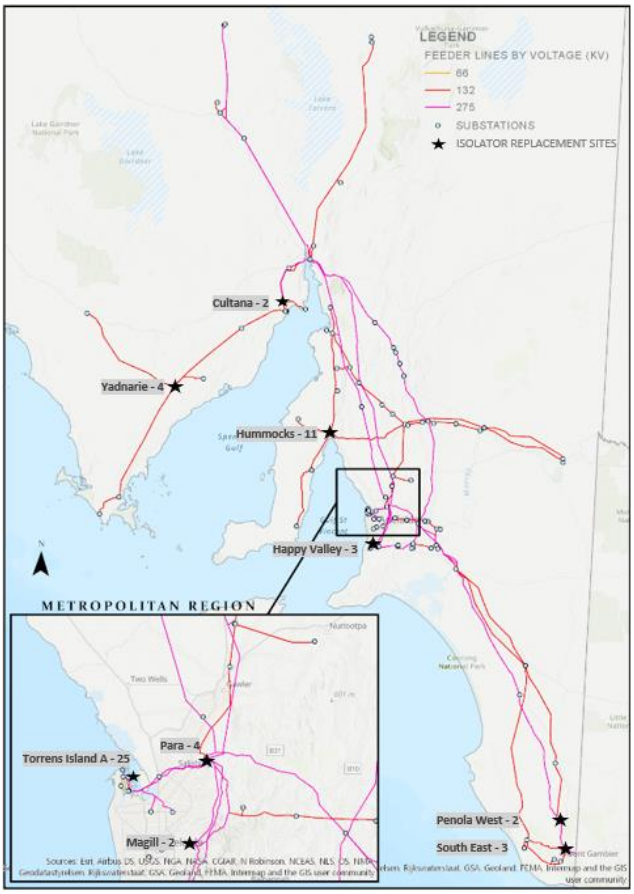
An example of a high voltage 66 kV isolator at Torrens Island A substation that is planned to be refurbished is illustrated in Figure 3.

Figure 3 – 66 kV isolator at the Torrens Island A substation.

The failure of an isolator may prevent the safe maintenance or return to service of plant as the isolator may be unable to open or close when required. Across our transmission network, we have identified 49 isolators, and/or parts of isolators, for removal and replacement, or in some cases removal only. A selection of the removed isolators is planned to be refurbished and disassembled to create a suitable spares inventory to allow for emergency maintenance of defective isolators.

The distribution of the nine substations where isolators are being refurbished or replaced and used to create spares is illustrated in Figure 4.

Figure 4 - Location of the Isolator identified for refurbishment or replacement.



Currently, we have an ageing population of isolators that do not have any manufacturers support as they are more than 20 years old. If a spares program is not implemented, it is likely there will be increased replacement costs and outages as, absent spare components, the replacement of entire isolator assemblies will be required under emergency conditions.

Specifically, when spare components are not available, a new isolator will have to be retro fitted to the old isolator position requiring significant increased costs and longer outages. Moreover, if an isolator does not operate, maintenance cannot be undertaken at the substation, or on transformers, lines, circuit breakers and, or customers may not be able to be returned to service after maintenance has been undertaken.

The average corrective maintenance unit cost for isolators differs significantly depending on whether spare components are available or not.

Specifically:

- when spare isolator components are available, this cost is approximately $30,000 for a 275 kV isolator and approximately $25,000 for a 132 kV component of an isolator; and

- without a spare, the emergency corrective maintenance cost would involve a whole new isolator and cost approximately $450,000 for a 275 kV isolator and $350,000 for a 132 kV isolator.

The creation of a spares program for isolator equipment enables ongoing inventory support for isolators and associated equipment that remains in service, where support is no longer available from the original equipment manufacturer. Furthermore, the spare components that are created from the strategically selected isolators will be able to be used at multiple sites throughout the transmission network.

The isolators we are intending to remove and/or replace in order to create spares are from the substations identified in Table 2, which also includes the isolator models that the spare components can be used to repair.

Table 2 - Substations with affected isolators

Substation	Isolator models
Para Substation	ETSA HDB (132 kV)
Happy Valley	ETSA HDB (132 kV)
Torrens Island A Substation	Switchgear HDB (66 kV), Haycolec Isolator and Earth Switches (66 kV)
Magill Substation	ETSA HDB (66 kV)
South East Substation	Westralian DBR (275 kV)
Cultana Substation	ABB - DBRP132 Isolators and Earth Switch
Penola West Substation	ABB - R145 (132 kV)
Yadnarie Substation	Replacement
Hummock Substation	ETSA DR Isolators and Earth Switch (132 kV)

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

The identified need for this project is to continue to provide reliable electricity transmission services in South Australia at a prudent and efficient level of cost.

Specifically, as set out in this PSCR, we consider that the costs associated with creating a spares inventory (i.e. the costs of removing and/ or replacing the isolators identified for creating spares) are more than outweighed by the cost savings compared to what would need to be incurred under the base case.

We have strategically identified isolators that are representative of approximately 80 per cent of the total population of isolators in the transmission network. The isolators that are being turned into spares can be used to replace the failed components of other in-service isolators and one isolator spare can be used to repair multiple failed isolators.

In its Industry Practice Note for asset replacement planning the Australian Energy Regulator says that Network Service Providers should apply the As Low as Reasonably Practicable (ALARP) approach to safety matters.[4] This is consistent with South Australia's Workplace Health and Safety Act, which requires us to ensure, so far as is reasonably practicable, the

[4] Australian Energy Regulator, "Industry practice application note Asset replacement planning", p.51, available from www.aer.gov.au, retrieved 2 April 2024.

health and safety of workers at our various sites and of the public generally. It is also consistent with our Safety, Reliability and Maintenance Technical Management Plan and with the obligation in our transmission licence to ensure that we operate the network in a manner consistent with good electricity industry practice.

Further, the Electricity (General) Regulations (the Regulations) 2012 require that:

51—Substations

(1) Substations must be designed, installed, operated and maintained to be safe for the electrical service conditions and the physical environment in which they will operate.

(2) Schedule 3 applies in relation to substations installed after 1 July 1997.

These obligations have been taken in to account in quantifying the benefits of this project which is classified as a 'market benefits' RIT-T. It is being progressed to deliver positive net benefits to customers by managing the risk of asset failure.

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 when an isolator fails focuses on four failure modes, being:

- contact failure – the current path (contacts, rotating heads or joints) or commutating contact components have failed on the isolator;
- control failure – the fuses, auxiliary contacts, monitoring devices (including sensors) have failed on the isolator;
- insulation failure – the main insulation to earth including support and drive insulators, pull rods, etc. have failed on the isolator; and
- operating mechanism failure – the motor drive on the isolator has failed due to a kinematic chain, motor, pump, control elements, gearbox, braking systems or mechanical transmission component failure.

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

2.3.1. The probability of failure

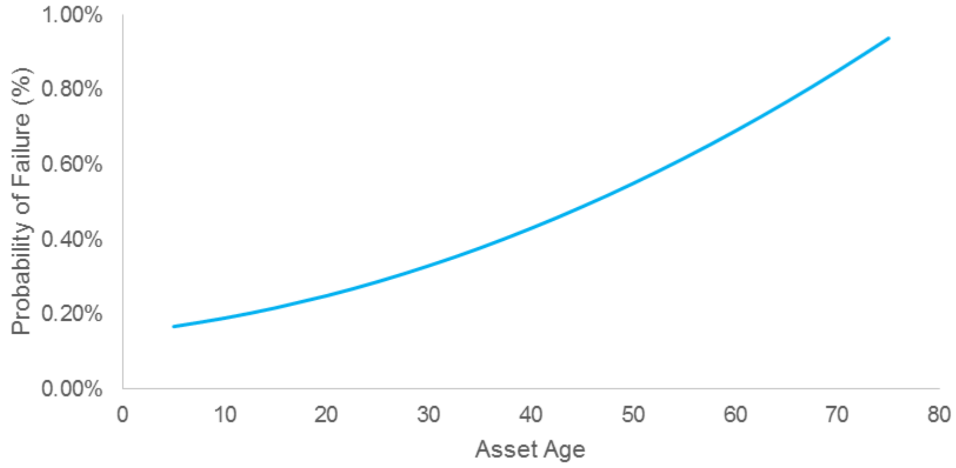
The probability of isolator failure is estimated by considering the asset's age and historical asset failure data from CIGRE's Final Report of the 2004 – 2007 International Enquiry on Reliability of High Voltage Equipment, Part 3 – Disconnectors and Earthing Switches.[5]

CIGRE is a global technical forum for large electric systems and is composed of researchers, academics, engineers, technicians, suppliers, market and system operators and other decision makers.

[5] Table 3-31 in page 30 of CIGRE Technical Brochure 511 (Final Report of the 2004 – 2007 International Enquiry on Reliability of High Voltage Equipment, Part 3 - Disconnectors and Earthing Switches).

The probability of failure is modelled based on a polynomial equation and increases as the assets age (a graph of the probability of isolator asset failures by asset age is shown in Figure 6 below).

Figure 6 - Probability of isolator asset failures given asset age



Therefore, we will be required to manage increasing isolator asset failures as we have a large proportion of isolators over the age of 30 years, when the probability of isolator asset failure begins increasing.

When an isolator fails and there are no spares available an emergency replacement is required. Only some critical isolators based on the substation and location within the substation are likely to cause an immediate outage.

If an isolator fails it is due to one of four different failure modes with the likelihood of each failure mode based on the CIGRE data. The probability of the different failure modes and the outage assumptions based on judgement applied in the modelling is detailed in Table 3 below.

Table 3 – Isolator failure modes and associated likelihoods

Failure Mode	Likelihood of failure	Estimated outage duration (hours)		Unserved Energy Load	VCR	Estimate generation support duration (hours)	
		With spare replacement	Without spare replacement			With spare replacement	Without spare replacement
Contact failure	10.58%	6	48	Dependant on the substation and the location of the isolator within the substation	$52,382	0	72
Control failure	35.10%	6	48			0	72
Insulation failure	12.53%	6	48			0	72
Operating mechanism failure	41.80%	6	48			0	72

2.3.2. The consequences of failure and not having available spares

Our risk cost model has individually identified isolators that have the potential to cause immediate consequences. The probability of failure associated with each of these assets has been determined with the potential consequences resulting from an isolator spare being unavailable including:

- additional corrective maintenance costs associated with having to replace the entire damaged isolator and other equipment in an unplanned emergency situation, rather than components of the isolator when spare components are available (as described in section **Error! Reference source not found.**).
- prolonged periods of unserved energy for electricity customers for select isolators during the time taken to restore (or fully replace) an isolator(s) on a reactive basis in the absence of spare parts;
  - this is particularly likely to be the case for isolators located in radial substations, radial lines and some exit lines;
  - for isolators located in other parts of the network, an outage will only occur when there is also a separate outage of a transformer; and
  - generation support costs for select isolators to maintain reliability of supply to customers for extended outages greater than 48 hours;

Each of these adverse effects is incorporated in the risk model.

Outage durations for isolators are based on the typical time to change out and commission a new isolator, either with or without a spare. The time it takes for replacement with or without a spare is identified in Table 3.

Outage cost is based on the Australian Energy Regulator's (AER) estimated Value of Customer Reliability (VCR) which is expressed in dollars per kilowatt-hour (kWh) and reflect the value different customer types place on reliable electricity supply. All loads are based on a representative load trace taken from 2019-20 escalated to 2023 dollars based on the Consumer Price Index for that year. The average load for each substation where outages are considered is approximately 11.8 MW.

Generation support cost assumptions have been sourced from existing contracts ElectraNet has with providers of these services.

The costs associated with reducing service interruptions, network support and corrective maintenance are the material factors underlying the assessment. We have therefore included a range of sensitivity tests on these as part of the economic assessment.

The adverse effect of incurring additional costs associated with postponing planned outages for operational and capital work when an isolator fails has not been captured in our risk cost modelling but is expected to further increase the net market benefits associated with Option 1.

Section 7 demonstrates this additional benefit would not change the preferred option and is not considered material in the context of this RIT-T.

3. Potential credible options to address the identified need

The analysis has identified that there is only one technically feasible option to be assessed against the base case, which is to create spare isolators from replacing current isolators in the network and to replace isolators that are remnant and at end of life. This is because isolators play a specific and important role in enabling substations to operate and be maintained in a timely fashion and to minimise any consequential effects on downstream customers.

We have however investigated different timings for this work in order to determine the optimal timing. This assessment is presented in section 7.

The option is technically and economically feasible and able to be implemented in sufficient time to meet the identified need.[6] In addition, all works are assumed to be completed in accordance with the relevant standards, with isolators being replaced with minimal modification to fit to the substation.

3.1. Option 1 – Planned replacement of isolators by 2028

Option 1 involves replacing or refurbishing the identified isolators in the 2024-2028 period and creating and storing isolators/isolator components as spares. Of the 49 existing isolators expected to be covered by this RIT-T:

- 25 are planned to be replaced and spares created; and
- 24 are planned to be refurbished.

The creation of isolator spare components enables ongoing inventory support for the isolators that remain in service with many of the isolators currently operating throughout the network no longer supported by the original equipment manufacturer. Furthermore, the spare components that are created from the strategically selected isolators will be able to be used at multiple sites throughout the transmission network.

ElectraNet has prepared an estimate of the cost of implementing this option which is $22.9 million. This is a Class 4 estimate prepared in accordance with the Australian Association of Cost Engineer's 'class 4' estimate categorisation. As such it was produced through a desktop review based on a scope prepared by ElectraNet's asset engineering team. It has an estimating range of -30% to +50%.

Routine operating and maintenance costs are not expected to be different to the base case.

The estimated construction time is approximately 3 years. We estimate that all the isolators could be addressed by 2028 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.

However, the identified need to manage the risk of asset failure does not lend itself to any solution other than to replace the identified isolators in order to generate spare components to maintain the remaining isolators on the most efficient basis as the only technically and economically feasible option given the unique and specific function of these assets. Consequently, we have not identified other feasible options.

6 In accordance with those identified in section **Error! Reference source not found.**.

Replacement of isolators without manufacturers support

Another option would be to replace all the isolators that now have no manufacturers support. However, the capital cost of this option is also expected to be significantly greater than the option outlined in section 3.1, estimated to be excess of $150 million for the isolators that are:

- more than 20 years old, and
- no longer have manufacturers support.

This option does not provide any additional market benefits and is not considered to be an economically feasible option.

In addition, as set out in section 4 below, we do not consider that a non-network option can address, or help address, the identified need.

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

We have considered whether the preferred option will have a material inter-regional impact.[7].

By reference to AEMO's screening test for an inter-network impact[8], 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.

[7] In accordance with NER clause 5.16.4(b)(6)(ii).

[8] 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

ElectraNet does not consider that a non-network option can provide a solution that is both technically and economically feasible.

For clarity, a non-network solution must be capable of providing the same services at a lower long run cost as compared to Option 1, which is to replace 25 and refurbish 24 isolators at nine substations.

Any non-network solution that avoids replacement or refurbishment of isolators in scope must therefore need to replicate the functionality, capacity and reliability of the entire substation that they are located.

We are not aware of non-network options that are capable of doing this, but invite submissions on this point from proponents of such options if they do exist.

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.[9]

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

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.

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.[10]

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.

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.

---

9 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.

10 AER, *Regulatory Investment Test for Transmission Application Guidelines*, August 2020, p. 29.

We consider that none of these are material for this RIT-T assessment for the reasons set out in Table 4.

Table 4 - 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.[11] 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.

[11] 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 isolators.

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.[12]

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.[13]

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.

While the isolators have asset lives greater than 20 years, we have taken a terminal value approach to incorporating capital costs in the assessment, which ensures that the capital cost of each option is appropriately captured in the 20-year assessment period.

We have adopted a real, pre-tax discount rate of 7.0 percent as the central assumption for the analysis presented in this report, consistent with AEMO's most recent Inputs, Assumptions and Scenarios Report – July 2023.[14] 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.[15]

---

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

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

14 AEMO*, Inputs, Assumptions and Scenarios Report*, July 2023, p. 123.

15 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 3.0 percent, and an upper bound discount rate of 10.5 percent.[16]

6.3. Description of reasonable scenarios

A RIT-T analysis is required to incorporate several 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.

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 5 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; 33% - low benefits scenario, 33% - central benefits scenario, and 33% - high benefits scenario.[17]

Table 5 - 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[18]	3.0%	7.0%	10.5%
Unplanned replacement cost	70 per cent of base case estimates	Base case estimates	130 per cent of base case estimates
Generation support or temporary bypass for extended outages without spares	70 per cent of base case estimates	Base case estimates	130 per cent of base case estimates
Outage cost due to isolator failure	70 per cent of base case estimates	Base case estimates	130 per cent of base case estimates
Additional outages due isolator failure during transformer or line maintenance	70 per cent of base case estimates	Base case estimates	130 per cent of base case estimates
Safety of personnel working on network assets	70 per cent of base case estimates	Base case estimates	130 per cent of base case estimates

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

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

[18] 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 and the option to delay the project by 5 years. The assessment compares these options against a 'do nothing' base case option.

7.1. Gross benefits for each credible option

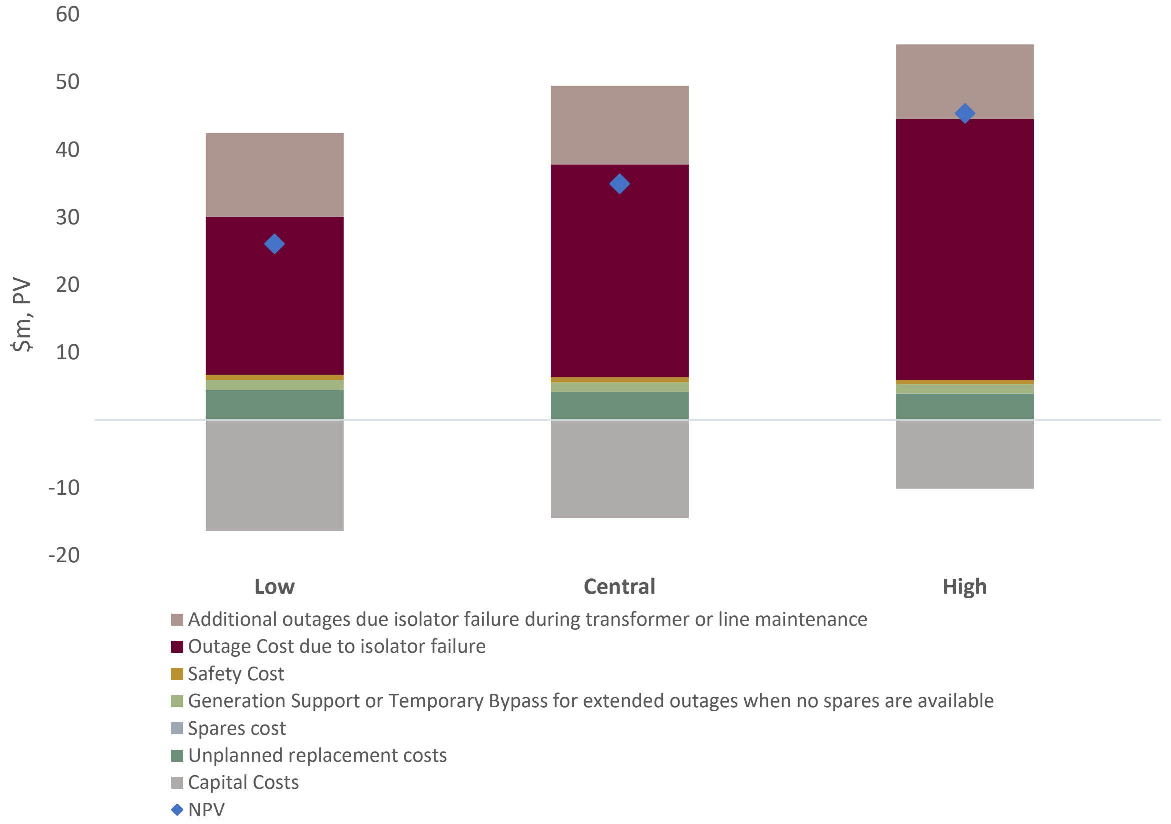
Table 6 below summarises the gross benefit estimated for the preferred, Option 1 undertaking the replacement of isolators and creation of spare isolator components by 2028 to Option 2, delaying the project by 5 years relative to the 'do nothing' base case in present value terms. The gross market benefit has been calculated for each of the three scenarios outlined in Table 5.

Table 6 - Estimated gross market benefit for each option, PV $m

Option	Low benefits scenario	Central scenario	High benefits scenario
Option 1 – Planned replacement of isolators and creation of spare isolator components by 2028	42.5	49.5	55.5
Option 2- Delay replacement of isolators and creation of spare isolator components by 5 years	30.5	32.1	32.6

Figure 4 below provides a breakdown of benefits. It shows that the benefits are derived from the reduced cost risk of isolator failure and the reduced time taken to resolve such failures.

Figure 4 - Breakdown of present value gross economic benefits of the preferred Option 1



ElectraNet
electranet.com.au

7.2. Estimated costs for each credible option

Table 7 summarises the capital costs of the preferred Option 1 and Option 2, relative to the base case, in present value terms for the different scenarios as described in Table 5.

Table 7 - Estimated capital cost for each option, PV $m

Option	Low benefits scenario	Central scenario	High benefits scenario
Option 1 – Planned replacement of isolators and creation of spare isolator components by 2028	-16.4	-14.5	-10.1
Option 2- Delay replacement of isolators and creation of spare isolator components by 5 years	-11.6	-9.2	-5.8

7.3. Net present value assessment outcomes

Table 8 summarises the net market benefit for Option 1 and Option 2 across the three scenarios, as well as on a weighted basis. The net market benefit is the gross benefit (as outlined in section 7.1) minus the cost (as outlined in section 7.2), 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 8 - Estimated net market benefit for each option, NPV $m

Option	Low benefits scenario	Central scenario	High benefits scenario	Weighted
Option 1 – Planned replacement of isolators and creation of spare isolator components by 2028	26.1	35.0	45.4	35.4
Option 2- Delay replacement of isolators and creation of spare isolator components by 5 years	18.9	23.0	26.9	22.9

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 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 and optimal timing.

Our assessment demonstrates that undertaking the project in the 2024-2028 period has a higher NPV benefit compared to delaying the project to the 2029-2033 period. This timing enables us to manage the risk of isolator failures.

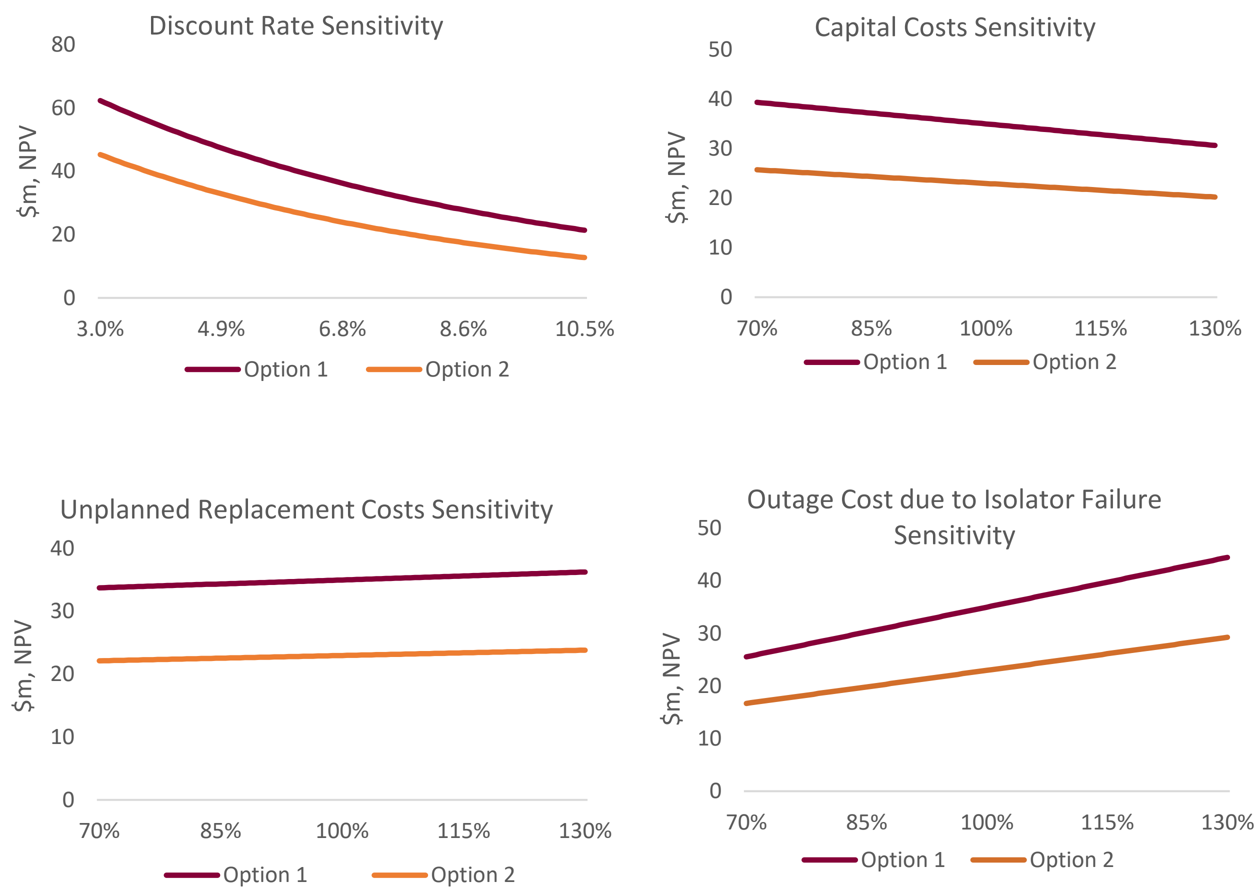
7.4.1. Sensitivity of the overall net market benefit

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

The charts in figure 5 below illustrate the estimated net market benefits for each option if the three 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 undertaking the replacement of isolators and creation of spare isolator components by 2028 is found to be strongly positive and higher than to Option 2, delaying the project by 5 years across all four key assumptions compared to the 'do nothing' base case option.

We do 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.

Figure 5 - Sensitivity testing of the NPV of net market benefits



ElectraNet
electranet.com.au

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, replacement of isolators and creation of spare isolator components by 2028. This option is described in section 3 and is estimated to have a capital cost of $22.9 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.[19]

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

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 210.

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:	–
	(1) a description of the identified need;	2.2
	(2) the assumptions used in identifying the identified need (including, in the case of proposed reliability corrective action, why the RIT-T proponent considers reliability corrective action is necessary);	2.3
	(3) the technical characteristics of the identified need that a non-network option would be required to deliver, such as: (i) the size of load reduction of additional supply; (ii) location; and (iii) operating profile;	4
	(4) if applicable, reference to any discussion on the description of the identified need or the credible options in respect of that identified need in the most recent Integrated System Plan;	1.1
	(5) a description of all credible options of which the RIT-T proponent is aware that address the identified need, which may include, without limitation, alternative transmission options, interconnectors, generation, system strength services, demand side management, market network services or other network options;	3
	(6) for each credible option identified in accordance with subparagraph (5), information about: (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 5.16.2(b)(6), together with reasons of why the RIT-T proponent considers that these classes of market benefit are not likely to be material; (iv) the estimated construction timetable and commissioning date; and (v) to the extent practicable, the total indicative capital and operating and maintenance costs.	3 & 5

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

This appendix defines the terms used in the economic assessment.

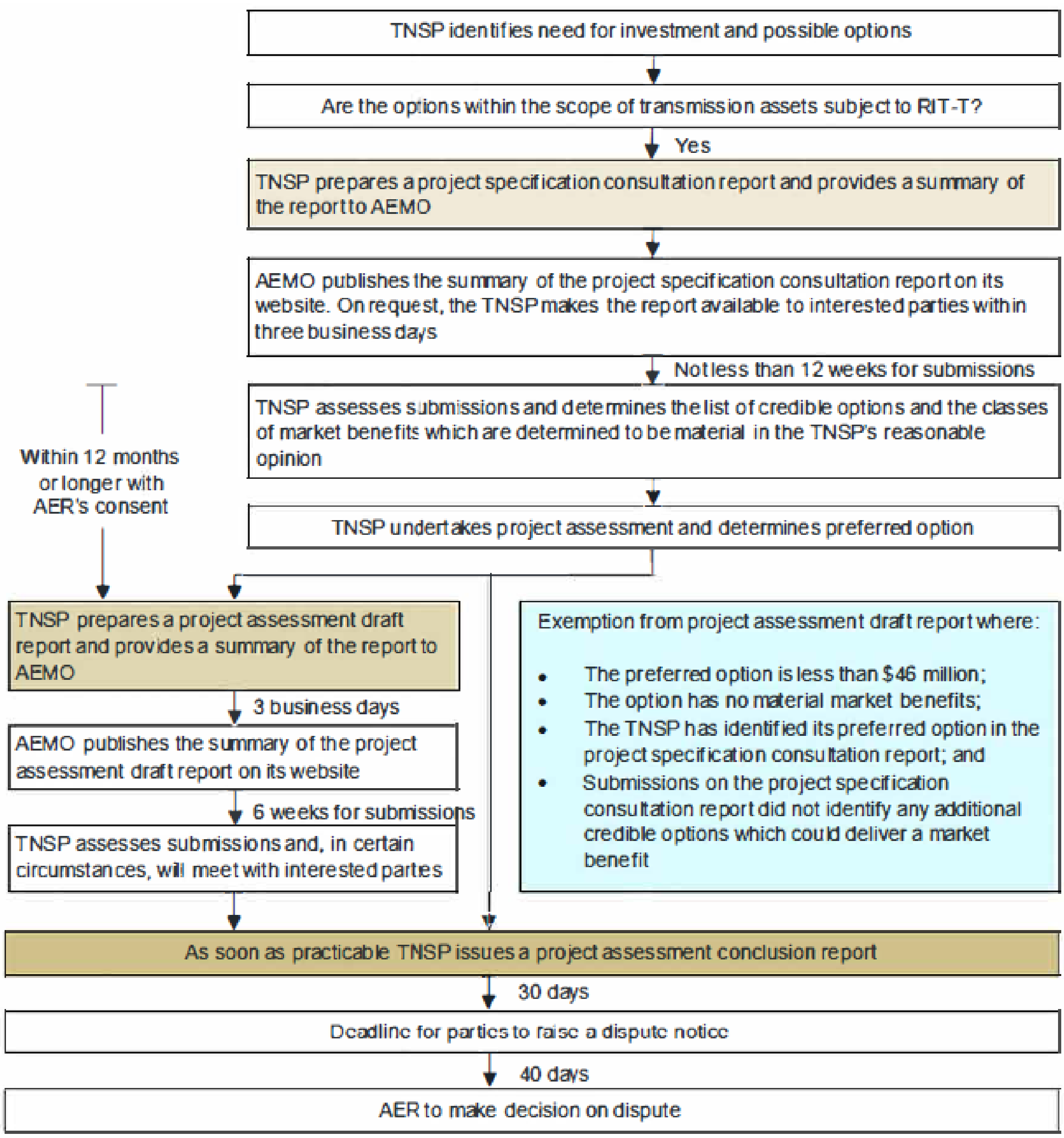
Definitions	
AEMO	Australian Energy Market Operator
Base case	A situation in which no option is implemented by, or on behalf of the transmission network service provider.
Commercially feasible	An option is commercially feasible if a reasonable and objective operator, acting rationally in accordance with 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 6 - The RIT-T assessment and consultation process



ElectraNet