27 May 2026

Addressing the Risk of 275kV Current Transformer Premature Failures in Queensland

Project Assessment Conclusions Report

Preface

Powerlink Queensland is a Transmission Network Service Provider (TNSP) that owns, develops, operates and maintains Queensland's high-voltage electricity transmission network. The network transfers bulk power from Queensland generators to electricity distributors Energex and Ergon Energy (part of the Energy Queensland Group), and to a range of large industrial customers.

This Project Assessment Conclusions Report has been prepared in accordance with version 246 of the National Electricity Rules (NER), the Regulatory Investment Test for Transmission (RIT-T) Instrument (November 2024) and RIT-T Application Guidelines (November 2024). The RIT-T Instrument and Application Guidelines are made and administered by the Australian Energy Regulator.

The NER requires Powerlink to carry out forward planning to identify future reliability of supply requirements, which may include replacement of network assets or augmentation of the transmission network. Powerlink must then identify, evaluate and compare network and non-network options (including, but not limited to, generation and demand side management) to identify the preferred option which can address future network requirements at the lowest net cost to electricity customers.

Powerlink also has obligations under the NER to address power system security requirements identified by the Australian Energy Market Operator in its annual System Security Reports.

The main purpose of this document is to provide details of the identified risks, credible options, categories of market benefits likely to impact the ranking of credible options and recommend the preferred option for implementation.

More information on how Powerlink applies the RIT-T process is available on Powerlink's website.

A copy of this report will be made available to any person within three business days of a request being made. Requests should be directed to the Manager Network and Alternate Solutions by phone (07 3860 2111) or email (networkassessments@powerlink.com.au).

Disclaimer

Powerlink acknowledges the Traditional Owners and their custodianship of the lands and waters of Queensland and in particular, the lands on which we operate. We pay our respect to their Ancestors, Elders and knowledge holders and recognise their deep history and ongoing connection to Country.

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Executive Summary

Premature failures of 275 kilovolt (kV) current transformers require Powerlink to take action

Powerlink has identified premature failures of a particular make and model of 275kV current transformers installed across the network (current transformer subset). These current transformers perform functions such as revenue metering, power system monitoring, telemetry, and protection system performance which are key to managing the network. Failures can result in network and load interruptions as well as loss of containment of oil and sand.

Powerlink has 451 of the 275kV oil-filled current transformer subset installed at 23 substation sites throughout the transmission network. Since 2011, there have been fourteen failures of this current transformer subset. The failed 275kV current transformers had been in service for between 10 to 24 years, failures occurred well before the 40-year lifespan expected of a typical current transformer. Seven failed routine maintenance testing, and seven failed while energised, demonstrating an elevated risk associated with sites where the current transformer subset is installed.

The correlation between time in service and likelihood of failure presents a risk to network reliability and operational stability, increasing the probability of unplanned outages and safety risks.

Powerlink must therefore take action to:

- avoid the increasing likelihood of a loss of power supply arising from failures of the current transformer subset in Queensland;
- avoid network and load interruptions due to loss of critical revenue metering, power system monitoring, telemetry, and protection system functions associated with failures of the current transformer subset; and
- remove the need for restricted access zones (RAZ), which hinder routine operational and maintenance activities supporting reliable operation of the network, at the affected substations.

Powerlink has implemented measures to manage safety risks

Powerlink has established RAZs of 30 metres around each current transformer subset while they are energised to manage safety risk in the vicinity. The RAZs ensure that no personnel approach an energised current transformer subset and be exposed to risk of injury.

Powerlink is required to apply the Regulatory Investment Test for Transmission

The estimated capital cost of the proposed credible option to address the network and safety risks associated with the current transformer subsets in northern, central and southern Queensland meets the minimum threshold (currently $8 million) to apply the Regulatory Investment Test for Transmission (RIT-T). As the identified need for the proposed investment is to meet reliability and service standards specified within Powerlink's Transmission Authority, guidelines and standards published by the Australian Energy Market Operator (AEMO), and Powerlink's ongoing compliance with Schedule 5.1 of the National Electricity Rules (NER), it is classified as a reliability corrective action under the NER.

Powerlink commenced this RIT-T with the publication of a Project Specification Consultation Report (PSCR) in August 2025 and the subsequent publication of a Project Assessment Draft Report (PADR) in March 2026 to outline the risks arising from the premature failure of the current transformer subset across the network. No submissions were received in response to either report. As a result, no additional credible options have been identified as a part of this RIT-T consultation.

This Project Assessment Conclusions Report (PACR) is the final step in the RIT-T process to address the network and safety risks associated with the current transformer subsets across the Queensland network. The PACR contains the results of the planning investigation and the cost-benefit analysis of the credible option compared to a non-credible base case where the asset condition issues are managed via operational maintenance or operational measures only. The base case is used as a reference point to compare the credible option against and reflects a situation which would result in an increase in overall risk levels due to continuing deterioration of asset condition.

Powerlink has developed one credible network option to address the identified need

The table below details the credible network option and shows that the option has a positive Net Present Value (NPV) relative to the base case.

Summary of Credible Option

Option	Description	Total Costs ($m, 2026)	NPV relative to the base case ($m, 2026)
1	Replacement of 451 identified current transformer subset across the network by 2029	126.61	372.75

Note: Total costs exclude risk and contingency.

Given that the functions performed by current transformers are essential for Powerlink to meet its regulatory and operational compliance obligations as a Transmission Network Service Provider and cannot be fully replicated or eliminated through alternative options, replacement of the current transformer subset was the only credible network option identified in this RIT-T to address the risks resulting from premature failure of the current transformer subset installed across the network.

Evaluation and conclusion

The RIT-T requires that the preferred option maximise the present value of economic benefits. If the identified need is for a reliability corrective action, the preferred option may have a net economic cost.

The cost-benefit analysis for this RIT-T demonstrates that Option 1, the replacement of the current transformer subset, provides the lowest net economic cost in NPV terms and is therefore the preferred option. The indicative capital cost of Option 1 is $126.61 million in 2025/26 prices. Design and construction works will commence in 2026, and commissioning will be completed by 2029.

Dispute Resolution

In accordance with clause 5.16B(a) of the NER, energy industry participants, the Australian Energy Market Commission, electricity consumers (including their representatives) may, by notice to the Australian Energy Regulator (AER), dispute conclusions made by Powerlink in this PACR in relation to:

- the application of the RIT-T;
- the basis on which Powerlink has classified the preferred option as a reliability corrective action; or
- Powerlink's assessment of whether the preferred option will have a material inter-network impact.

Notice of a dispute must be given to the AER within 30 days of the publication date of this report. Any parties raising a dispute are also required to simultaneously provide a copy of the dispute notice to Powerlink. Powerlink requests a copy of any dispute notice be sent by email (NetworkAssessments@powerlink.com.au) and marked for the attention of the Head of Legal Services.

1. Introduction

1.1. Powerlink asset management and obligations

Powerlink's approach to asset management delivers value to customers and stakeholders by optimising whole of life cycle costs, benefits and risks, while ensuring compliance with relevant legislation, regulations and standards. This is underpinned by Powerlink's corporate risk management framework, risk assessment guidelines and methodologies.

1.2. Overview of the Regulatory Investment Test for Transmission

The purpose of a Regulatory Investment Test for Transmission (RIT-T) is to identify the preferred investment option that meets the identified network need. The preferred option maximises the present value of economic benefit. If the identified need is for a reliability corrective action, the preferred option may have a net economic cost.[1]

Powerlink applies the RIT-T to potential prescribed (regulated) investments in the transmission network where the estimated capital cost of the most expensive option exceeds $8 million.[2]

Powerlink commenced this RIT-T with publication of a Project Specification Consultation Report (PSCR) on 29 August 2025, followed by the Project Assessment Draft Report (PADR) on 16 March 2026. Both reports identified a single option, involving the replacement of the identified current transformer subset, as the preferred option to address the risks across the network. The PADR stated that the indicative capital cost was $122.52 million in 2025/26 prices, and that design and construction works will commence in 2026, and commissioning will be completed by 2029.

This Project Assessment Conclusions Report (PACR) is the final step in the RIT-T process to address the risks posed by the current transformer subset. The PACR includes:

- a description of each credible option assessed;
- a quantification of the costs, including a breakdown of operating and capital expenditure, and classes of material market benefit for each credible option;
- reasons why Powerlink has determined that a class or classes of market benefit are not material;
- the results of Net Present Value (NPV) analysis for each credible option assessed, together with accompanying explanatory statements;
- the identification of the proposed preferred option, including details of the technical characteristics and the estimated construction timetable and commissioning date; and
- triggers to reopen this RIT-T.[3]

More information on the RIT-T process is provided in Appendix 1.

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[1] National Electricity Rules (NER), clause 5.15A.1(c) and chapter 10, glossary ('net economic benefit').
[2] NER, clauses 5.15.3(a) and (b)(2) set the threshold at $5 million. The Australian Energy Regulator's (AER) latest cost threshold review increased the value to $8 million for three years from 1 January 2025.
[3] NER, clause 5.16.4(v). As Powerlink did not receive any submissions in response to the PSCR for this RIT-T, the PADR and PACR do not include a summary of and commentary on submissions received.

1.3. Consumer and Non-network Engagement

Powerlink undertakes a considered and consistent approach to ensure an appropriate level of stakeholder engagement is undertaken for each individual RIT-T consultation. The scope of engagement activities is dependent upon various considerations, such as the characteristics and complexity of the identified need and potential credible options.

For all RIT-Ts, members of Powerlink's Non-network Engagement Stakeholder Register receive email notifications of publication of RIT-T reports. For projects where Powerlink identifies material or significant market benefits, additional activities such as webinars or dedicated engagement forums may be appropriate. For more information, see Powerlink's RIT-T stakeholder engagement matrix.

Additionally, Powerlink takes a proactive approach to engagement generally. This includes:

- the Transmission Network Forum – Powerlink's annual customer engagement event.
- collaboratively working with Powerlink's customers, including regular consultation on RIT-Ts with our Customer Panel (Powerlink Customer Panel | Powerlink)
- transparency on future network requirements, such as our Transmission Annual Planning Report (TAPR)

Appendix 2 provides more detail on Powerlink's engagement approach.

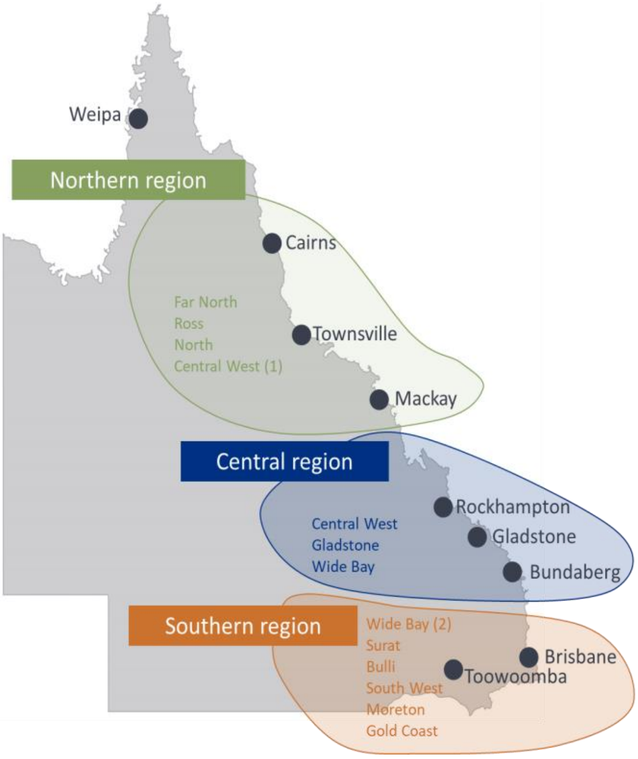
2. Identified Need

The primary driver in this RIT-T for reinvestment in the network is plant reliability due to premature failures leading to network interruptions, an outage in power supply to customers, the need to replace the current transformers under emergency conditions, as well as potential safety implications. Powerlink has introduced interim measures to maintain community safety prior to removal from the network, as discussed below.

2.1. Geographical overview

Figure 2.1.1 provides an overview of the northern, central and southern regions of Powerlink's network. Table 2.3.2 shows the regions where the current transformers are located within these regions. The delivery of the project is proposed to be run as three regional programs per the regions below.

Figure 2.1.1: Overview of current transformer subset locations across the network



Notes:

(1) Geographical zones as described in Powerlink's TAPR
(2) Southern region includes substation sites within the Surat and Moreton zones.

2.2. Description of identified need

Powerlink's Transmission Authority requires it to plan and develop the transmission network in accordance with good electricity industry practice, having regard to the value that end users of electricity place on the quality and reliability of electricity services. It allows load to be interrupted during a critical single network contingency, provided the maximum load and energy will not exceed 50 megawatts (MW) at any one time, or will not be more than 600 megawatt hours (MWh) in aggregate.[4] The Transmission Authority is also subject to a broader obligation under the *Electricity Act 1994* (Qld) (the Electricity Act) that Powerlink operate, maintain (including repair and replace if necessary) and protect its transmission grid to ensure the adequate, economic, reliable and safe transmission of electricity.[5]

Current transformers perform functions such as revenue metering, power system monitoring, telemetry, and protection system performance which are key to managing the network. Premature failures of the current transformer subset present a risk to network reliability and operational stability, increasing the probability of unplanned outages and network disruptions.

This presents Powerlink with a range of reliability of supply and safety risks which puts at risk Powerlink's ongoing compliance with the reliability and service standards set out in the NER, Powerlink's Transmission Authority and applicable regulatory instruments.

Powerlink must therefore take action to:

- avoid the increasing likelihood of loss of power supply arising from failures of the current transformer subset in Queensland;
- avoid network and load interruptions due to loss of critical revenue metering, power system monitoring, telemetry, and protection system performance functions associated with failures of the current transformer subset; and
- remove restricted access zones (RAZs) put in place to manage safety risks with the current transformer subset, as these hinder routine operational and maintenance activities that support the reliable operation of the network.

As a result, the proposed investment is for meeting reliability and service standards. These standards are set through Powerlink's Transmission Authority requirements and Schedule 5.1 of the NER. this RIT-T is classified as a reliability corrective action under the NER.[6] A reliability corrective action differs from that of an increase in producer and consumer surplus (market benefit) driven need in that the preferred option may have a negative net economic outcome. The NER includes reliability corrective actions to allow for meeting an externally imposed obligation on the network business.[7]

2.3. Description of asset condition and risks

Current transformers are installed at substations to measure and monitor the current flowing through transmission lines. They are a crucial component of the transmission network that perform functions including revenue metering, power system monitoring, telemetry, and protection system performance. These functions are critical in helping Powerlink meet its regulatory and operational compliance obligations as a Transmission Network Service Provider.

Current transformers can be of many different types and constructions (toroidal, optical, dry type, post type, etc.). The majority of post type current transformers in transmission networks are either gas-insulated sulphur hexafluoride (SF6) or oil-filled. A typical current transformer has an expected service life of approximately 40 years and are tested every three years as part of routine maintenance. Failure of a current transformer can lead

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[4] Transmission Authority No. T01/98, section 6.2(c).
[5] *Electricity Act 1994* (Qld), section 34(1)(a).
[6] NER, clause 5.10.2 (definition of 'reliability corrective action').
[7] NER, clause 5.15A.1(c).

to network interruptions and involuntary load curtailment for customers because Powerlink may need to de-energise parts of the network being monitored by the failed current transformer. Containment failure can also damage nearby equipment and cause potential harm to nearby environment and individuals.

There have been fourteen premature failures of the current transformer subset. Seven were identified through routine maintenance testing to be at high risk of failure and immediately removed from service. The failure details are shown in Incident Numbers 2 to 7 and 9 in Table 2.3.1.

There have been a further seven in-service failures of this current transformer subset since 2011. These failures resulted in the loss of containment of oil and sand up to a diameter of 17 metres. These incidents did not result in any personnel injury, as no one was within range of the oil and sand at the time of failure. The failure details are shown in Incident Numbers 1, 8, 10, and 11 to 14 in Table 2.3.1.

Table 2.3.1: Details of current transformer subset failures on Powerlink's network

Incident Number	Failure type	Years in service	Date of failure	Consequence	Consequence comment
1	Loss of containment	10	30/10/2011	N/A	N/A
2	Testing failure	23	31/10/2011	N/A	N/A
3	Testing failure	23	18/04/2013	N/A	N/A
4	Testing failure	23	18/01/2016	N/A	N/A
5	Testing failure	24	10/06/2016	N/A	N/A
6	Testing failure	23	02/06/2018	N/A	N/A
7	Testing failure	24	09/11/2018	N/A	N/A
8	Loss of containment	17	26/11/2019	Fire	Debris (approximately 5 metres)
9	Testing failure	23	1/07/2020	N/A	N/A
10	Loss of containment	13	19/08/2020	Oil spill	Oil and sand (distance not recorded)
11	Loss of containment	18	29/11/2023	Fire	Debris and oil spray (approximately 16 metres)
12	Loss of containment	18	23/01/2024	Oil spill	Oil and sand only (approximately 2 metres)
13	Loss of containment	18	27/07/2024	Fire	Debris (approximately 17 metres)
14	Loss of containment	19	11/06/2025	Fire	Debris (approximately 10 metres)

Table 2.3.2 lists the quantity of current transformer subset per substation site in each region.

Table 2.3.2: Quantity of 275kV current transformer subset per substation in each region

Region	Substation	Quantity
Northern	Nebo	18
	Ross	6
	Chalumbin	3
	Strathmore	27
	Subtotal	**54**
Central	Broadsound	8
	Calvale	4
	Wurdong	9
	Larcom Creek	21
	Subtotal	**42**
Southern	Tarong	81
	Braemar	14
	Millmerran	3
	Halys	60
	Western Downs	15
	South Pine	5
	Belmont	18
	Mudgeeraba	4
	Woolooga	36
	Palmwoods	6
	Mt England	29
	Middle Ridge	18
	Goodna	12
	Abermain	12
	Teebar Creek	21
	Greenbank	21
	Subtotal	**355**
	Total Quantity	**451**

2.3.1. Risk management measures

Powerlink's ongoing operational maintenance practices are designed to monitor equipment condition and ensure any emerging risks are proactively managed.

In addition, Powerlink has established RAZs of 30 metres around each current transformer subset while they are energised to manage safety risks. However, these RAZs create significant access challenges at the affected substations, hindering routine operational and maintenance activities and further exacerbating the network reliability risks associated with this subset.

Powerlink has also developed a refined work methodology, including the use of shields that can reduce the restricted access zone to 10 metres minimising network outages in adjacent feeders. These reduce the safety risk, but do not eliminate network reliability risks.

2.4. Consequences of failure

Powerlink has assessed the consequences of failure and risk scenario on a case-by-case basis, taking into account the type of asset, location of the asset, network connectivity, and operating and environmental conditions.

For the current transformer subset requiring replacement, the following safety, network, financial and environmental potential consequences have been identified.

Safety

- potential safety impacts to field personnel working in the vicinity of current transformers when loss of containment occurs, noting RAZs are in place to manage this risk

Network

- interruptions to supply and extended outages
- reduced transfer limits and different patterns of generation dispatch

Financial

- replacement of a failed asset in emergency conditions
- damage to adjacent items of plant in the event of oil and sand release or fire
- clean-up and remediation of oil and other contaminants
- costs associated with alternate sources of supply during prolonged outages
- delays to projects, rescheduling of planned works, and other business disruption costs

Environmental

- loss of containment of oil and sand leading to contamination of nearby ground and drainage systems
- fire leading to smoke by-products and runoff impacting nearby air, soil and drainage systems

3. Potential credible network options to address the identified need

Powerlink has developed one credible network option to address the identified need. This option addresses the risks associated with current transformer subset premature failures through a state-wide replacement program of the current transformer subset in the network. Design and construction works will commence in 2026, and commissioning will be completed by 2029.

A summary of this option is shown in Table 3.1.

Table 3.1: Summary of credible option

Option	Description	Breakdown of costs ($m, 2026)	Total Cost of option ($m, 2026)	Indicative annual O&M costs ($m, 2026)
1	Replacement of 451 identified current transformer subset across the network by 2029 in 3 regional programs		126.61	0.45
	• Northern Queensland (54 CTs)	12.14		
	• Central Queensland (42 CTs)	11.75		
	• Southern Queensland (Surat and Metro) (355 CTs)	102.72		

Note

1. *O&M denotes operations and maintenance.*
2. *The capital cost has been updated from the $122.52M indicative estimate in the PADR to $126.61M based on refined Class 3 engineering scoping. Refer Section 5.1 for further details.*

The credible option addresses the major risks resulting from the identified current transformer subset to allow Powerlink to meet its reliability of supply and safety obligations under its Transmission Authority, the Electricity Act and Schedule 5.1 of the NER, by the replacement of the current transformer subset across Powerlink's network.

4. Economic Analysis of the Base Case

Powerlink has developed a risk modelling framework consistent with the RIT-T Application Guidelines. An overview of the framework is available on Powerlink's website and the principles of the framework have been used to calculate the monetised risk, termed risk costs, in the National Electricity Market (NEM) context for the base case. The framework includes the modelling methodology and general assumptions underpinning the analysis.

4.1. Modelling a base case under the RIT-T

The base case is the situation in which the RIT-T proponent does not implement a credible option to meet the identified need and continues with business-as-usual (BAU) activities.[8]

The assessment undertaken in this RIT-T compares the costs and benefits of the credible option to address the risks arising from the identified need with a base case. As characterised in the RIT-T Application Guidelines, the base case reflects a situation in which the network reliability and safety risks arising from the current transformer subset premature failures are only addressed through standard operational activities, with resultant safety, financial, environmental and network risks.[9]

To develop the base case, the existing reliability and safety issues are managed by undertaking operational maintenance or operational measures only. This results in overall risk levels increasing over time with the age of current transformer subset. These risk levels are assigned a monetary value that is used to evaluate the credible options designed to offset or mitigate these risk costs.

The base case therefore includes the costs of work associated with operational maintenance and the costs associated with the failure of the current transformer subset. The costs associated with failures are modelled in the risk cost analysis and are not included in the operational maintenance costs.

The base case acts as a benchmark and provides a reference point in the cost-benefit analysis to compare and rank the credible options against each other over the same timeframe.

4.2. Quantifiable risk costs for the base case

The NER requires RIT-T proponents to quantify a number of classes of market benefits for each credible option, unless the proponent can demonstrate that a specific category(ies) is/are unlikely to materially affect the outcome of the assessment of credible options.[10] In line with Powerlink's framework, three key risk costs have been quantified in the cost benefit analysis in response to the identified need:

- **Network risk cost** – this is the cost of loss of supply that results from an in-service failure of the identified equipment and is typically known as unserved energy. For an in-service failure of a current transformer, a loss of supply would occur where there is a coincident feeder or transformer trip events within the wider area. The Queensland wide average Value of Customer Reliability (VCR) of $25,700/MWh, published within the

[8] AER, *Regulatory Investment Test for Transmission*, November 2024, glossary ('base case').
[9] AER, *Application Guidelines, Regulatory Investment Test for Transmission*, November 2024, page 21. See AER, *Regulatory Investment Test for Transmission*, November 2024, paragraph 24 and AER, *Application Guidelines, Regulatory Investment Test for Transmission*, November 2024, pages 32-35 for a definition and discussion of states of the world in a RIT-T.
[10] NER, clauses 5.15A.2(b)(4), (5) and (6). See also AER, *Regulatory Investment Test for Transmission*, November 2024, paragraphs 10 to 13.

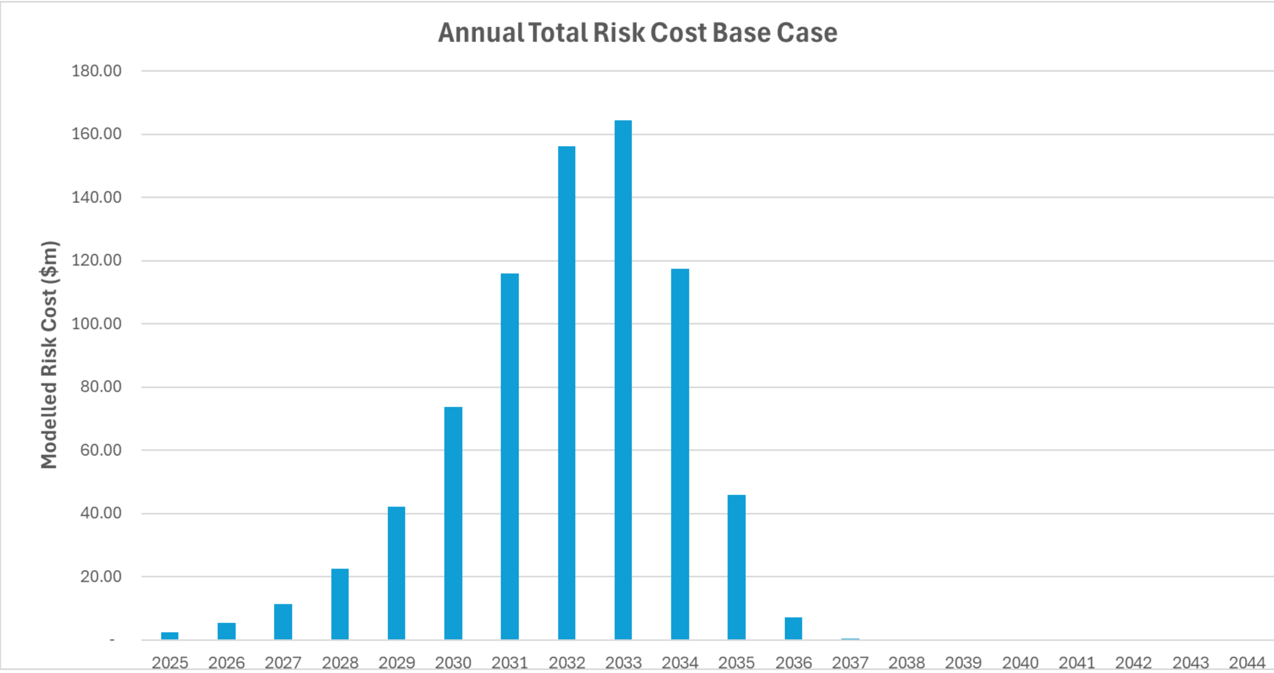
'Value of customer reliability – Final report on VCR values' by the AER (updated in December 2024) has been used to quantify this risk.

- **Financial risk cost** – this is the cost associated with rectifying the failure of an in-service current transformer subset. A typical unit cost for replacement of current transformers has been utilised, with a premium applied to represent the increased costs associated with replacement work completed under emergency conditions.
- **Safety risk cost** – this is the assessed safety impact that may result from the unlikely event of a catastrophic in-service failure of a current transformer subset. Powerlink utilises guidance from the Department of Prime Minister and Cabinet to assess and quantify this risk.

Appendix 3 outlines the market benefits that Powerlink has assessed as not having a material impact on the options analysis.

The 20-year forecast of risk costs for the base case is shown in Figure 4.2.1.

Figure 4.2.1: Modelled base case and option residual risk costs



Based upon the assessed condition of the fleet of current transformer subset, the total value of monetised risk is projected to increase from around $2.5 million in 2025 to $164.5 million in 2033.

The main areas of risk costs are network risks that involve reliability of supply through a current transformer subset failure modelled as probability weighted unserved energy[11] and financial risk costs associated with the replacement of failed assets in an emergency.

[11] Unserved energy is modelled using a VCR consistent with that published by the AER in its *Values of Customer Reliability, Final Report and Appendices A-D*, 2024.

Over time, as the fleet of current transformer subset ages and its condition deteriorates, the likelihood of failure rises and increases the risk costs. At a certain point, the majority of the fleet of current transformer subset have failed and been replaced, after which the risk costs start to rapidly decrease.

5. Cost-benefit Analysis and Identification of Preferred Option

5.1. Cost Estimation

Basis of Estimation

The basis for the estimation of costs for the credible option presented in this PACR are outlined in the methodologies and processes as described in Powerlink's Cost Estimation Methodology.[12] The estimates are informed by the level of specific project information available across the program of work and to the extent practicable for individual sites at the time of PACR preparation. Powerlink's Cost Estimation Methodology also provides context to the classes of estimate discussed in this section.

Key inputs and assumptions

Option 1: Replacement of current transformers in Northern, Central and Southern Region by 2029

A Class 3 Estimate has been produced for Option 1 (see Table 3.1) with an accuracy range of -20% to +30%.

Powerlink has made the following scope assumptions in producing this estimate:

- The new current transformers will be post-type, have polymer insulators and be replaced on the existing foundations using either new structures or adaptor plates.
- All identified current transformers will be replaced under outage conditions.
- Due to operational complexities at certain substation sites, shielding plans will be put in place to maintain safe approach distances between adjacent equipment during construction.
- A refined work methodology, including the use of blast and diverter shields to minimise network outages in adjacent feeders, has been developed and factored into the cost estimate.

Powerlink's Cost Estimation Methodology also provides context to the class of estimate discussed in this section.

Cost Estimate Refinement

The initial estimate of $86 million in the PSCR was a Class 5 estimate with an accuracy range of -50% to +100% for early consultation.

Following further site-specific scoping and a Class 3 engineering assessment, the estimate is now $126.61 million. This revision reflects the progression of estimate maturity, which has incorporated the following:

- Refinement of Scope: Transitioning from conceptual banding to a detailed engineering estimate.
- Market Pricing: Updated pricing for key long-lead materials, including current transformers.
- Workforce Requirements: Refinement of the labour costs required to perform the work safely across a geographically diverse program of work.
- Site Methodology: Improved clarity on the approach to site-specific access restrictions and safety mitigation measures.

[12] The methodology is available on the RIT-T Consultations page of Powerlink's website.

Cost estimate components

The main components of the credible option's capital cost estimate is shown in Table 5.1.1.

Table 5.1.1: Credible option capital cost components

Cost Estimate Components	Option 1 ($m)
Design	11.16
Materials	33.59
Construction	52.65
Commissioning	13.34
Other[13]	15.86
Total	**126.61**

Contingency allowance

For proposed transmission investments subject to the RIT-T, known and unknown delivery risk costs are excluded from the cost of the option. This approach aligns with that of the RIT-T Instrument which requires that the cost of the options considered include only direct costs, apart from any other costs the AER has agreed to in writing.[14]

5.2. Modelling assumptions

The proposed option has been scoped to manage the major risks arising in the base case and to maintain compliance with all statutory requirements, NER and AEMO standards. The residual risk is calculated based upon the implementation strategy of the option. This is included with the capital and operational maintenance cost to develop the NPV inputs.

Powerlink has undertaken the RIT-T analysis over a 20-year period, from 2025 to 2044. A 20-year period considers the scale of the current transformer subset replacement program. There will be remaining asset life by 2044, at which point a terminal value is calculated to account for capital costs under the option.

Powerlink has adopted a real, pre-tax commercial discount rate of 7% as the central assumption for the NPV analysis.[15] Powerlink has 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% and an upper bound discount rate of 10%.[16]

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[13] Generally, comprises project management, design and commissioning coordination, project governance, administrative support, cost estimation and RIT-T consultation costs.

[14] AER, *Regulatory Investment Test for Transmission*, November 2024, paragraph 5.

[15] This indicative commercial discount rate of 7% is based on AEMO, 2025 Inputs, Assumptions and Scenarios Report, August 2025, page 158.

[16] A discount rate of 3% lower bound discount rate is based on AEMO's *2025 Inputs, Assumptions and Scenarios Report*, August 2025, page 158.

5.3. Scenario Analysis

Powerlink has considered capital cost, discount rate and risk cost sensitivities individually, and in combination, and found that none of the parameters has an impact on the ranking of the results (see Appendix 4). Table 5.3.1 outlines the key parameters of the reasonable scenario presented.

Table 5.3.1: Reasonable scenario parameters

Key parameter	Central Scenario
Capital cost	100% of base capital cost estimate
Maintenance cost	100% of base maintenance cost estimate
Discount rate	7.0%
Risk cost	100% of base risk cost forecast

5.4. NPV analysis

Table 5.4.1 outlines the NPV and the corresponding ranking of Option 1 relative to the base case.

Table 5.4.1: NPV of credible option relative to the base case

Option	Description	Central scenario NPV relative to Base Case ($m)	Ranking
1	Replace 451 current transformer subset with new insulated current transformers by 2029	372.75	1

Figure 5.4.1 sets out the NPV results, determined using a breakdown of capital cost, operational maintenance cost and monetised risk for base case and Option 1 under the central scenario. Note that the non-credible base case consists of operational maintenance and total risk costs and does not include any capital expenditure.

Figure 5.4.1: NPV of the base case and credible option (NPV $m)

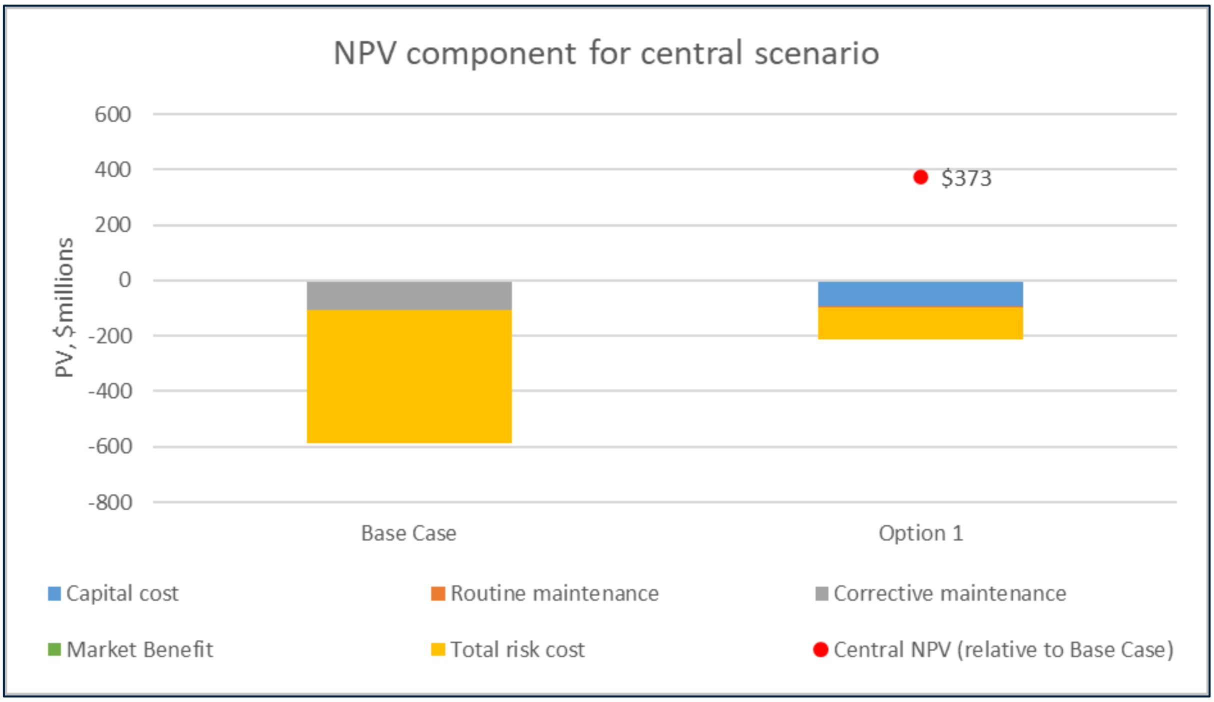

Figure 5.4.1 illustrates that Option 1 has significant reduction of risk cost compared to the Base Case and results in a positive NPV relative to the Base Case.

5.5. Conclusion

The result of the cost-benefit analysis indicates that Option 1 provides the highest net economic benefit (highest NPV relative to base case) over the 20-year analysis period. Sensitivity testing shows the analysis is robust to variations in the capital cost, risk cost and discount rate assumptions (see Appendix 4). Powerlink therefore considers Option 1 satisfies the requirements of the RIT-T.

6. Final Recommendation

Based on the conclusions drawn from the NPV analysis and regulatory requirements relating to the proposed replacement of transmission network assets, it is recommended that Option 1 be implemented to address the risk of current transformer subset premature failures across the network. Implementing this option will also ensure ongoing compliance with relevant standards, applicable regulatory instruments and the NER.

Option 1 involves the replacement of the 451 current transformer subset with new current transformers by 2029. The indicative capital cost of this option is $126.61 million in 2025/26 prices.

Powerlink will now proceed to implement Option 1.

7. Reopening Triggers

The sensitivity analysis in Appendix 4 demonstrates that the proposed preferred option is robust to changes in costs (including assumed risk costs) and the discount rate. Powerlink therefore considers it to be unlikely that the proposed preferred option will change.

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In the PADR, Powerlink offered the following potential reopening trigger events that may require an altered response and even possibly a new RIT-T.

- Material change in the identified need including:
  - A change in the timing, magnitude, or nature of the identified reliability or security issue, such as changes to the current transformer subset failure rates.
- Identification of a credible alternative network or non-network option where the option:
  - Was not identified during the PSCR or PADR consultation processes, and
  - Is materially different from options previously assessed, and
  - Is capable of addressing the identified need either in full or in part, at a lower cost (under the RIT-T assessment framework) or higher net market benefits than the preferred option.
- Material change in cost estimates or deliverability of the preferred option including**:**
  - Material increases in capital or operating costs to the extent that the preferred option no longer provides the highest net economic benefit.
  - Material changes in delivery risk, constructability, or implementation timing that affects the net market benefits of the preferred option.

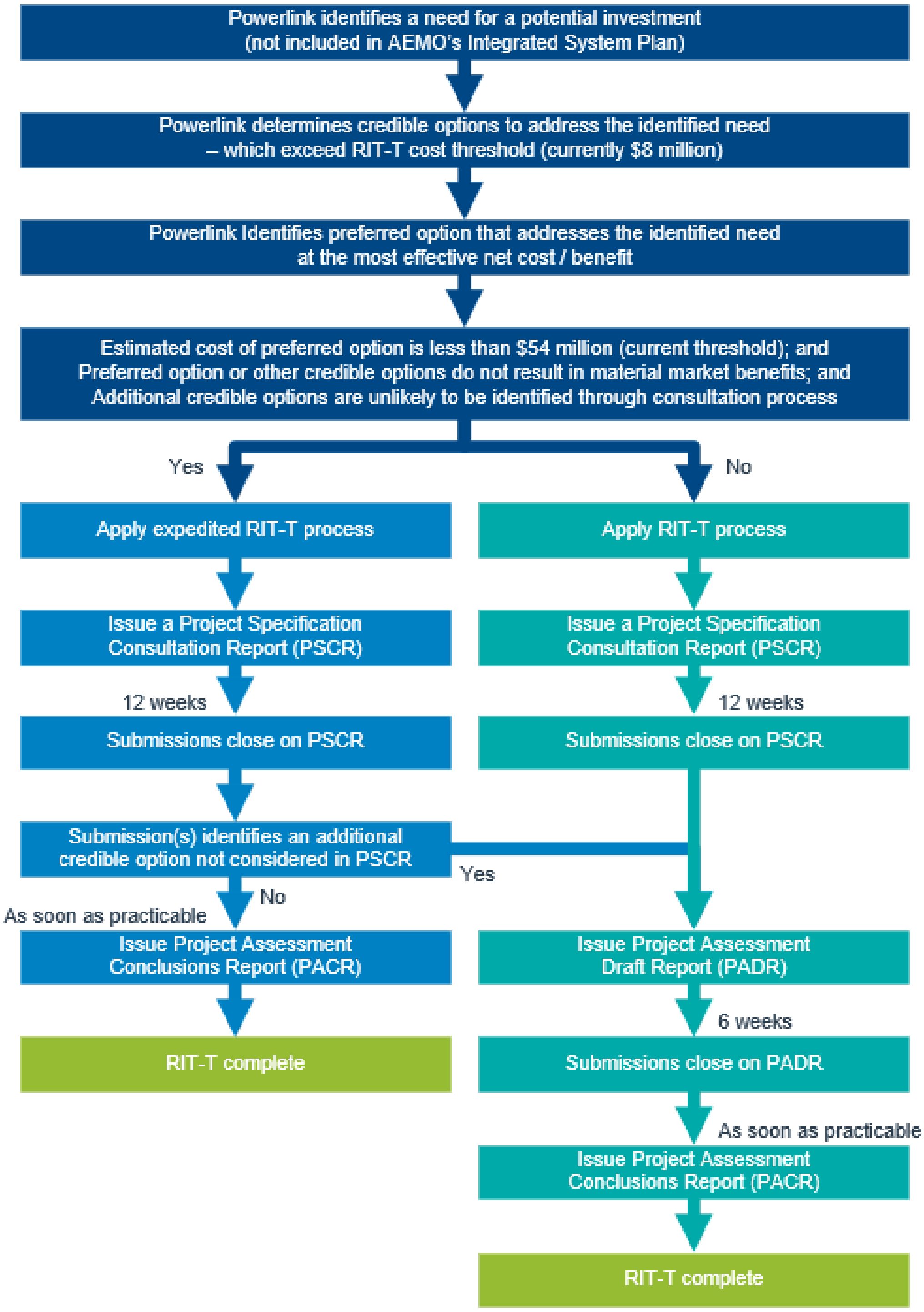
Powerlink did not receive any submissions in response to the PADR, and confirms the triggers proposed at the PADR stage as the final reopening triggers at the PACR stage. If any of the above reopening triggers are activated following completion of the RIT-T, Powerlink would notify the AER of the material change in circumstances, and outline (for the AER's approval) the actions Powerlink proposes to undertake.[17]

Further, as noted in the PADR, Powerlink will also advise the AER of, and propose actions to respond to, a change in the key assumptions used to identify the identified need described in the PACR, or a change in circumstances which, in Powerlink's reasonable opinion, means that the preferred option identified in the PACR may no longer be the preferred option.[18]

[17] NER, clause 5.16.4(z3)(4).
[18] NER, clause 5.16.4(z4).

Appendix 1: RIT-T Process

The flow chart below illustrates the RIT-T process where the need is not an actionable project in AEMO's ISP.



Appendix 2: Powerlink's Approach to Engagement

More than five million Queenslanders and 241,000 Queensland businesses depend on Powerlink's performance. Powerlink recognises the importance of engaging with a diverse range of customers and stakeholders who have the potential to affect, or be affected by, Powerlink activities and/or investments.

Together with our industry counterparts from across the electricity and gas supply chain, Powerlink has committed to the Energy Charter. The charter is a national CEO-led collaboration that supports the energy sector towards a customer-centric future. Powerlink joins other signatories in committing to progress the culture and solutions needed to deliver more affordable, reliable and sustainable energy systems. Powerlink's Energy Charter Disclosure Statement for 2024/25 shows Powerlink's achievements against the principles of the Energy Charter.

Powerlink takes a proactive approach to engagement

Powerlink regularly hosts a range of activities to provide timely and transparent information to customers and stakeholders within the broader community.

Powerlink's annual Transmission Network Forum (TNF) is a primary vehicle used to engage with the community, understand broader customer and industry views and obtain feedback on key topics. It also provides Powerlink with an opportunity to further inform its business network and non-network planning objectives. TNF participants include customers, landholders, environmental groups, Traditional Owners, government agencies, and industry bodies.

Engagement activities such as the TNF help inform the future development of the transmission network and assist Powerlink in providing services that align with the long-term interests of customers. Powerlink also incorporates feedback from these activities into a number of publicly available reports.

Working collaboratively with Powerlink's Customer Panel

Powerlink's Customer Panel provides a face-to-face opportunity for customers and consumer representatives to give their input and feedback about Powerlink's decision-making, processes and methodologies. The panel also provides Powerlink with a valuable avenue to keep customers and stakeholders better informed, and to receive feedback about topics of relevance, including RIT-Ts.

The Customer Panel is regularly advised on the publication of Powerlink's RIT-T documents and is briefed quarterly on the status of current RIT-T consultations as well as upcoming RIT-Ts. This provides an ongoing opportunity for the Customer Panel to ask questions and provide feedback to further inform RIT-Ts, and for Powerlink to better understand the views of customers when undertaking the RIT-T consultation process.

Powerlink will continue to provide updates to and request input from the Customer Panel throughout the RIT-T consultation process.

Transparency on future network requirements

Powerlink's annual planning review findings are published in the Transmission Annual Planning Report (TAPR) and TAPR templates (available via the TAPR portal). It provides early information and technical data to customers and stakeholders on potential transmission network needs over a 10-year outlook period. The TAPR plays an important part in planning Queensland's transmission network and helping to ensure it continues to meet the needs of Queensland electricity customers and participants in the NEM.[19]

Community engagement

Powerlink recognises the importance of engaging with stakeholders who may reasonably be expected to be affected by the works required to meet the identified need described in this PACR.

The engagement frameworks and strategies that underpin Powerlink's engagement approach include:

- The International Association for Public Participation (IAP2) spectrum[20], noting each stakeholder group has unique needs and requires an individual assessment on the spectrum;
- Powerlink's Community Engagement Approach and Reflect Reconciliation Action Plan; and
- the Energy Charter Landholder and Community Better Practice Engagement Guide; and Better Practice Social Licence Guideline.

Powerlink assesses the requirement for community engagement based on the identified need

Powerlink undertakes an assessment of the potential for social and environmental impacts of anticipated replacement or augmentation projects well in advance of the identified need timing. Understanding if and when community engagement may be required, as well as the appropriate engagement approach, is an integral component of the early planning analysis needed to inform option identification, consideration of statutory processes (e.g. Ministerial Infrastructure Designation if required) and subsequent project development strategy and engagement plans.

Powerlink's engagement approach is tailored to maximise the accessibility of the proposed project's information to the stakeholder groups and/or communities affected by the project once the need to undertake community engagement is identified. Key stakeholders may include, but are not limited to, directly impacted and adjacent landholders, Traditional Owner groups, local residents, businesses and other organisations such as schools, community organisations and environmental groups, local government authorities and elected representatives within local and state governments.

Assessment and basis of assessment on the need for community engagement

Powerlink has assessed that minimal community engagement is required given the scope of works under consideration for the proposed network option to meet the identified need will be within existing Powerlink substation sites. Powerlink will provide notifications to nearby residents as required to ensure all affected parties are appropriately informed of project activities.

[19] The 2025 TAPR indicated the proposed commissioning date for the current transformer replacement program would be June 2031. See Powerlink, *2025 Transmission Annual Planning Report*, October 2025, page 85.
[20] Refer to IAP2's website.

Appendix 3: Market benefits that are not material for this RIT-T assessment

A discussion of each market benefit under the RIT-T that Powerlink considers not to be material is presented below.

- **Changes in patterns of generation dispatch**: replacement of ageing assets under the credible options by itself does not affect transmission network constraints or affect transmission flows that would change patterns of generation dispatch. It follows that changes through different patterns of generation dispatch are not material to the outcome of the RIT-T assessment.
- **Changes in voluntary load curtailment**: replacement of at-risk assets under the credible option by itself does not affect prices in the wholesale electricity market. It follows that changes in voluntary load curtailment will not be material for the purposes of this RIT-T.
- **Changes in costs for other parties**: the effect of replacement of at-risk assets under the credible option considered are localised to the substation they are located at and do not affect the capacity of transmission network assets and therefore are unlikely to change generation investment patterns (which are captured under the RIT-T category of ‘costs for other parties’)
- **Differences in the timing of expenditure**: the credible option for asset replacement does not affect the capacity of transmission network assets, the way they operate, or transmission flows. Accordingly, differences in the timing of expenditure of unrelated transmission investments are unlikely to be affected.
- **Changes in network losses**: the credible option is not expected to provide any changes in network losses as replacing at risk assets does not affect the characteristics of primary transmission assets.
- **Changes in ancillary services cost**: there is no expected change to the costs of Frequency Control Ancillary Services (FCAS), Network Control Ancillary Services (NCAS), or System Restart Ancillary Services (SRAS) due to credible option under consideration. These costs are therefore not material to the outcome of the RIT-T assessment.
- **Changes in Australia’s greenhouse gas emissions**: Powerlink does not consider that the credible option will materially affect Australia’s greenhouse gas emissions, and the cost of quantifying any greenhouse gas emission benefits would involve a disproportionate level of effort compared to the additional insight it would provide.
- **Competition benefits:** Powerlink does not consider that the credible option will materially affect competition between generators, and generators’ bidding behaviour and, consequently, considers that the techniques required to capture any changes in such behaviour would involve a disproportionate level of effort compared to the additional insight it would provide.
- **Option value**: Powerlink does not consider that the identified need for the option considered in this RIT-T is affected by uncertain factors about which there may be more clarity in future. As a consequence, option value is not a relevant consideration for this RIT-T.
- **Costs associated with social licence activities:** Powerlink does not consider that the cost of social licence activities is material given there is only one credible option under consideration in this RIT-T and therefore not material to the outcome of the RIT-T assessment.

Appendix 4: Sensitivity Analysis

Powerlink has investigated the following sensitivities on key assumptions:

- a range from 3% to 10% discount rate;
- a range from 75% to 125% of base capital expenditure estimates;
- a range from 75% to 125% of base risk cost estimates; and
- a range from 75% to 125% of base operational maintenance expenditure.

As illustrated in Figures A4.1 to A4.3, sensitivity analysis for the NPV relative to the base case shows that varying the discount rate, capital expenditure, and total risk costs has no impact on the identification of the preferred option. Option 1 is the preferred option under all scenarios tested.

Figure A4.1: Discount rate sensitivity

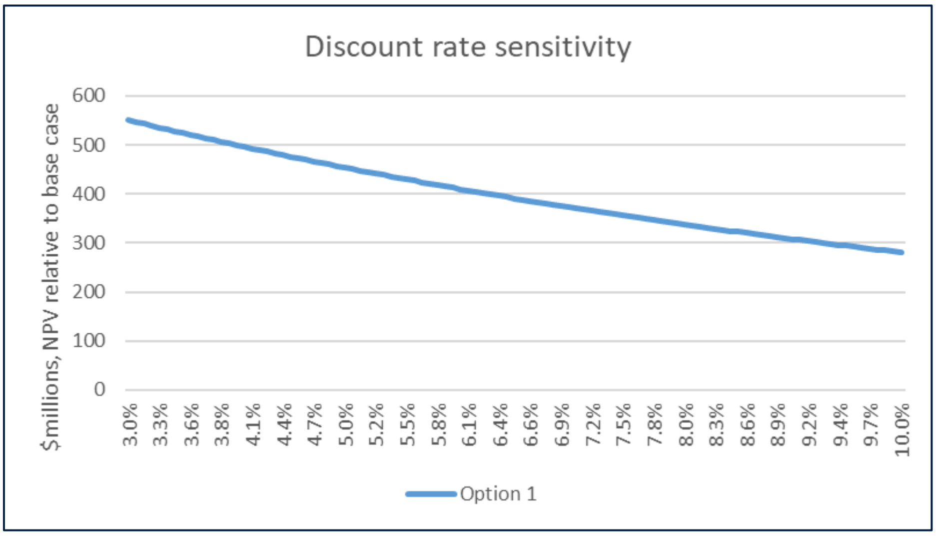


Figure A4.2 Capital cost sensitivity

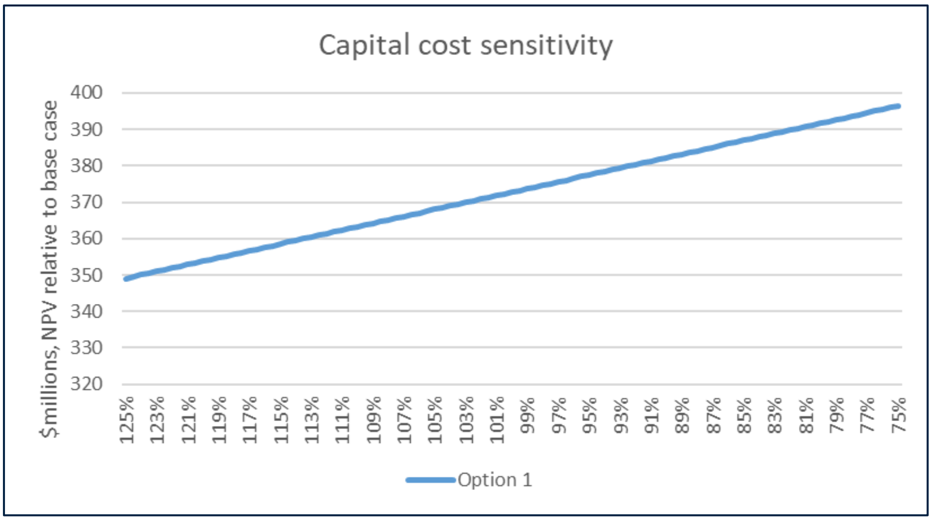
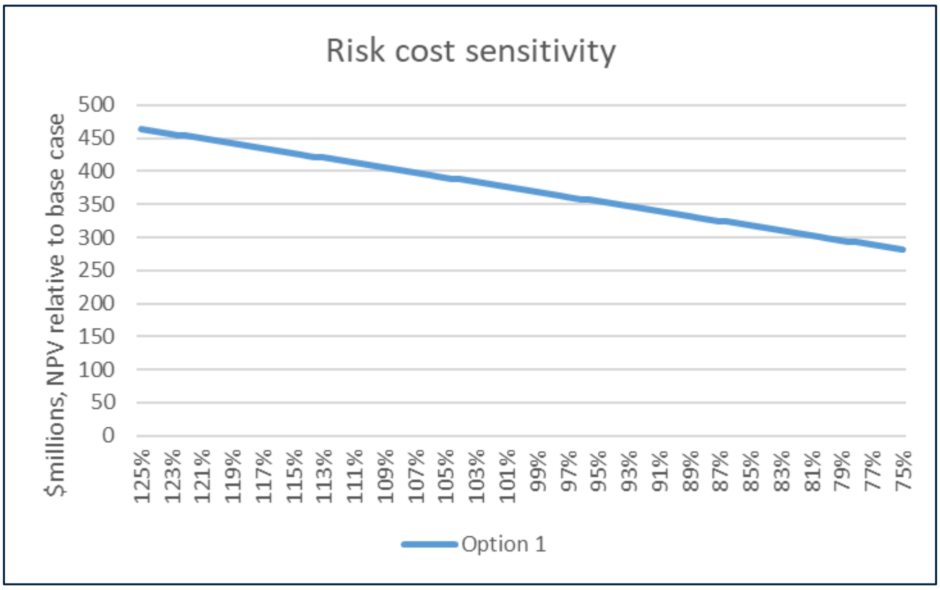
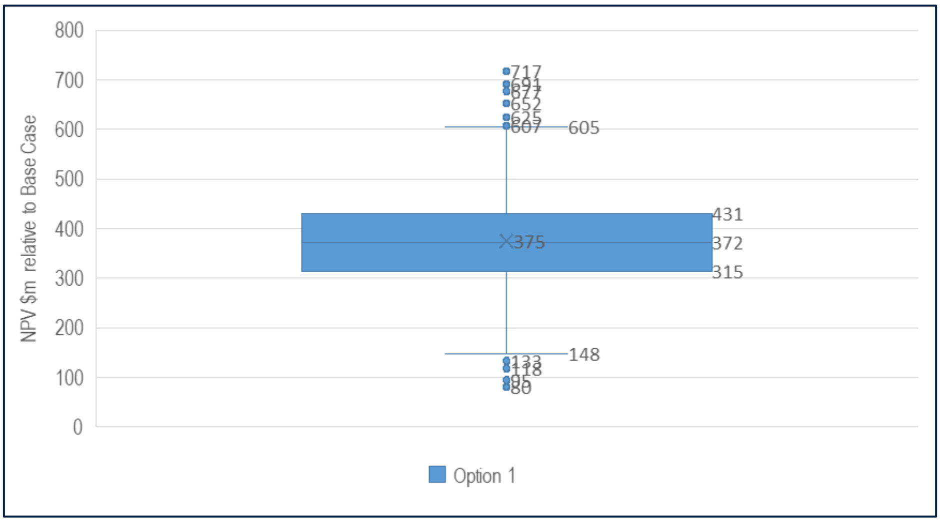


Figure A4.3 Risk cost sensitivity



Powerlink also performed a Monte Carlo simulation with multiple input parameters (including capital cost, discount rate and total risk cost) generated for the calculation of the NPV for each option. This process was repeated over 5,000 iterations, each time using a different set of random variables from the probability function. The sensitivity analysis output is presented as a distribution of possible NPVs for each option, as illustrated in Figure A4.4.

Figure A4.4: NPV sensitivity analysis of multiple key assumptions relative to the base case



Note: The box represents the interquartile interval, where 50% of the data is found. The horizontal line through the box is the median and the mean is represented by the cross (X). The two lines outside the box extend to 1.5 times the interquartile range. Data points that are outside of this interval are shown as dots on the graph.

Option 1 is robust over a range of input parameters in combination.

Appendix 5: Compliance Checklists

NER Requirements for RIT-T

Clause 5.16.4(v) of the NER states that a PACR must include the matters detailed in the PSCR/PADR (as required under clause 5.16.4(k)) and summarise and comment on submissions received on the PSCR/PADR. Table A5.1 outlines Powerlink's compliance with PADR/PACR content requirements set out in each sub-paragraph of clause 5.16.4(k) of the NER.

Table A5.1: NER Compliance Checklist

Sub-para	Requirement	Section
(1)	Description of each credible option	3
(2)	Summary of and commentary on submissions to the PSCR/PADR[21]	No submissions received
(3)	Quantification of costs, including breakdown of operating and capital expenditure Classes of material market benefit for each credible option	3, 4.2, 5.1
(4)	Description of methodologies used to quantify each class of material market benefit and cost	4.2
(5)	Reasons why a class/classes of market benefit are not material	Appendix 3
(6)	Identification and quantification of any class of market benefit estimated to arise outside Queensland	N/A
(7)	Results of NPV analysis for each credible option, and explanation of results	5.4
(8)	Identification of preferred option	5.5, 6
(9)	For the preferred option: (i) details of the technical characteristics (ii) the estimated construction timetable and commissioning date (iii) an augmentation technical report from AEMO (if required) (iv) a statement that the preferred option satisfies the RIT-T	 3 3, 6 N/A 5.5
(10)	RIT reopening triggers	7

N/A denotes not applicable.

[21] Powerlink did not receive any submissions in response to the PSCR and PADR for this RIT-T.

RIT-T Application Guidelines Compliance Checklist

Table A5.2 outlines Powerlink's compliance with binding requirements included in the RIT-T Application Guidelines.

Table A5.2: RIT-T Application Guidelines Compliance Checklist

Section of Guidelines	Topic	Requirements	Section
3.2.5	Social licence principles	Consider social licence issues in the identification of credible options, and include information about when and how social licence considerations have affected the identification and selection of credible options.	Appendix 2
3.4.3	Value of emissions reduction	The VER, reported in dollars per tonne of emissions (CO2 equivalent), is used to value emissions within a state of the world. A RIT-T proponent is required to use the then prevailing VER under relevant legislation or, otherwise, in any administrative guidance.	N/A
3.5	Valuing costs	Costs are the present value of the following direct costs: • Constructing or providing the credible option; • Operating and maintenance costs; • Costs of complying with relevant laws, regulations and administrative requirements; and Costs of removing and disposing of existing assets (particularly for asset replacement programs).	3, 4, 5.1
3.5.3	Social licence costs	Provide the basis for any social licence costs, including any reference to best practice	N/A
3.5A.1	Cost estimation accuracy	Outline cost estimation process (as applicable to stage of the RIT-T)	5.1
3.5A.2	Cost estimation information	Details of inputs, assumptions and methodologies for each credible option (as applicable to the stage of the RIT-T)[22]	5.1
3.6	Market benefit classes	Apply market benefit classes consistently across all credible options	4.2
3.7.3	Market benefits	Calculation of changes in Australia's greenhouse gases	N/A

[22] Although the provisions in section 3.5A.2 of the RIT-T Application Guidelines are not included in the table of binding requirements at Appendix C of the Guidelines, Powerlink has added them to the compliance checklist as the provisions are expressed as being binding in section 3.5A.2 of the Guidelines.

Section of Guidelines	Topic	Requirements	Section
3.8.2	Sensitivities	Sensitivity analysis on all credible options	Appendix 4
3.9.4	Contingency allowance	Details of any contingency allowance included in a cost estimate for a credible option	N/A
3.11.2	Concessional finance	Provide sufficient detail about a concessional finance agreement	N/A
4.1	Community engagement	Description of assessment of requirement for community engagement and, as applicable, how engagement has been undertaken and any relevant concerns sought to be addressed, and how the proponent plans to engage with stakeholder groups.	1.3, Appendix 2

Notes:

N/A denotes not applicable.

Contact us

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