Powerlink Queensland

Project Specification Consultation Report

22 November 2018

Maintaining reliability of supply to the Brisbane metropolitan area

Document Purpose

For the benefit of those not familiar with the National Electricity Rules (the Rules) and the National Electricity Market (NEM), Powerlink offers the following clarifications on the purpose and intent of this document:

1. The Rules require Powerlink to carry out forward planning to identify future reliability of supply requirements and consult with interested parties on the proposed solution as part of the Regulatory Investment Test for Transmission (RIT-T). This includes replacement of network assets in addition to augmentations of the transmission network.
2. Powerlink must 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 consumers. This assessment compares the net present value (NPV) of all credible options to identify the option that provides the greatest economic benefits to the market.
3. The main purpose of this document is to provide details of the identified need, credible options, technical characteristics of non-network options, and categories of market benefits addressed in the assessment. In particular, it seeks information from potential proponents of feasible non-network options to address the identified need.

Contents

Executive Summary

The West Darra to Rocklea and South Pine to Upper Kedron transmission lines are 110kV double circuit lines that form part of the Greater Brisbane transmission network in the Moreton transmission zone[1], with the South Pine and Rocklea Substations providing the high voltage injection points for the western part of the Greater Brisbane area. Originally commissioned in 1963 the lines consist of 68 galvanised steel lattice towers with a combined route length of 22.5 kilometres.

Under the *Electricity Act 1994*, Powerlink is required to "operate, maintain (including repair and replace if necessary) and protect its transmission grid to ensure the adequate, economic, reliable and safe transmission of electricity". The West Darra to Rocklea and South Pine to Upper Kedron transmission lines are nearing the end of their technical service lives, with the majority of structures exhibiting signs of degradation. The presence of advanced corrosion on the lines' earth wire attachment points and hardware, as well as the total loss of sacrificial galvanising to the foundation interfaces on 30% of the tower legs, have increased the risk of mechanical failure, particularly in storm and severe wind conditions. The earth wires are also not sufficiently rated to cater for the continuing growth in forecast fault levels over time.

The condition of the West Darra to Rocklea and South Pine to Upper Kedron transmission lines present Powerlink with a range of safety, reliability of supply and compliance risks requiring resolution.

Powerlink is required to apply the RIT-T to this investment

This investment is driven by an obligation in the Rules, and is classified as a 'reliability corrective action' under the RIT-T.

Three credible options have been identified to address the identified need

The Base Option reflects a conventional replacement strategy that seeks to maximise the life of the current lines while ensuring continued compliance with the Rules and serves as the basis of comparison between options. This strategy involves a two stage refit of the existing lines by December 2028, followed by full replacement in 2043.

This has then been compared with two other credible network options.

Option 1 involves a single stage refit by December 2020, followed by replacement in 2043.

Option 2 involves a minor single stage refit of the existing lines by December 2020, followed by full replacement in 2028.

All options will provide the Brisbane metropolitan area with a reliable, cost effective supply.

Details of each option are summarised in Table 1.

[1] This relates to the standard geographic definitions (zones) identified within the Powerlink's Transmission Annual Planning Report, (TAPR) which is published annually by 30 June.

Table 1: Summary of credible options

Option	Description	Indicative capital cost ($million, 2018/19)	Indicative annual O&M costs ($million, 2018/19)
Base Option: Two stage refit by 2028, replacement by 2043	Repair or replace selected components, by December 2020*	4.55*	0.037
	Repair or replace selected components, including members, by December 2028†	8.47†	
	Rebuild lines by December 2043†	22.53†	
Option 1: Refit by 2020, replacement by 2043	Repair or replace selected components, including members, by December 2020*	10.25*	0.038
	Rebuild lines by December 2043†	22.53†	
Option 2: Minor refit by 2020, replacement by 2028	Repair or replace selected components, by December 2020*	4.55*	0.043
	Rebuild lines by December 2028†	22.53†	

* Proposed RIT-T project
† Modelled projects

Powerlink has also considered whether non-network options could address the identified need. A non-network option that avoids replacement of the ageing West Darra to Rocklea and South Pine to Upper Kedron transmission lines would need to replicate the support that these lines provide Powerlink and Energex in meeting their reliability of supply obligations on an enduring basis at a cost that is lower than the network options under consideration.

Powerlink welcomes submissions from potential proponents who consider that they could offer a credible non-network option that is both economically and technically feasible.

Base Option has been identified as the preferred option.

Due to the nature of the investment, none of the credible options considered are expected to give rise to material market benefits. The major differences between the options relates primarily to the timing of the capital investments, with the Base Option and Option 1 being the most favourable in net present value (NPV) terms (refer to Table 2).

As can be seen from the “Relative NPV to Base Option” column in Table 2, the difference in NPVs between Base Option and Options 1 is immaterial in comparison to the net present value of the options.

Table 2: NPV of credible options (NPV, $m 2018/19)

Option	Weighted NPV ($m)	Ranking	Relative NPV to Base Option ($m)
Base option	-12.46	2	-
Option 1	-12.37	1	+0.09
Option 2	-15.66	3	-3.20

Powerlink recommends the Base Option for the following reasons:

- optimised life of existing plant
- minimum upfront investment to address the risks arising from the condition of ageing assets while providing greater flexibility for future network investments.

The staged approach of this option also allows for a further review of the risks arising from the condition of the lines remaining in service prior to the second stage. This will confirm the need for remedial action is still required at that point in time.

The indicative capital cost of the RIT-T project for the preferred option is $4.55 million.

Powerlink will:

- review and refine the timing of subsequent stages of this option, if required, based on future condition assessments of the risks arising from these lines remaining in service
- review and realign the strategy of the anticipated subsequent stages of this option, if required, based on future network topology requirements to meet forecast demand in the Brisbane metropolitan area and
- undertake any necessary additional regulatory consultations at the appropriate time for future investments if required.

Submissions

Powerlink welcomes written submissions on this *Project Specification Consultation Report*. Submissions are particularly sought on the credible options presented.

Submissions are due on or before 19 February 2019.

Please address submissions to:

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1. Introduction

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

Powerlink's approach to asset management includes a commitment to sustainable asset management practices that ensure Powerlink provides a valued transmission service to its customers by managing risk,[2] optimizing performance and efficiently managing assets through the whole of asset life cycle.[3]

Under the *Electricity Act 1994*, Powerlink is required to "operate, maintain (including repair and replace if necessary) and protect its transmission grid to ensure the adequate, economic, reliable and safe transmission of electricity". The condition of the West Darra to Rocklea and South Pine to Upper Kedron transmission lines present Powerlink with a range of safety, reliability of supply and compliance risks requiring resolution.

Under the Rules, Powerlink must take action to address these risks within the RIT-T framework.

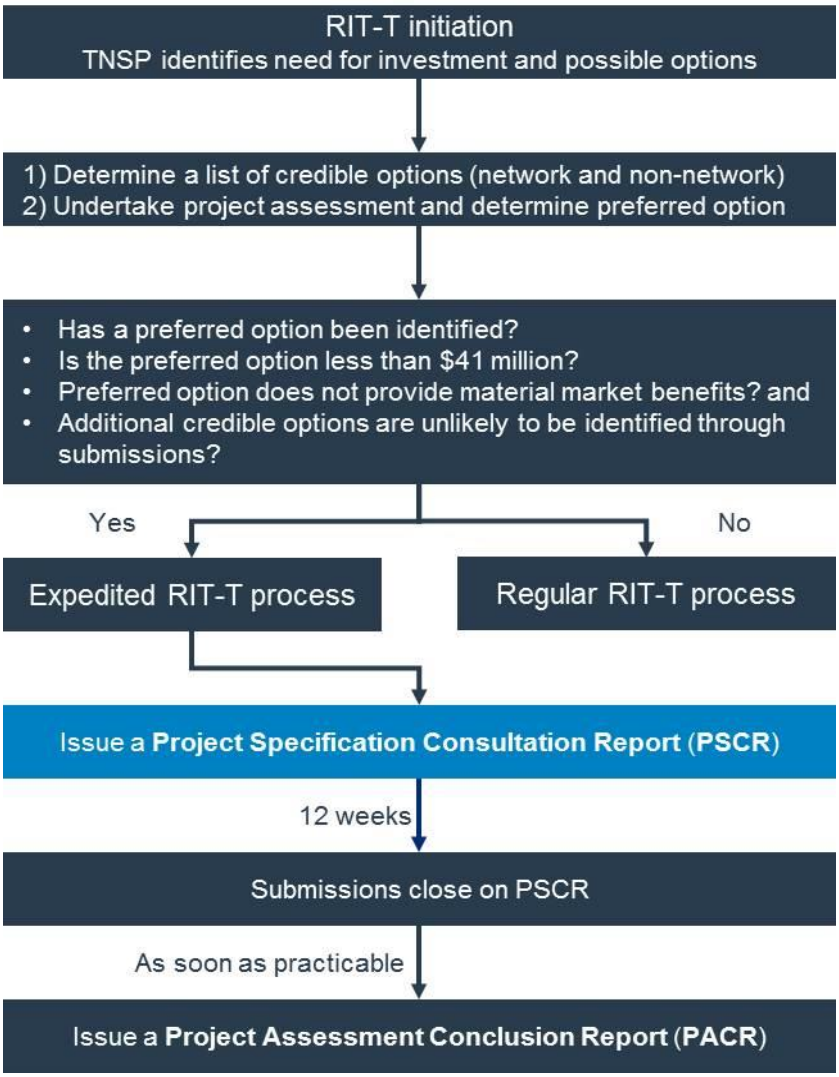
This Project Specification Consultation Report (PSCR) is the first step in the RIT-T process[4]. It:

- describes the reasons why Powerlink has determined that investment is necessary (the 'identified need'), together with the assumptions used in identifying this need
- provides potential proponents of non-network options with information on the technical characteristics that a non-network solution would need to deliver, in order to assist proponents in considering whether they could offer an alternative solution
- describes the credible options that Powerlink currently considers may address the identified need
- discusses why Powerlink does not expect certain market benefits to be material for this RIT-T[5]
- presents the NPV assessment of each of the credible options (as well as the methodologies and assumptions underlying these results)
- identifies and provides a detailed description of the credible option that satisfies the RIT-T, and is therefore the preferred option
- provides stakeholders with the opportunity to comment on this assessment so that Powerlink can refine the analysis (if required) as part of the Project Assessment Conclusion Report (PACR).

Figure 1.1 outlines the RIT-T process.

[2] Risk assessments are underpinned by Powerlink's corporate risk management framework and the application of a range of risk assessment methodologies set out in AS/NZS ISO31000:2018 *Risk Management Guidelines*.
[3] Powerlink aligns asset management processes and practices with AS ISO55000:2014 *Asset Management – Overview, principles and terminology* to ensure a consistent approach is applied throughout the life cycle of assets
[4] This RIT-T consultation has been prepared based on the following documents: *National Electricity Rules, Version 113,* 5 October 2018 and AER, *Final Regulatory Investment Test for Transmission Application Guidelines,* September 2017.
[5] As required by clause 5.16.1(c)(iv) of the Rules.

Figure 1.1: RIT-T process overview



Powerlink has adopted the expedited process for this RIT-T, as allowed for under the Rules for investments of this nature.[6]

Specifically, Powerlink is proposing to publish a PACR following public consultation on this PSCR and apply the exemption from publishing a Project Assessment Draft Report (PADR) as:

- the preferred option has an estimated capital cost of less than $41 million
- none of the credible options have material market benefits
- Powerlink has identified its preferred option in this PSCR (together with the supporting quantitative cost benefit analysis)
- Powerlink does not envisage that additional credible options which could deliver material market benefits will be identified through the submission process, given the nature of the identified need.

Powerlink will however publish a PADR if submissions to this PSCR identify other credible options that have not yet been considered and which could provide a material market benefit.

[6] In accordance with clause 5.16.4(z1) of the Rules

2. Early stakeholder engagement activities for the Brisbane metropolitan area

2.1 Powerlink's Transmission Network Forum

Each year Powerlink publishes its Transmission Annual Planning Report (TAPR), which is a major part of Powerlink's planning and direction-setting for the future. In addition, Powerlink utilises the TAPR as a primary vehicle to engage and understand broader consumer, customer and industry views on key topics as part of the annual Transmission Network Forum (TNF).

In July 2015 Powerlink's TNF included an interactive session with a broad range of stakeholders to seek feedback and understand their views in relation to addressing the risks arising from the condition of the transmission lines in the Brisbane metropolitan area. Forum participants suggested that low cost, innovative maintenance techniques to keep the transmission lines safely in service, retaining current easements, until future demand growth was better understood, was the preferred way forward.

Powerlink has continued to signal in subsequent TAPRs that potential reinvestment (network or non-network) will be required to address the risks arising from the condition of the transmission lines in the Brisbane metropolitan area (refer to section 4).

3. Identified need

This section provides an overview of the existing 110kV supply arrangements in the Brisbane metropolitan area, Powerlink's statutory obligations in relation to the supply of electricity and details of the most recent condition assessment of the West Darra to Rocklea and South Pine to Upper Kedron transmission lines.

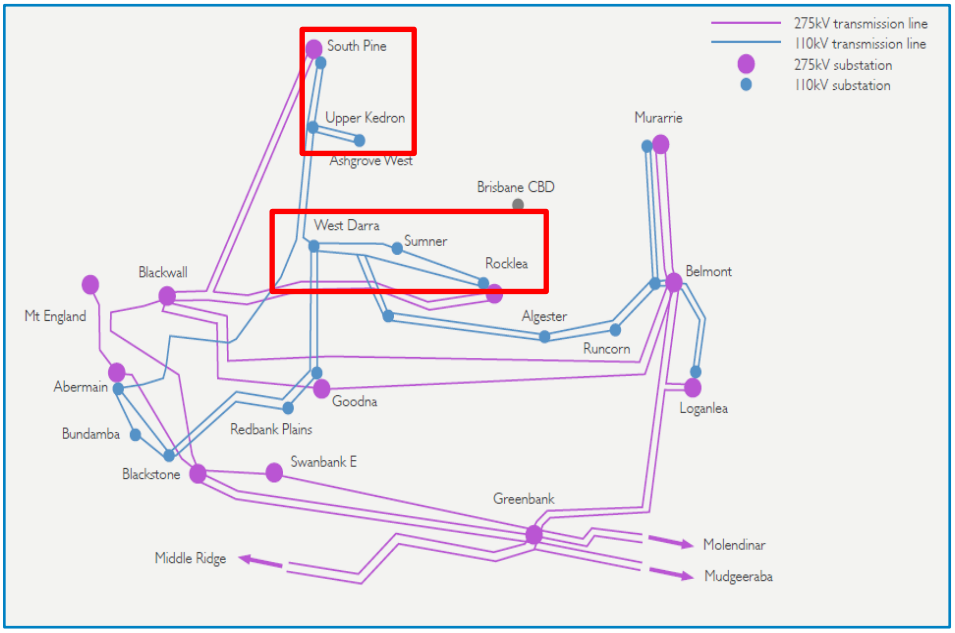
3.1 Geographical and network overview

The West Darra to Rocklea and South Pine to Upper Kedron transmission lines are 110kV double circuit lines that form part of the Greater Brisbane transmission network in the Moreton transmission zone[7], with the South Pine and Rocklea Substations providing the high voltage injection points for the western part of the Greater Brisbane area. Originally commissioned in 1963 the lines consist of 68 galvanised steel lattice towers with a combined route length of 22.5 kilometres.

They traverse a mixture of semi-rural, suburban and industrial land uses, as well as crossing the Centenary Highway and the Ipswich train line.

The relevant transmission network is shown in Figure 3.1.

Figure 3.1: Greater Brisbane transmission network



3.2 Description of identified need

With peak demand in the areas serviced by these lines forecast to remain steady for the next 10 years[8], it is critical that supply is maintained in the Brisbane metropolitan area, and for Powerlink to continue to meet its reliability of supply obligations.

Powerlink's condition assessment of the transmission lines has highlighted that at over 50 years of age, the majority of structures are exhibiting signs of degradation, which if not addressed will lead to increased safety and network risks.

3.3 Assumptions underpinning the identified need

The need to invest is driven by the risks arising from the condition of ageing structures on the West Darra to Rocklea and South Pine to Upper Kedron transmission lines, for which Powerlink has legal compliance obligations under the Rules and jurisdictional instruments.

[7] This relates to the standard geographic definitions (zones) identified within the Powerlink's Transmission Annual Planning Report, (TAPR) which is published annually by 30 June.
[8] Powerlink Transmission Annual Planning Report 2018

Planning studies have confirmed an enduring need for the West Darra to Rocklea and South Pine to Upper Kedron transmission lines to ensure Powerlink is able to meet its jurisdictional reliability standards within the Greater Brisbane transmission network.

At over 50 years of age the West Darra to Rocklea and South Pine to Upper Kedron transmission lines are exhibiting signs of degradation; presenting a potential risk to the ongoing safe, reliable and economic supply of electricity into the Brisbane metropolitan area.

The consequence of not addressing these condition-based risks is that the asset condition will continue to decline at an accelerated rate. In the short term, this leads to additional works to rectify the condition and address the resulting risks. Under the worst case scenario, components of the asset will ultimately fail with the potential to result in public safety and network reliability risks.

It follows that the consequences of failure combined with the increasing cost of remedial action compels Powerlink to undertake reliability corrective actions on the West Darra to Rocklea and South Pine to Upper Kedron transmission lines if it is to continue to meet the reliability standards set out in the Rules and Powerlink's Transmission Authority[9].

3.4 Description of asset condition and risks

The 110kV West Darra to Rocklea and South Pine to Upper Kedron transmission lines were constructed in the early 1960s to service a growing demand for electricity supply in the greater Brisbane area. Today much of the original easement is bordered by urban development, with the lines now crossing a number of major urban roads, business premises and large car parks.

The transmission lines are located in a semi-tropical environment and subject to the conditions of both a highly industrial and dense urban environment bordering major road and rail corridors.

Advanced corrosion to the overhead earth wire attachment points and hardware is increasing the risk of these transmission lines failing, potentially heightening the risk to public safety and causing the lines to trip. Depending upon the location of the failure, emergency repairs could require the closure of major transport corridors.

The earth wires are also not sufficiently rated to cater for the continuing growth in forecast fault levels over time, increasing the risk of the earth wires failing during a fault condition.

The sacrificial galvanised coating on several low lying foundation interfaces has also completely broken down, exposing the underlying steel to the environment. If not addressed, this exposed steel will corrode at an accelerated rate, losing cross-sectional area and structural strength. This ultimately renders the foundation interfaces far more susceptible to failure during severe wind conditions.

The structures' original nuts and bolts, conductor hanger brackets and approximately 0.5% of light members will also reach the end of their technical service lives within the next 5 years. Beyond this time they will begin to deteriorate to the point where they become a structural risk or less suitable for remedial work. A failure of a hanger bracket can lead to a conductor dropping resulting in electricity transmission failure and high risk safety consequences for the public.

Climbing step bolts are also exhibiting corrosion and fail to meet current requirements as an attachment point for fall arrest devices.

The heavy tower members remain in good condition.

The lines' conductors are in good condition and are appropriately rated when considered against the current demand forecast. They are expected to reach the end of their technical service life in 2043, triggering the need to replace the structures as they do not meet the current design standards[10] with respect to the loads and stresses applied during conductor re-stringing.

[9] Schedule 5.1a System Standards and 5.1.2 Network Reliability of the Rules, and Queensland Transmission Authority T01/98
[10] AS/NZS 7000:2010 Australia/New Zealand Standard, Overhead line design – Detailed procedures

4. Required technical characteristics for non-network options

The information provided in this section is intended to enable interested parties to formulate and propose genuine and practicable non-network solutions such as, but not limited to, local generation and Demand Side Management (DSM) initiatives.

Powerlink identified in its Transmission Annual Planning Reports (TAPRs) 2015 to 2018, an expectation that action would be required on the West Darra to Rocklea and South Pine to Upper Kedron transmission lines to maintain reliability of supply to the Brisbane metropolitan area.[11]

Powerlink has consulted with Registered Participants, Powerlink's Non-Network Engagement Stakeholder Register and interested parties on the proposed investment on this transmission line as part of the TAPR publication and associated engagement activities. No submissions proposing credible and genuine non-network options were received from prospective solution providers in the normal course of business or in response to the TAPRs. As a result, Powerlink is currently not aware of any non-network options that could be adopted, but will investigate the feasibility of any potential non-network option proposed or otherwise identified.

This PSCR provides a further opportunity for providers of feasible non-network options to submit details of their proposals for consideration.

4.1 Criteria for proposed network support services

A non-network solution that avoids life extension and/or replacement of the West Darra to Rocklea and South Pine to Upper Kedron transmission lines would need to replicate the capacity and reliability of the lines on an enduring basis at a cost that is lower than the network options currently under consideration.

Any non-network solution to supply the load to the Brisbane metropolitan area would require injection to the 110kV network of over 150MW at peak for the south western suburbs of Brisbane through the Richland and Sumner substations and over 150MW at peak for part of the Brisbane CBD and inner western suburbs of Brisbane via the South Pine and Upper Kedron lines[12].

Powerlink has identified the following common criteria that must be satisfied if any proposed non-network solutions are to meet supply requirements[13].

Size and location

- Proposed solutions must be large enough, individually or collectively, to provide the size of injection or demand response set out above. However, the level of support is dependent on the location, type of network support and load forecasts.
- Due to the bulk nature of the transmission network, aggregation of sub 10MW non-network solutions will be the sole responsibility of the non-network provider.
- Notwithstanding the location of any solution, each proposal would require assessment in relation to technical constraints pertinent to the network connection, such as other intra-regional transfer limits, fault level or quality of supply impacts of operation.

[11] This relates to the standard geographic definitions (zones) identified within the *Powerlink's Transmission Annual Planning Report*,, which is published annually by 30 June.
[12] Energex connection point forecast of summer medium growth native maximum demand.
[13] Powerlink's Network Support Contracting Framework has been developed as a general guide to assist potential non-network solution providers. This framework outlines the key contracting principles that are likely to appear in any Powerlink non-network support agreement.

Operation

- A non-network option would need to be capable of operating continuously 24 hours per day on an ongoing basis.
- If a generation service is proposed (either standalone or in conjunction with other services), such operation will be required regardless of the pool price.[14]
- Proponents of generation services are advised that network support payments are intended for output that can be demonstrated to be additional to the plant's normal operation in the NEM.
- Where there are network costs associated with a proposed non-network option, including asset decommissioning, these costs will form part of the option economic assessment.

Reliability

- Proposed services must be capable of reliably meeting electricity demand under a range of conditions and, if a generator must meet all relevant National Electricity Rules requirements related to grid connection.
- Powerlink has obligations under the National Electricity Rules, its Transmission Authority and connection agreements to ensure supply reliability is maintained to its customers. Failure to meet these obligations may give rise to liability. Proponents of non-network options must also be willing to accept any liability that may arise from its contribution to a reliability of supply failure.

Timeframe and certainty

- Proposed services must be able to be implemented in sufficient time to meet the identified need using proven technology and, where not already in operation, provision of information in relation to development status such as financial funding and development timeline to support delivery within the required timeframe must be provided.

Duration

- The agreement duration for any proposed service will provide sufficient flexibility to ensure that Powerlink is pursuing the most economic long run investment to address the risks arising from the ageing West Darra to Rocklea and South Pine to Upper Kedron transmission lines.

Powerlink welcomes submissions from potential proponents who consider that they could offer a credible non-network option that is both economically and technically feasible.

[14] The National Electricity Rules prevent a generator that is providing network support from setting the market price.

5. Potential credible options to address the identified need

Powerlink has developed three credible network options to address the identified need for maintaining the reliability of supply to the Brisbane metropolitan area.

- Base Option – Two stage refit by 2028, replacement by 2043
- Option 1 - Refit by 2020, replacement by 2043
- Option 2 – Minor refit by 2020, replacement by 2028

Table 5.1 Summary of Credible Options

Option	Description	Indicative capital cost ($million, 2018/19)	Indicative annual O&M costs ($million, 2018/19)
Base Option: Two stage refit by 2028, replacement by 2043	Repair or replace selected components, by December 2020*	4.55*	0.037
	Repair or replace selected components, including members, by December 2028†	8.47†	
	Rebuild lines by December 2043†	22.53†	
Option 1: Refit by 2020, replacement by 2043	Repair or replace at risk components, including members, by December 2020*	10.25*	0.038
	Rebuild lines by December 2043†	22.53†	
Option 2: Minor refit by 2020, replacement by 2028	Repair or replace selected components, by December 2020*	4.55*	0.043
	Rebuild lines by December 2028†	22.53†	

* Proposed RIT-T project
† Modelled project

The work to be committed under each option as a result of this RIT-T is identified as a 'proposed RIT-T project'; while future planned projects included in the economic analysis to provide a complete view of the options are identified as 'modelled projects'.

All of the credible options address the identified need and are expected to be technically and economically feasible. They address the identified need in a timely manner and avoid a situation where corrective maintenance of ageing assets is no longer practical.

None of these options has been discussed by the Australian Energy Market Operator (AEMO) in its most recent National Transmission Network Development Plan (NTNDP)[15].

Additional options that have been considered but not progressed, for technical or economic reasons, are listed in Appendix 1.

5.1 Selection of a Base Option

Powerlink has undertaken this RIT-T assessment using a Base Option that reflects the conventional approach that would otherwise be implemented by Powerlink to ensure ongoing compliance with the Rules. This base option provides a benchmark against which to assess other credible options.

[15] Clause 5.16.4(b)(4) of the Rules requires Powerlink to advise whether the identified need and or solutions are included in the most recent NTNDP. The 2016 NTNDP is currently the most recent NTNDP.

5.2 Base Option: Two stage refit by 2028, replacement by 2043

Powerlink is the proponent of this option.

This option involves remedial repair of 54 low-lying and corroded tower leg-foundation interfaces along with the replacement of 6% of structure nuts and bolts, as well as all overhead earth wires and all climbing step bolts, plus earthing improvements to 48 structures, by December 2020.

Repairs are then made to 26 low-lying and corroded tower leg-foundation interfaces, along with the replacement of the balance of all nuts and bolts, 0.5% of light members and 400 hanger brackets by December 2028.

The lines are then rebuilt in 2043.

This option maximises the technical service life of the existing structures and addresses the immediate risks arising from those components with the highest possibility of failure with a minimal upfront cost.

Table 5.2: Main project components for the Base Option

Option Stage	Description	Indicative cost ($million, 2018/19)
RIT-T project		
Refit by December 2020	Repair selected components, including 54 tower legs; replace 6% of structure nuts and bolts, plus all earth wires and all climbing step bolts. Upgrade earthing of 48 structures.	4.55
Modelled capital projects		
Refit by December 2028	Repair 26 tower legs; replace 0.5% of light members and balance of structure nuts and bolts, plus 400 hanger brackets	8.47
Rebuild by December 2043	Rebuild lines	22.53
TOTAL		**35.55**

5.3 Option 1: Refit by 2020, replacement by 2043

Powerlink is the proponent of this option.

Option 1 involves the repair of selected components, including 80 tower legs, along with the replacement of all nuts and bolts, 0.5% of light members, all earth wires and all climbing step bolts, along with earthing improvements to 48 structures, by December 2020.

The lines, including conductors, are then replaced by December 2043.

This option seeks to optimise the life of existing structures and reduce the number of mobilisations required to complete all future required work.

Table 5.3 Main project components for Option 1

Option Stage	Detailed Description	Indicative cost ($million, 2018/19)
RIT-T project		
Refit by December 2020	Repair selected components, including 80 tower legs; replace all structure nuts and bolts, all earth wires, all climbing step bolts, 400 hanger brackets and 0.5% of light members. Upgrade earthing of 48 structures.	10.25
Modelled capital project		
Rebuild by December 2043	Rebuild lines	22.53
TOTAL		**32.78**

5.4 Option 2: Minor refit by 2020, replacement by 2028

Powerlink is the proponent of this option.

Option 2 involves an initial repair of selected components of the lines by December 2020 to address the immediate risks arising from the most degraded components. This work includes the repair of 54 tower legs, along with the replacement of 6% of the most corroded nuts and bolts on the lines, all earth wires and all climbing step bolts, along with earthing improvements to 48 structures.

This is then followed by a full line rebuild to be completed by December 2028.

This option seeks to address the immediate risks arising from those components with the highest possibility of failure with a minimal upfront cost and reduces the number of mobilisations required to complete all future required work.

Table 5.4: Main project components for Option 2

Option Stage	Detailed Description	Indicative cost ($million, 2018/19)
RIT-T project		
Minor refit by December 2020	Repair selected components, including 54 tower legs; replace 6% of structure nuts and bolts, all earth wires and all climbing step bolts. Upgrade earthing of 48 structures.	4.55
Modelled capital project		
Rebuild by December 2028	Rebuild lines	22.53
TOTAL		**27.08**

5.5 Material inter-network impact

Powerlink does not consider that any of the credible options being considered will have a material inter-network impact, based on AEMO's screening criteria[16].

[16] In accordance with Rules clause 5.16.4(b) (6) (ii). AEMO has published guidelines for assessing whether a credible option is expected to have a material inter-network impact.

6. Materiality of market benefits

Powerlink does not consider that the proposed West Darra to Rocklea and South Pine to Upper Kedron transmission line projects would provide any material market benefits due to the nature of the asset. The AER has recognised that if the proposed investment will not have an impact on the wholesale market, then a number of classes of market benefits will not be material in the RIT-T assessment, and so do not need to be estimated.[17]

6.1 Market benefits that are not material for this RIT-T assessment

A discussion of each market benefit under the RIT-T is included below:

- **changes in patterns of generation dispatch**: life extension or like for like replacement does not in itself affect transmission network constraints or affect transmission flows that would change patterns of generation dispatch. It follows that changes in patterns of generation dispatch are not material to the outcome of the RIT-T assessment
- **changes in voluntary load curtailment**: life extension or like for like replacement does not in itself 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 involuntary load shedding**: life extension or like for like replacement under the credible options considered are unlikely to result in changes to involuntary load shedding
- **changes in costs for other parties**: the effect of life extension or like for like replacement under the credible options considered are localised to the western Brisbane metropolitan area 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**: life extension or like for like replacement of the transmission line 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**: credible options are not expected to provide any changes in network losses as the refit/replacement will 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 the credible options under consideration. These costs are therefore not material to the outcome of the RIT-T assessment
- **competition benefits:** Powerlink does not consider that any of the credible options 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 options 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.

6.2 Consideration of market benefits for non-network options

Powerlink notes that non-network options may impact the wholesale electricity market (for example by displacing generation output). Accordingly, it is possible that several of the above classes of market benefits may be material where there are credible non-network options, depending on the technical characteristics of the non-network option.

Where credible non-network options are identified as part of the consultation process on this PSCR, Powerlink intends on assessing the materiality of market benefits arising from these options. Where the market benefits are considered to be material, these will be quantified as part of the RIT-T assessment of these options.

[17] AER, *Final Regulatory Investment Test for Transmission Application Guidelines,* June 2010, version 1, page 15.

7. General modelling approach adopted to assess net benefits

7.1 Analysis period

The RIT-T analysis has been undertaken over a 30-year period, from 2019 to 2048. A 30-year period takes into account the size and complexity of the transmission line refit and replacement program.

As the replacement plant will have differing residual values by 2048 under each option, terminal values have been calculated to offset these variations.

7.2 Discount rate

Under the RIT-T, a commercial discount rate is applied to calculate the net present value (NPV) of costs and benefits of credible options. Powerlink has adopted a real, pre-tax commercial discount rate of 7.04%[18] as the central assumption for the NPV analysis presented in this report.

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 3.47%[19] and an upper bound discount rate of 10.61% (i.e. a symmetrical upwards adjustment).

7.3 Description of reasonable scenarios

The RIT-T analysis is required to incorporate different reasonable scenarios to estimate market benefits. The scenarios must be appropriate to the credible options under consideration.

The choice of reasonable scenarios must reflect any variables or parameters that are likely to affect the ranking of the credible options, where the identified need is reliability corrective action[20].

Powerlink has considered capital costs and discount rate sensitivities individually and in combination and found that only the discount rate affects option rankings. Powerlink has therefore adopted three scenarios based on high, low and central estimates of the discount rate.

As all cash-flows being discounted relate to regulated network costs and there are no material market benefits identified, Powerlink has applied weightings to the final NPV ranking that reflect that the low discount rate scenario is the most appropriate for the discounting of costs. Notwithstanding this, any credible non-network options identified during the PSCR consultation process will be modelled accordingly and weightings amended as necessary.

Table 7.1: Reasonable scenarios adopted

Key variable/ parameter	Low discount rate scenario	Central discount rate scenario	High discount rate scenario
Discount rate	3.47%	7.04%	10.61%
NPV Weighting	0.6	0.3	0.1

[18] The indicative commercial discount rate is calculated on the assumption that a private investment in the electricity sector would hold an investment grade credit rating, a return on equity and a debt gearing ratio equal to an average firm on the Australian stock exchange.
[19] A discount rate of 3.47 per cent is based on the AER's Final Decision for Powerlink's 2017-2022 transmission determination, which allowed a nominal vanilla WACC of 6.0 per cent and forecast inflation of 2.45 per cent that implies a real discount rate of 3.47 per cent. See AER, *Final Decision: Powerlink transmission determination 2017-2022 | Attachment 3 – Rate of return*, April 2017, p 9.
[20] AER, *Final Regulatory Investment Test for Transmission*, June 2010, version 1, paragraph 16, p. 7

8. Cost benefit analysis and identification of the preferred option

8.1 Net present values

Table 8.1 outlines the NPV for each credible option under the high, central and low discount rate scenarios as well as under the weighted scenario.

Table 8.1: NPV for each credible option ($m, 2018/19)

Option	Description	High Scenario	Central Scenario	Low Scenario	Weighted
Base Option	Two stage refit by 2028, replacement by 2043	-8.58	-10.83	-13.92	-12.46
Option 1	Refit by 2020, replacement by 2043	-10.17	-11.49	-13.17	-12.37
Option 2	Refurbishment by 2020, replacement by 2028	-12.37	-14.77	-16.66	-15.66

The Base Option is ranked first in NPV terms for the high and central scenarios, while Option 1 is ranked first for the low and weighted scenarios.

Table 8.2 shows more detail on the comparison of the NPVs under the weighted scenario for each option relative to the Base Option as well as the corresponding ranking of each option.

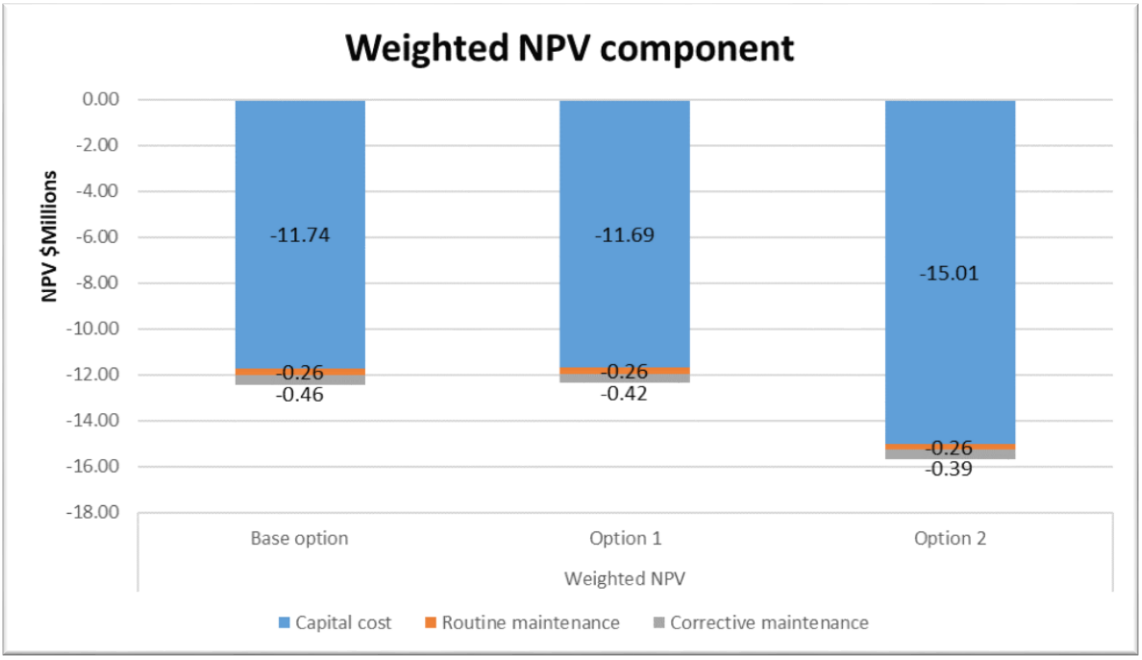
Table 8.2: Weighted NPV for each credible option, NPV relative to the Base Option (NPV $m, 2018/19) and Option Ranking

Option	Description	Weighted NPV	NPV relative to Base Option	Ranking
Base Option	Two stage refit by 2028, replacement by 2043	-12.46	-	**2**
Option 1	Refit by 2020, replacement by 2043	-12.37	+0.09	**1**
Option 2	Refurbishment by 2020, replacement by 2028	-15.66	-3.20	**3**

Under the weighted scenario, Option 1 is ranked first in NPV terms, followed closely by the Base Option.

Figure 8.1 provides a breakdown of capital, maintenance and operational costs for each option under the weighted scenario. It can be seen that all options have similar maintenance costs, though the Base Option has a relatively higher maintenance cost when compared to Option 1 due to the deferral of the more substantial refit program to a later stage. Option 1 has the lowest capital cost component, though it is of a similar magnitude to the Base Option.

Figure 8.1: Weighted NPV component for each credible option (NPV $m, 2018/19)



8.2 Sensitivity analysis

Powerlink has investigated the following sensitivities on key assumptions:

- a lower discount rate of 3.47% as well as a higher rate of 10.61% (see Figure 8.2)
- a 25% increase/decrease in capital costs (see Figure 8.3).

Sensitivity analysis for the NPV relative to the Base Option shows that varying the discount rate impacts the ranking, whereas varying the capital cost has no impact on the preferred option.

For a discount rate of less than 5.25%, Option 1 is identified as the preferred option. For discount rates greater than 5.25%, the Base Option is identified as the preferred option.

Figure 8.2: Sensitivity Analysis for Discount Rate

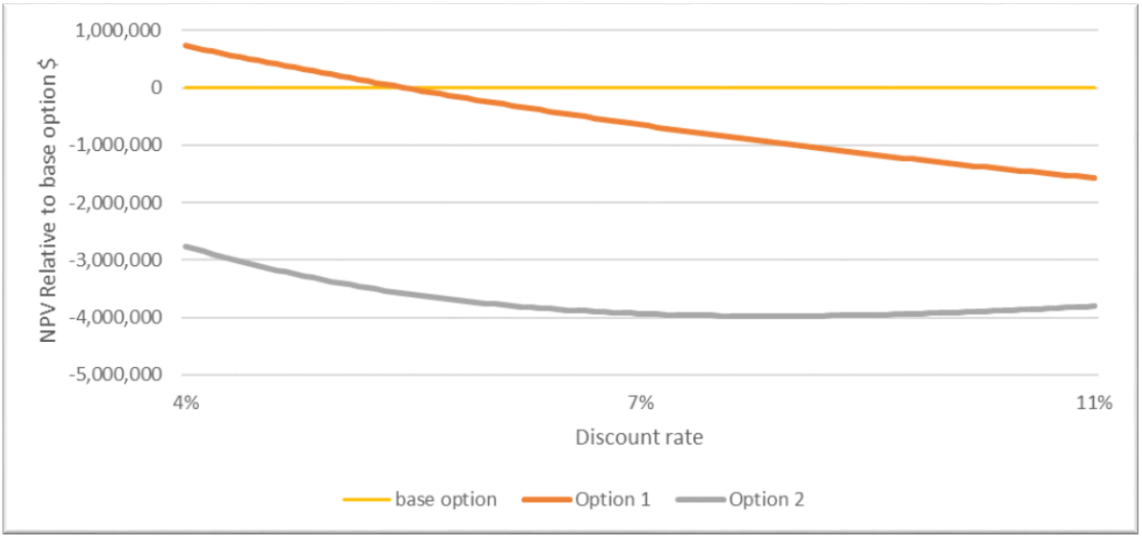
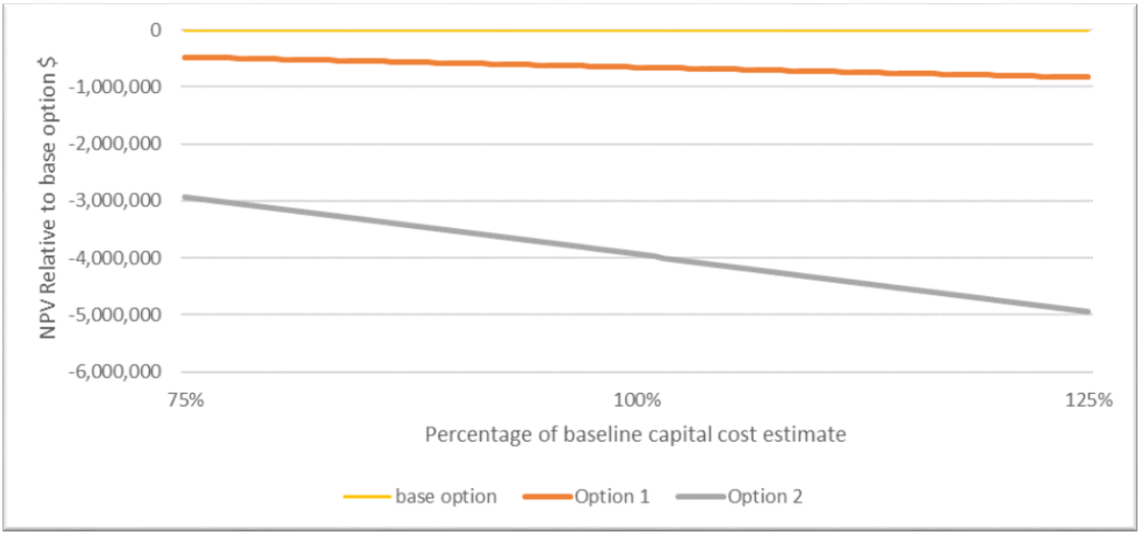


Figure 8.3: Sensitivity Analysis for Capital Cost



8.3 Conclusion

The result of the cost benefit analysis indicates that the difference in NPVs between the Base Option and Option 1 is immaterial in comparison to the total NPV of the options.

Option 1 leads the ranking in NPV terms under the weighted discount scenario, with the Base Option ranking second (Option 1 is $0.09m less expensive compared with Base Option under the weighted scenario). However, this difference is considered immaterial when considering the size and complexity of the investment. In addition, the Base Option is preferred under a broader spectrum of scenarios (both the high and central scenarios).

Therefore, both the Base Option and Option 1 can be considered as satisfying the requirement of the RIT-T.

9. Draft recommendation.

Based on the conclusions resulting from the NPV analysis and the Rules requirements relating to the proposed replacement of transmission network assets, it is recommended that the Base Option be implemented to address the risks arising from the ageing transmission line assets from West Darra to Sumner, Rocklea to Sumner and South Pine to Upper Kedron.

Under the preferred option, design work for the initial refit will commence in early 2019, with on-site work being completed by December 2020.

It is proposed that the highest at risk components on the lines will be addressed under this RIT-T project in 2020, with a second refit project proposed in 2028 and full replacement in 2043.

This is the most prudent strategy as it delivers the lowest cost method of addressing the highest 'at risk' components, maintaining network reliability, while providing flexibility for the development of future options across a range of plausible futures.

Powerlink will at a later date:

- review and refine the timing of subsequent stages of this option, if required, based on future condition assessments of the risks arising from these lines remaining in service
- review and realign the strategy of the anticipated subsequent stages of this option, if required, based on future network topology requirements to meet forecast demand in the Brisbane metropolitan area and
- undertake any necessary additional regulatory consultations at the appropriate time for future investments if required.

The indicative capital cost of the RIT-T project for the preferred option is $4.55 million in 2018/19 prices.

10. Submissions requirements

Powerlink invites submissions and comments in response to this PSCR from Registered Participants, AEMO, potential non-network providers and any other interested parties.

Submissions should be presented in a written form and should clearly identify the author of the submission, including contact details for subsequent follow-up if required. If parties prefer, they may request to meet with Powerlink ahead of providing a written response.

10.1 Submissions from non-network providers

This is not a tender process – submissions are requested so that Powerlink can fulfil its regulatory obligations to analyse non-network options. In the event that a non-network option appears to be a genuine and practicable alternative that could satisfy the RIT-T, Powerlink will engage with that proponent or proponents to clarify cost inputs and commercial terms.

Submissions from potential non-network providers should contain the following information:

- details of the party making the submission (or proposing the service)
- technical details of the project (capacity, proposed connection point if relevant, etc.) to allow an assessment of the likely impacts on future supply capability
- sufficient information to allow the costs and benefits of the proposed service to be incorporated in a comparison in accordance with AER RIT-T guidelines
- an assessment of the ability of the proposed service to meet the technical requirements of the Rules
- timing of the availability of the proposed service
- other material that would be relevant in the assessment of the proposed service.

As the submissions will be made public, any commercially sensitive material, or material that the party making the submission does not want to be made public, should be clearly identified.

It should be noted that Powerlink is required to publish the outcomes of the RIT-T analysis. If parties making submissions elect not to provide specific project cost data for commercial-in-confidence reasons, Powerlink may rely on cost estimates from independent specialist sources.

10.2 Assessment and decision process

Powerlink intends to carry out the following process to assess what action, if any, should be taken to address future supply requirements:

Part 1	PSCR Publication	22 November 2018
Part 2	Submissions due on the PSCR Have your say on the credible options and propose potential non-network options.	19 February 2019
Part 3	Publication of the PACR Powerlink's response to any further submissions received and final recommendation on the preferred option for implementation.	March 2019

Powerlink reserves the right to amend the timetable at any time. Amendments to the timetable will be made available on the Powerlink website (www.powerlink.com.au).

Appendix 1: Options considered but not progressed

Option description	Reason for not progressing option
Retire from service the 110kV transmission line between South Pine and Upper Kedron and establish a new Upper Kedron 275/110kV injection point.	The performance of the 110kV transmission network was tested with a new injection point at Upper Kedron. The result of the study shows significant overload between Upper Kedron to Ashgrove and on the EQL-Energex feeders between Rocklea and Ashgrove West under contingency conditions. This option is not technically feasible because it does not meet Powerlink's mandated planning criteria

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