



Powerlink Queensland

Project Assessment Draft Report

25 January 2019

Maintaining reliability of supply to the Rockhampton area

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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 presents the results of the NPV analysis of the credible network options proposed in the PSCR, along with any credible non-network options received and nominates a preferred option based upon this analysis. The document also seeks feedback on the preferred option along with any further information from potential proponents of feasible non-network options to address the identified need.

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Executive Summary

Overview

The Egans Hill to Rockhampton transmission line is a 132kV double circuit line commissioned in 1963 that forms part of the connection between Powerlink's Bouldercombe and Rockhampton substations. It provides a critical link into the Rockhampton Substation which is a major injection point for the Rockhampton and surrounding area distribution network.

The transmission line between Egans Hill and Rockhampton is nearing the end of its technical service life, with the majority of structures on the transmission line exhibiting signs of degradation. Specifically, loss of the galvanising on members, the onset of early corrosion to nuts, bolts and hardware, and the decay of grillage foundations, all increase the risk of mechanical failure of components of the transmission line, particularly in storm and cyclonic conditions. This presents a risk to the ongoing safe, reliable and economic supply of electricity into Rockhampton and the surrounding area.

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.

Powerlink is required to apply the RIT-T to this proposed investment, which is driven by an obligation under the Rules, and is classified as a 'reliability corrective action' under the RIT-T.

This Project Assessment Draft Report (PADR) has been prepared as part of a prescribed process under the National Electricity Rules (the Rules) for the proposed transmission investment. It contains the results of the planning investigation and cost benefit analysis of credible options.

Options considered

Powerlink published a Project Specification Consultation Report (PSCR) to Registered Participants, the Australian Energy Market Operator (AEMO) and interested parties in September 2018 with respect to maintaining reliability of supply to the Rockhampton area. The PSCR invited submissions of credible non-network options to replicate the support that the Egans Hill to Rockhampton transmission line provides both Powerlink and Ergon Energy in meeting the Rule's reliability obligations on an enduring basis.

No submissions were received in response to the PSCR that closed on 24 December 2018. As a result, no additional credible options, that could deliver a material market benefit, have been identified as a part of the PSCR Stage of this RIT-T consultation.

Powerlink proposed four credible network options in the PSCR to address the identified condition-based need on the Egans Hill to Rockhampton transmission line.

The Base Option reflects a conventional approach to ensuring continued compliance with the Rules' obligations and has been selected to serve as the basis of comparison between options. The current line would be partially refitted by 2020, maintained for 10 years and then replaced with a new line in 2030.

This option has then been compared with three other options where rebuilding of the entire line is deferred until 2044 under a number of interim strategies. This latest date for the replacement of the transmission line is determined by the expected end of technical service life of the conductors of the line.

A summary of the credible options is given in Table 1.

Table 1: Summary of credible options

Option	Description	Indicative capital cost (\$million, 2018/19)	Indicative annual O&M costs (\$million, 2018/19)
Base Option: Partial refit by December 2020. Rebuild by December 2030	Minimalist refit of line without painting by December 2020*	8.08*	0.112
	Rebuild entire line by December 2030†	24.85†	
Option 1: Staged life extension by December 2020 and December 2030. Rebuild by December 2044	Refit and paint northern section of the line by December 2020*	9.98*	0.071
	Refit without painting the southern section by December 2020*		
	Minimalist refit and paint of the southern section by December 2030†	2.30†	
	Rebuild entire line by December 2044†	24.85†	
Option 2: Life extension by December 2020. Rebuild by December 2044.	Refit and paint entire line by December 2020*	12.48*	0.041
	Rebuild entire line by December 2044†	24.85†	
Option 3: Partial rebuild and life extension by December 2020. Rebuild of balance by December 2044.	Rebuild southern section of the line by December 2020*	14.49*	0.015
	Refit and paint northern section of the line by December 2020*		
	Rebuild northern section of line by December 2044†	16.02†	

* Proposed RIT-T project

† Modelled project

Evaluation and Conclusion

The RIT-T requires that the preferred option maximises the present value of the net economic benefit to all those who produce, consume and transport electricity in the market compared to other credible options.

The difference between the options relates primarily to the timing of the investments, all of which culminate in the rebuilding of the line. Under the Base Option the entire line is rebuilt in 2030, while under Options 1 and 2, it is rebuilt by 2044. Under Option 3 the southern section is rebuilt by 2020 and the northern by 2044.

Due to the nature of the investment, none of the credible options considered, including the preferred option, are expected to give rise to material market benefits. Table 2 shows the Net Present Value (NPV) of all options.

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

Option	Central Scenario NPV	Ranking
Base option	-17.05	4
Option 1	-11.78	1
Option 2	-12.89	2
Option 3	-15.22	3

This PADR includes a draft recommendation to implement Option 1 as the preferred option based on the following:

- least cost option in NPV terms
- optimised service life of the current asset
- complete rebuild deferred until 2044.

The three-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 subsequent stages. This will confirm if 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 \$9.98 million in 2018/19 prices.

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 Rockhampton 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 Assessment Draft Report'. Submissions are particularly sought on the credible options presented.

Submissions are due on or before Friday 15 March 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. This 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,¹ optimizing performance and efficiently managing assets through the whole of asset life cycle.²

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 Egans Hill to Rockhampton transmission line is nearing the end of its technical service life, which presents a risk to the ongoing safe, reliable and economic supply of electricity into Rockhampton and the surrounding area. Under the Rules, Powerlink must take action to address this risk within the RIT-T framework.

This Project Assessment Draft Report (PADR) is the second step in the RIT-T process³. 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 a summary of the submissions to the Project Specification Consultation Report (PSCR)
- describes the credible options that Powerlink currently considers may address the identified need
- discusses why Powerlink does not expect market benefits to be material for this RIT-T⁴
- presents the Net Present Value (NPV) economic assessment of each of the credible options (as well as the methodologies and assumptions underlying these results)
- identifies and provides a detailed description, including the estimated construction timetable and commissioning date, 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 Conclusions Report (PACR).

Figure 1.1 outlines the RIT-T process

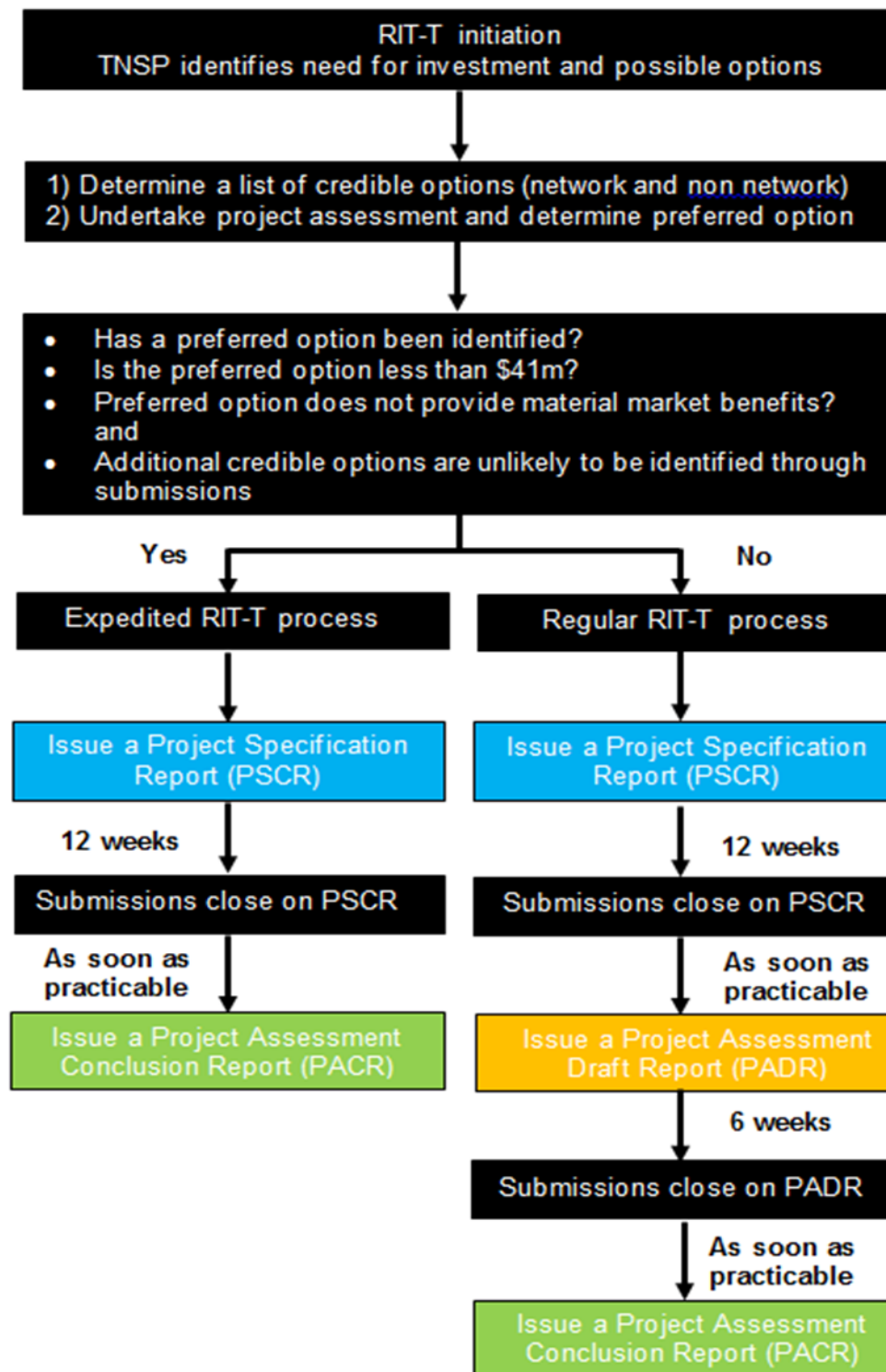
¹ Risk assessments are underpinned by Powerlink's corporate risk management framework and the application of a range of risk assessment methodologies set out in AS/NZS ISO31000:2018 *Risk Management Guidelines*.

² 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

³ This RIT-T consultation was commenced in September 2018 and has been prepared based on the following documents: *National Electricity Rules, Version 112*, 18 September 2018 and AER, *Final Regulatory Investment Test for Transmission Application Guidelines*, September 2017.

⁴ As required by clause 5.16.1(c)(iv) of the Rules.

Figure 1.1: RIT-T process overview



This RIT-T meets the requirements to apply the expedited process. However, as Powerlink has proposed transmission line refit work as a credible option for the first time under the RIT-T process, Powerlink considers that this warrants additional opportunity for engagement and consultation with Registered Participants, the Australian Energy Market Operator (AEMO), consumers and interested parties. As such, exemption from issuing a PADR was not sought.

2. Stakeholder engagement activities

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.

Powerlink identified in its Transmission Annual Planning Report (TAPR) from 2015 to 2018, an expectation that action would be required on the Egans Hill to Rockhampton transmission line to maintain reliability of supply to Rockhampton.⁵ No submissions proposing credible and genuine non-network options were received from prospective solution providers in the normal course of business, in response to the TAPRs or as part of the forums.

2.2 Powerlink's RIT-T engagement process

In the context of engagement activities with customers and consumers, and taking into consideration the risks arising from the identified need, Powerlink takes a proportionate approach to ensure a suitable level of engagement is undertaken for each RIT-T. Please visit [Powerlink's website](#) for more information on the types of engagement activities which may be undertaken during the consultation process (and earlier where necessary). These activities focus on enhancing the value and outcomes of the RIT-T engagement process for customers and consumers.

2.3 Customer Panel

Powerlink's Customer Panel provides a face-to-face forum for customers and consumer representative bodies to give their input and feedback about Powerlink's decision making, processes and methodologies. It also provides Powerlink with another avenue to keep customers and consumers better informed, and to receive feedback about topics of relevance, particularly RIT-Ts. The Customer Panel is briefed quarterly on up and coming Powerlink RIT-Ts and considers advice received in preparing the RIT-T consultation documentation. The Customer Panel was advised of the RIT-T consultation for maintaining the reliability of supply to the Rockhampton area in panel meetings from April 2018.

3. Identified need

This section provides an overview of the existing supply arrangements at Rockhampton Substation, Powerlink's statutory obligations in relation to the supply of electricity and details of the most recent condition assessment of the Egans Hill to Rockhampton transmission line.

3.1 Geographical and network overview

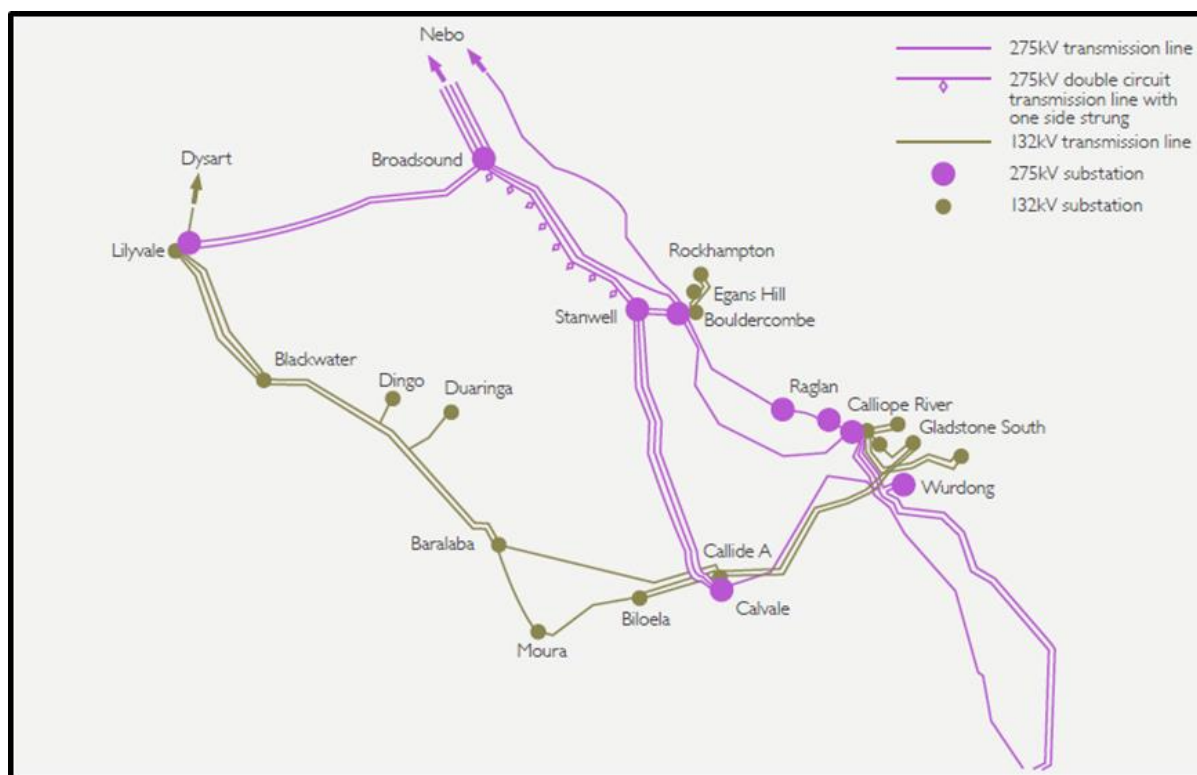
The Egans Hill to Rockhampton transmission line is a 132kV double circuit line that forms part of the connection between Powerlink's Bouldercombe and Rockhampton substations. Originally commissioned in 1963 the line's insulators were most recently replaced between 2008 and 2014.

Egans Hill is located approximately 8 kilometres south east of Rockhampton, while the line itself is just over 11 kilometres in length and crosses both the Bruce Highway and the Fitzroy River into Rockhampton.

The relevant transmission network is shown in Figure 2.1.

⁵ This relates to the standard geographic definitions (zones) identified within the [Powerlink's Transmission Annual Planning Report](#), which is published annually by 30 June.

Figure 2.1: Central West and Gladstone Transmission Zones



3.2 Description of identified need

With peak demand in the Rockhampton area forecast to increase above current levels, it is vital that the Egans Hill to Rockhampton transmission line has the ongoing capacity to meet these demands⁶.

Powerlink's condition assessment of the transmission line has highlighted that the majority of structures have reached the end of their technical service life and are exhibiting signs of degradation, which if not addressed will lead to increased safety and network risks. Early loss of 'sacrificial' galvanising on members and the onset of corrosion to nuts, bolts and hardware requires action to ensure the ongoing reliability of supply to the Rockhampton area.

Under the Rules⁷, Powerlink is required to meet minimum network reliability standards; including planning and operating its network so that it can ensure the transfer of power from generating units to customers.

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 Egans Hill to Rockhampton transmission line, for which Powerlink has legal compliance obligations under the Rules.

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 transmission line between Egans Hill and Rockhampton is nearing the end of its technical service life, with the majority of structures on the transmission line exhibiting signs of degradation. This presents a potential risk to the ongoing safe, reliable and economic supply of electricity into Rockhampton and the surrounding area.

⁶ [Powerlink Transmission Annual Planning Report 2018](#)

⁷ 5.1.2 Network Reliability of the Rules

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, potentially presenting serious risk to public safety and network reliability.

It follows that the consequences of failure, combined with the increasing cost of remedial action, compels Powerlink to undertake reliability corrective actions on the Egans Hill to Rockhampton transmission line if it is to continue to meet the reliability standards set out in the Rules, and to avoid the impacts of having the asset fail.

3.4 Description of asset condition and risks

The 132kV Egans Hill to Rockhampton transmission line is approximately 11km in length and consists of 32 steel lattice towers and four concrete poles. It traverses a range of rural and residential areas in central Queensland and crosses the Bruce Highway and Fitzroy River to the south and east of Rockhampton respectively.

The transmission line is located in a semi-tropical environment which has caused moderate to high levels of corrosion, impacting the life of its galvanised components. Originally built in 1963, many of the towers are exhibiting evidence of a break down in the galvanised coatings of steel members, as well as the onset of corrosion in almost 50% of the nuts and bolts that attach the earth wire and insulator hanging brackets. Approximately 10% of the towers' structural bolts are also showing signs of more advanced corrosion.

Galvanised coatings are by their nature 'sacrificial' and will break down over time exposing the underlying steel to the environment. If not addressed, the exposed steel will corrode at a far greater rate and lose cross-sectional area and structural strength.

Accepted industry practice is to paint and where required replace affected steel before it becomes susceptible to accelerated rates of corrosion. Delay to addressing the condition of the structures increases the amount of surface blasting and preparation required prior to painting, as well as resulting in a far higher number of structural members needing replacement.

The line also contains several towers that were constructed using grillage foundations. This type of foundation was commonly used throughout the 1960s and consists of buried steel structures that anchor the towers into the soil. Recent investigations in north and central Queensland have shown grillage foundations in these areas to be particularly susceptible to accelerated rates of corrosion in low lying areas. This represents a potential risk to the integrity of the towers, particularly in storm and cyclonic conditions. Given the location and age of the grillage foundations on the Egans Hill to Rockhampton transmission line, these foundations require remedial action to ensure the integrity of the line and the reliability of supply to the Rockhampton area.

4. Submissions received

Powerlink published a PSCR in September 2018 seeking submissions from Registered Participants, the Australian Energy Market Operator (AEMO) and interested parties on the credible options presented, and for any alternative credible network and non-network options that could replicate the support that the Egans Hill to Rockhampton transmission line provides both Powerlink and Ergon Energy in meeting the Rule's reliability obligations on an enduring basis.

There were no submissions received in response to the PSCR that was open for consultation until 24 December 2018.

As a result, at this stage of the RIT-T consultation, Powerlink is not aware of any:

- non-network options that could be adopted, either in full or in conjunction with a network option to meet or defer the identified need or
- additional credible options that could deliver a material market benefit.

This PADR provides a further opportunity for submissions from all stakeholders and for providers of feasible non-network options to submit details of their proposals for consideration.

5. 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.

5.1 Criteria for proposed network support services

A non-network solution that avoids life extension and/or replacement of the Egans Hill to Rockhampton transmission line would need to replicate the capacity and reliability of the line 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 Rockhampton Substation would require injection to the 66kV network at Rockhampton of up to 87MW peak in 2019/20 and up to 89MW peak in 2026/27⁸.

Powerlink has identified the following common criteria that must be satisfied if any proposed non-network solutions are to meet supply requirements⁹.

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.

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.¹⁰
- 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 material network costs associated with a proposed non-network option, including but not limited to asset decommissioning, protection schemes and equipment to support maintenance outages, these costs will form part of the scope of any non-network option and will be included in the overall cost of a non-network option as part of the RIT-T cost-benefit analysis.

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.

⁸ Ergon connection point forecast of summer medium growth native maximum demand.

⁹ [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.

¹⁰ The National Electricity Rules prevent a generator that is providing network support from setting the market price.

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 condition of the ageing Egans Hill to Rockhampton transmission line.

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

6. Potential credible options to address the identified need

Powerlink has developed four credible network options to address the identified need for maintaining the reliability of supply to the Rockhampton area as summarised in Table 6.1.

Table 6.1 Summary of Credible Options

Option	Description	Indicative capital cost (\$million, 2018/19)	Indicative annual O&M costs (\$million, 2018/19)
Base Option: Partial refit by December 2020. Rebuild by December 2030	Minimalist refit of line without painting by December 2020*	8.08*	0.112
	Rebuild entire line by December 2030†	24.85†	
Option 1: Staged life extension by December 2020 and December 2030. Rebuild by December 2044	Refit and paint northern section of the line by December 2020*	9.98*	0.071
	Refit without painting the southern section by December 2020*		
	Minimalist refit and paint of the southern section by December 2030†	2.30†	
Option 2: Life extension by December 2020. Rebuild by December 2044.	Rebuild entire line by December 2044†	24.85†	
	Refit and paint entire line by December 2020*	12.48*	0.041
Option 3: Partial rebuild and life extension by December 2020. Rebuild of balance by December 2044.	Rebuild entire line by December 2044†	24.85†	
	Rebuild southern section of the line by December 2020*	14.49*	0.015
	Refit and paint northern section of the line by December 2020*		
	Rebuild northern section of line by December 2044†	16.02†	

* 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, are expected to be technically and economically feasible and are able to be implemented in sufficient time. 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)¹¹.

Under all credible options, an investment is required to be completed by December 2020 to deliver an extension to the technical service life of the transmission line. Other investment stages are planned and modelled for each option to ultimately extend the life of the existing asset to 2030 for the Base Option and 2044 for all other options, when replacement of the transmission line is modelled.

The latest date for the replacement of the transmission line is determined by the expected end of technical service life of the conductors of the transmission line.

Additional options that have been considered but not progressed due to not being either economically or technically feasible, were identified in the [PSCR](#).

6.1 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 extend the life of the line¹². This involves a one-off minimalist refit of components with an advanced level of atmospheric corrosion without painting.

6.2 Base Option: Partial refit by December 2020 followed with rebuild by December 2030

Powerlink is the proponent of this option.

This option involves an initial minimalist refit strategy to facilitate a ten year deferral of a full line rebuild by December 2030.

Refit work on both the northern and southern sections of the line includes reviewing all tower leg / stub members and encapsulating the concrete to steel interface where corrosion is evident, replacing corroded members, nuts, bolts and micro-piling of grillage foundations on six structures. Steel earth strapping and anti-climb barriers will also be replaced on the northern section.

Major cost components are shown in Table 6.2.

Table 6.2: Main project components for the Base Option

Base Option	Description	Indicative capital cost (\$million, 2018/19)
Partial refit by December 2020*	Refit and paint northern section of the line by December 2020 Refit without painting the southern section by December 2020	8.08*
Rebuild by December 2030†	Rebuild entire line by December 2030	24.85†
TOTAL		32.93

* Proposed RIT-T project

† Modelled project

¹¹ 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.

¹² *Regulatory investment test for transmission application guidelines Version 02 18 September 2017*

6.3 Option 1: Staged Life Extension by December 2020 and December 2030 with full rebuild by December 2044

Powerlink is the proponent of this option.

Option 1 involves refit of the line as well as painting of the northern section by December 2020. Refit work involves reviewing all tower leg / stub members and encapsulating the concrete to steel interface where corrosion is evident, replacing corroded members, nuts and bolts and the micro-piling of grillage foundations on six structures.

Any subsequently corroded components on the southern section of the line will be replaced by December 2030, and the section painted.

The entire line, including conductor, is then replaced by December 2044.

Major cost components are shown in Table 6.3.

Table 6.3: Main project components for Option 1

Option 1	Description	Indicative capital cost (\$million, 2018/19)
Staged life extension by December 2020*	Refit and paint northern section of the line by December 2020 Refit without painting the southern section by December 2020	9.98*
Staged life extension by December 2030†	Minimalist refit and paint of the southern section by December 2030	2.30†
Rebuild by December 2044†	Rebuild entire line by December 2044	24.85†
TOTAL		37.13

* Proposed RIT-T project

† Modelled project

6.4 Option 2: Life Extension by December 2020 with full rebuild by December 2044

Powerlink is the proponent of this option.

Option 2 involves an initial refit and paint of the complete line by December 2020.

This work includes the review of all tower leg / stub members and encapsulation of the concrete to steel interface where corrosion is evident, replacing corroded members, nuts and bolts, micro-piling of grillage foundations on six structures and replacement of all steel earth strapping and anti-climb barriers.

This is then followed by a full line rebuild to be completed by December 2044.

Major cost components are shown in Table 6.4.

Table 6.4: Main project components for Option 2

Option 2	Description	Indicative capital cost (\$million, 2018/19)
Life extension by December 2020*	Refit and paint entire line by December 2020	12.48*
Rebuild by December 2044†	Rebuild entire line by December 2044	24.85†
TOTAL		37.33

* Proposed RIT-T project

† Modelled project

6.5 Option 3: Partial rebuild with life extension by December 2020 and rebuild of balance by December 2044

Powerlink is the proponent of this option.

Option 3 involves a rebuild of the southern section of the line and a refit and paint of the northern section by December 2020.

Refit work of the northern section includes the review of all tower leg / stub members and encapsulation of the concrete to steel interface where corrosion is evident, replacement of corroded members, nuts and bolts, micro-piling of grillage foundations on one structure and replacing of all steel earth strapping and anti-climb barriers.

This is followed by a rebuild of the northern section to be completed by December 2044.

Major cost components are shown in Table 6.5.

Table 6.5: Main project components for Option 3

Option 3	Description	Indicative capital cost (\$million, 2018/19)
Rebuild southern section and life extend northern section by December 2020*	Rebuild southern section of line by December 2020 Refit and paint northern section of line by December 2020	14.49*
Rebuild northern Section by December 2044†		16.02†
TOTAL		30.51

* Proposed RIT-T project

† Modelled project

6.6 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 criteria¹³.

7. Materiality of market benefits

Powerlink does not consider that the proposed Egans Hill to Rockhampton transmission line life extension 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.¹⁴

7.1 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.

¹³ 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.

¹⁴ AER, *Final Regulatory Investment Test for Transmission Application Guidelines*, June 2010, version 1, page 15.

- **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 Rockhampton 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.

7.2 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 specific form of the option.

Where credible non-network options are identified as part of the consultation process on this PADR, 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.

8. General modelling approach adopted to assess net benefits

8.1 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 expected operational service life of the existing transmission line. As timing of the full line rebuild varies across the options, there will be varying residual values by 2048 under each option, at which point a terminal value is calculated to correctly account for capital costs.

8.2 Discount rate

Under the RIT-T, a commercial discount rate is applied to calculate the NPV of costs and benefits of credible options. Powerlink has adopted a real, pre-tax commercial discount rate of 7.04%¹⁵ 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%¹⁶ and an upper bound discount rate of 10.61% (i.e. a symmetrical upwards adjustment).

8.3 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 that¹⁷:

- are likely to affect the ranking of the credible options, where the identified need is reliability corrective action
- are likely to affect the ranking of the credible options, or the sign of the net economic benefits of any of the credible options, for all other identified needs.

Powerlink has considered capital costs and discount rate sensitivities individually and in combination and found that these variables do not affect the relative rankings of credible options or identification of the preferred option. As sensitivities (both individually and in combination) do not affect ranking results, Powerlink has elected to present one central scenario in Table 8.1 below.

Table 8.1: Reasonable scenario assumed

Key variable/parameter	Central scenario
Capital costs	100% of central capital cost estimate
Discount rate	7.04%

¹⁵ 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.

¹⁶ 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.

¹⁷ AER, *Final Regulatory Investment Test for Transmission*, June 2010, version 1, paragraph 16, p. 7

9. Cost benefit analysis and identification of the preferred option

9.1 Net present values

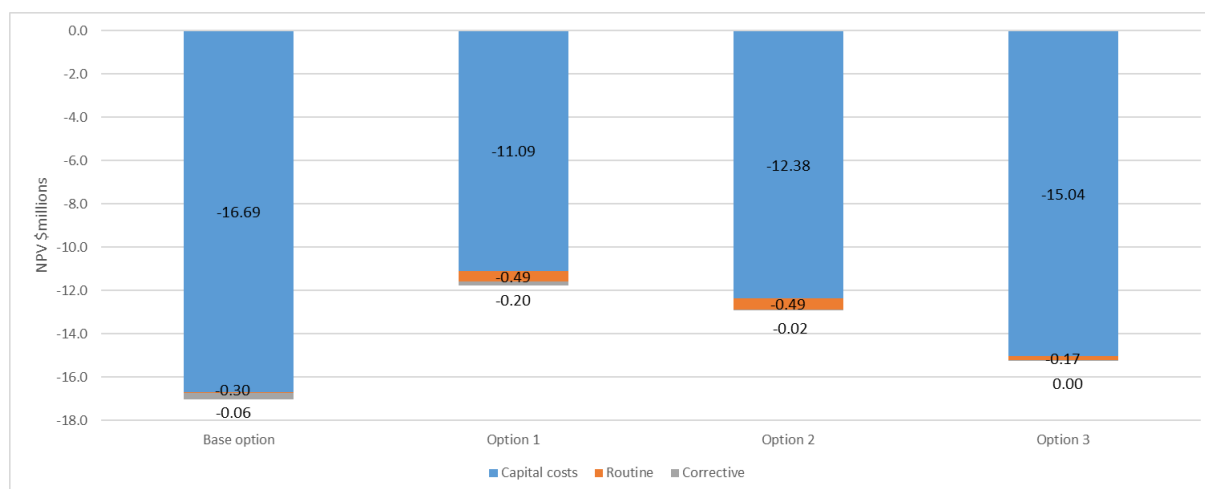
Table 9.1 summarises the NPV for each credible option.

Table 9.1: NPV for each credible option (\$m, 2018/19)

Option	Description	Central Scenario NPV (\$m)	Ranking
Base Option	Minimalist refit of line without painting by December 2020. Rebuild entire line by December 2030	-17.05	4
Option 1	Refit and paint northern section of the line by December 2020. Refit without painting the southern section by December 2020 Minimalist refit and paint of the southern section by December 2030. Rebuild entire line by December 2044	-11.78	1
Option 2	Refit and paint entire line by December 2020 Rebuild entire line by December 2044	-12.89	2
Option 3	Rebuild southern section of the line by December 2020 Refit and paint northern section of the line by December 2020 Rebuild northern section of line by December 2044	-15.22	3

Option 1 is ranked as the lowest cost option in NPV terms. Figure 9.1 provides a breakdown of capital and maintenance costs for the central scenario.

Figure 9.1: NPV component for each credible option (NPV \$m, 2018/19)



A comparison of the NPVs for each option relative to the Base Option is shown in Table 9.2

Table 9.2: NPV for each credible option relative to the Base Option, (NPV \$m, 2018/19)

Option	Description	NPV relative to Base Option (\$m)
Option 1	Refit and paint northern section of the line by December 2020. Refit without painting the southern section by December 2020 Minimalist refit and paint of the southern section by December 2030. Rebuild entire line by December 2044	5.27
Option 2	Refit and paint entire line by December 2020 Rebuild entire line by December 2044	4.17
Option 3	Rebuild southern section of the line by December 2020 Refit and paint northern section of the line by December 2020 Rebuild northern section of line by December 2044	1.84

The NPV of Options 1, 2 and 3 relative to the Base Option indicate that Option 1 is the preferred option.

9.2 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%
- a 25% increase/decrease in capital costs.

Sensitivity analysis of the NPVs for Options 1, 2 and 3 relative to the Base Option shows that varying discount rates and capital costs has no impact on the preferred option.

Figure 9.2 Sensitivity Analysis for Discount Rate

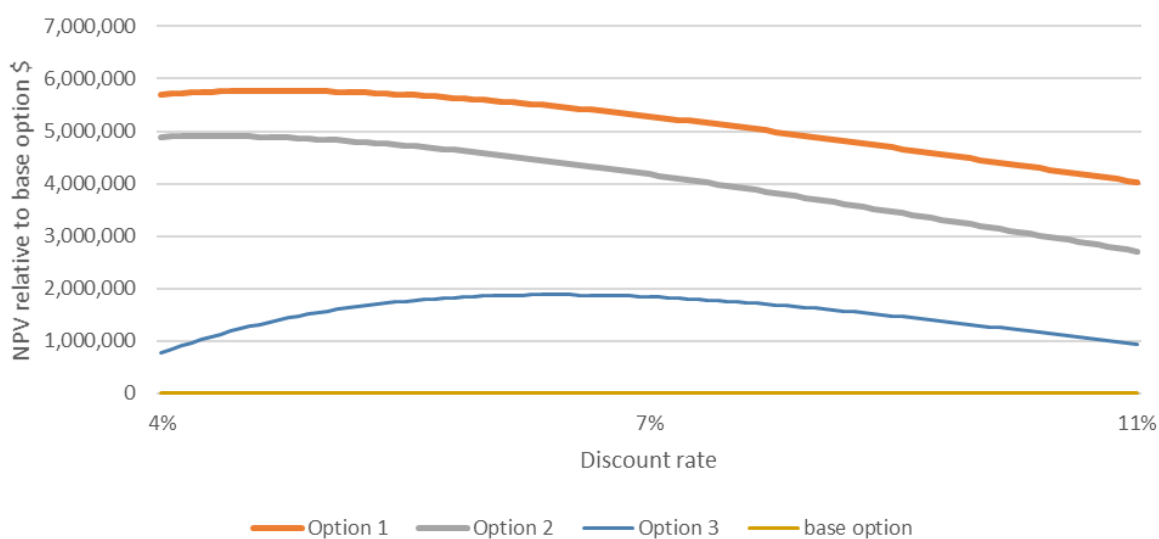
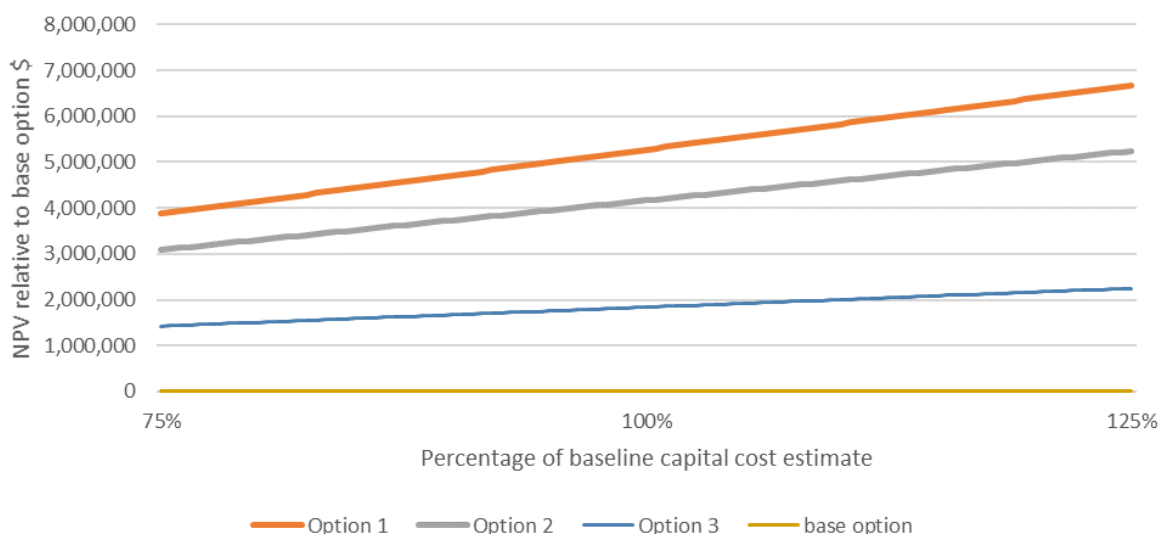


Figure 9.3 Sensitivity Analysis for Capital Cost



10. Preferred option

Based on the conclusions drawn from the NPV analysis and the rules requirements relating to the proposed replacement of transmission network assets, it is recommended that Option 1 be implemented to address the risks associated with the condition of the ageing Egans Hill to Rockhampton transmission line.

Option 1 involves refitting and painting the northern section of the line by December 2020 as well as refitting, without painting, the southern section. A second minimalist refit and paint of the southern section is then undertaken by December 2030. The entire line is subsequently scheduled to be fully rebuilt by December 2044.

Sensitivity testing shows the analysis is robust to variations in discount rates and capital costs.

Option 1 is therefore considered to satisfy the requirements of the RIT-T and is the preferred option.

11. Conclusions

The following conclusions have been drawn from the analysis presented in this report:

- Powerlink has identified condition risks arising from the ageing transmission line between Egans Hill and Rockhampton requiring action.
- TNSPs must maintain (including repair and replace if necessary) their transmission grid to ensure the adequate, economic, reliable and safe transmission of electricity, including the ability to meet peak demand if a major element of the network was to fail.
- The increasing likelihood of faults associated with the ageing Egans Hill to Rockhampton transmission line compels Powerlink to undertake reliability corrective actions if it is to continue meeting the reliability standards set out in the Rules.
- Studies were undertaken to evaluate four credible options; all four credible options were evaluated in accordance with the AER's RIT-T.
- Powerlink published a PSCR in September 2018 requesting submissions from Registered Participants, AEMO and interested parties on the credible options presented, including alternative credible non-network options which could address the condition risks on the Egans Hill to Rockhampton transmission line.

- There were no submissions received in response to the PSCR which was open for consultation until 24 December 2018. As a result, no additional credible options that could deliver a material market benefit have been identified so far as part of this RIT-T consultation.
- The result of the cost-benefit analysis under the RIT-T identified that Option 1 is the highest net benefit solution over the 30 year analysis period. Sensitivity testing showed the analysis is robust to variations in the discount rate and the capital cost assumptions.

As a result Option 1 is considered to satisfy the RIT-T and is the preferred option.

12. Draft recommendation.

Based on the conclusions drawn from the NPV analysis and the Rules requirements relating to the proposed replacement of transmission network assets, it is recommended that Option 1 be implemented to address the risks associated with the condition of the ageing Egans Hill to Rockhampton transmission line.

Option 1 involves the staged refit and painting of the line in 2020 and 2030, prior to a full rebuild in 2044.

This staged approach allows for a further review of the risks arising from the condition of the transmission line remaining in service prior to subsequent stages. This will confirm if the need for remedial action is still required at that point in time.

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 Rockhampton 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 \$9.98 million in 2018/19 prices.

Design and construction activities would be expected to commence in early to mid 2019, with completion of the RIT-T project by December 2020.

13. Submissions requirements

Powerlink invites submissions and comments in response to this PADR 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.

13.1 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.

13.2 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	26 September 2018
	Submissions closed on the PSCR	24 December 2018
Part 2	PADR Publication Powerlink's response to any submissions received and identification of the preferred option. Have your say on the draft recommendation and propose any non-network solutions.	25 January 2019
	Submissions due on the PADR	15 March 2019
Part 3	Publication of the PACR Powerlink's response to any further submissions received and final recommendation on the preferred option for implementation.	April 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).



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