Powerlink Queensland

Project Specification Consultation Report

14 June 2018

Maintaining reliability of supply to Ingham

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

Ingham South Substation was established in 2005 as a replacement for the original Ingham Substation. Two 132/66kV transformers connect the Powerlink substation to the Ergon Energy switchyard at Ingham supplying the local area. Both transformers are now over 50 years old, having previously been installed at other locations on the network.

The transformers are nearing the end of their technical lives, with an increasing risk of failure. The failure of a transformer can result in an extensive replacement timeframe increasing the risk of loss of supply to the local area, and in extreme cases, could present a risk to the safety of personnel and members of the public.

Planning studies have confirmed there is an enduring need for the transformer capacity to maintain the supply of electricity in the Ingham area.

The National Electricity Rules (the Rules) require Transmission Network Service Providers (TNSPs) to plan, design, operate and maintain the transmission network to allow the efficient transfer of electrical energy from producers to users. In addition, under its *Transmission Authority* and obligations set out in the *Electricity Act*, Powerlink must make appropriate investments to ensure continuity of supply.

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

Since this investment is driven by an obligation in the Rules, it is a 'reliability corrective action' under the RIT-T.

Three credible options have been identified to address the identified need

Powerlink has identified three credible network options to address the identified need, as presented in Table 1.

A base option reflecting a conventional approach to ensuring continued compliance with Powerlink's obligations in the Rules has been identified to serve as the basis of comparison between options. Under this option both transformers would be refitted in 2019 to extend their lives and then replaced around 2032.

This option has then been compared with the initial replacement of one transformer and refit of the second, with a subsequent need to replace the refitted transformer in 2032, and a third option in which both transformers are replaced in 2019.

Table 1: Summary of credible options

Option	Description	Indicative capital cost ($m, 2017/18)
Base option:	Refit both T1 and T2 in 2019, then replace both T1 & T2 in 2032	10.5
Option 1:	Replace T1 and refit T2 in 2019, then replace T2 in 2032	8.1
Option 2:	Replace both T1 and T2 in 2019	5.7

Powerlink has also considered whether non-network options could address the identified need. A non-network option that offsets the need to replace both transformers would be required to partially replicate the support Ingham South Substation provides Powerlink in meeting its reliability obligations on an enduring basis at a cost that is lower than the network options currently under consideration.

The nature of the underlying problem (i.e. ageing assets) limits the number of possible solutions that can be adopted. Powerlink is not currently aware of other credible network or non-network options that could be adopted. Notwithstanding this assessment, Powerlink welcomes

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

Option 2 has been identified as the preferred option

Due to the nature of the investment, none of the options considered, including the preferred option, are expected to give rise to market benefits. The difference between the options relates primarily to the costs of life extending the transformers, an interim measure to help offset the timing of the replacement. This is supported by the NPV analysis (Table 2 below).

Table 2 NPV of options (NPV $m, 2017/18)

Option	Central scenario	Ranking
Base option	-4.7	3
Option 1	-4.5	2
Option 2	-4.2	1

Powerlink has elected to recommend Option 2 based on the following characteristics:

- lowest capital costs in terms of net present value of all the credible options
- lower risk to electricity supply compared to the base option and Option 1 which both rely upon an ageing asset as the sole source of supply during the refit process
- simplified planning, design and implementation as there is no need to support two different transformer configurations, which would be required under the base option and Option 1 and
- simplified project delivery, by avoiding multiple mobilisations of specialist resources for staged projects, which would be required under both the base option and Option 1.

Under Option 2, preparatory construction activities would occur on site early in 2019 to provide for installation of the two transformers in late 2019 with completion of the project in December 2019. The indicative capital cost of this option is $5.7 million in 2017/18 prices.

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 Wednesday, 12 September 2018.

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 Essential Energy, 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.

With the two transformers at Ingham South having first been commissioned over 50 years ago, predictive condition assessments show they are now nearing the end of their technical life. This presents Powerlink with a range of operational and compliance issues that if not addressed in a comprehensive manner have the potential to significantly compromise the supply of electricity to the Ingham region.

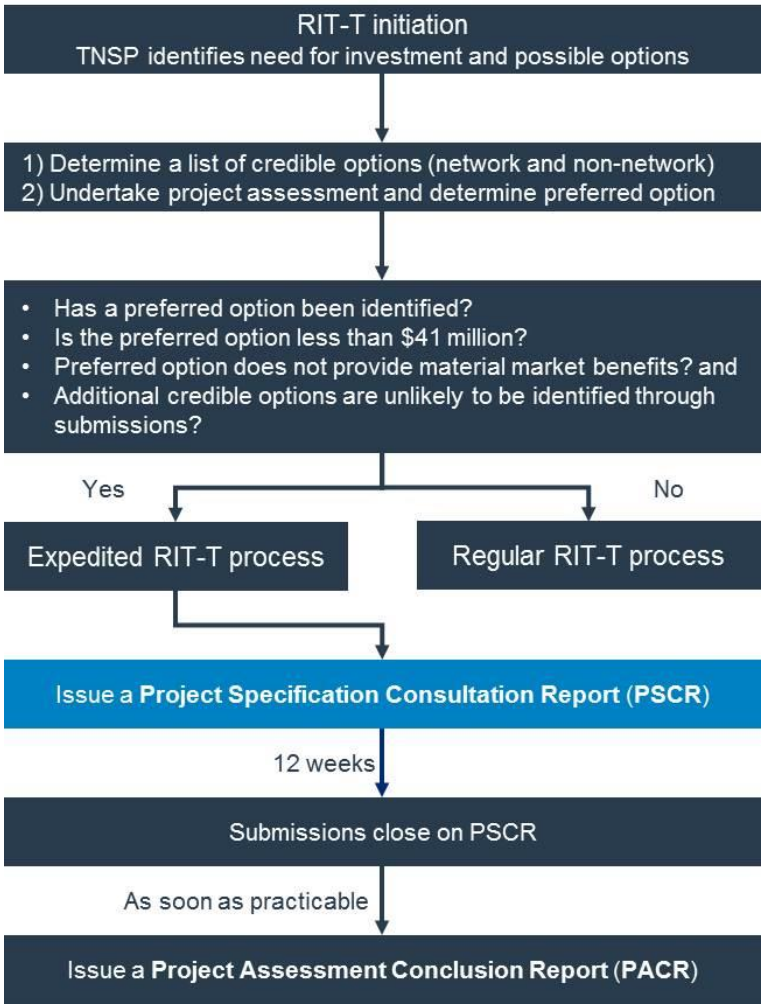
This Project Specification Consultation Report (PCSR) has been prepared by Powerlink in accordance with the requirements of the National Electricity Rules (the Rules) clause 5.16. It represents the first stage of the consultation process in relation to the application of the Regulatory Investment Test for Transmission (RIT-T) to the proposed replacement of the transformers at Ingham South Substation.

Specifically, the PSCR:

- 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 option 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 market benefits to be material for this RIT-T[2]
- 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 in order for Powerlink to refine the analysis (if required) as part of the Project Assessment Conclusions Report (PACR).

[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 ISO 31000:2018*Risk Management Guidelines*.
[2] 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.[3]

Specifically, Powerlink is proposing to publish a PACR following community 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 option has 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 this replacement project.

However, Powerlink will 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.

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

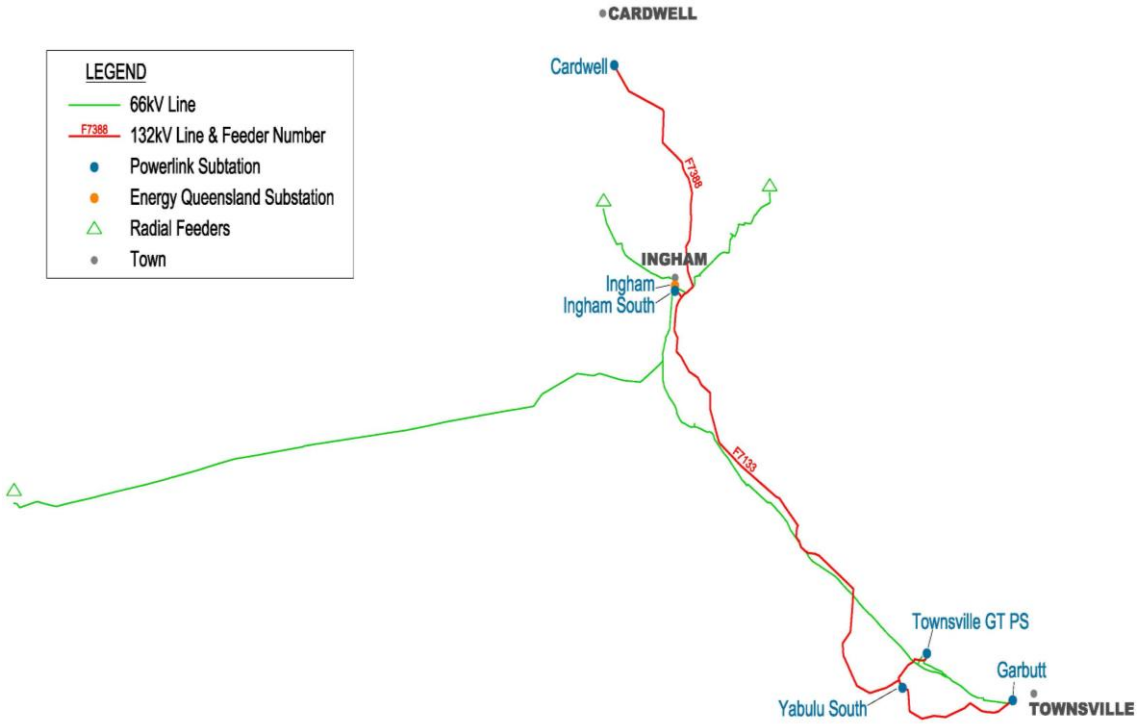
2. Identified need

This section provides an overview of the existing supply arrangements around Ingham South Substation, Powerlink's statutory obligations and details of the most recent condition assessment of the transformers at Ingham South Substation.

2.1 Geographical and network overview

Powerlink's Ingham South Substation was built in 2005 to replace the original Ingham Substation and service a growing demand for electricity in the region. It consists of a switchyard operating at 132kV and 66kV and provides the injection point for Ingham and surrounding areas.[4]

Figure 2-1: Ingham South Substation - Location & Connections



2.2 Description of identified need

Under the Rules and statutory requirements[5], Powerlink is required to meet minimum reliability standards. In particular Powerlink must plan and operate its network such that it can meet forecast peak electricity demand during an outage of the most critical single network element.

With peak demand forecast to remain at or slightly above current levels[6], it is vital that the Ingham South Substation have the ongoing capacity to meet these demands.

This places an obligation on Powerlink to undertake actions that address the risks associated with the potential failure of one or both transformers at Ingham South.

[4] Ingham South Substation is supplied by two 132kV feeders. The two 132/66kV transformers are connected to Ergon Energy's 66kV switchyard at Ingham
[5] Schedule 5.1a System Standards and 5.1.2 Network Reliability of the Rules, and Queensland Transmission Authority T01/98
[6] Powerlink's Transmission Annual Planning Report 2017

2.2.1 Assumptions underpinning the identified need

The failure of a single transformer at Ingham South, and the subsequent reliance on the other similarly aged transformer, presents a high level of risk to the stable and continuous supply of electricity to Ingham and the surrounding area.

The transformers are nearing the end of their technical life, resulting in an increased likelihood of failure. In the case of Ingham South, both transformers have a comparable risk profile, meaning the prospect of both failing within a similar timeframe is substantially increased.

Transformers are large and complex items of plant that are both difficult and expensive to repair, which can leave them out of service for long periods of time.

Powerlink's obligations as a TNSP mean that it must maintain (including repair and replace if necessary) its 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. For Ingham South, this includes the availability of a second transformer to maintain the load should the first transformer fail.

2.2.2 Description of asset condition and risks

Both transformers are over 50 years old and in accordance with accepted asset management principles have been comprehensively assessed to estimate the end of life of their major components, as well as their overall life. This process included on-site condition assessments, desktop evaluation of historical oil and insulation test results and the evaluation of maintenance and through fault data.

The component parts of a transformer can be divided into three broad groupings from an operational and maintenance perspective:

- insulation - winding paper and insulating oil
- mechanical – tanks, radiators, pipe work, desiccant breathers, bushings, internal clamping structures, tap changers
- ancillary – transformer secondary systems including cabling and instrumentation.

Of these it is the mechanical components which primarily begin to fail first due to their ongoing exposure to the environment. In this case the transformers have been subjected to coastal and tropical environments since first being commissioned at Gladstone in 1966.

This combination of salt laden air and high moisture content has impacted the condition of all externally exposed metal components, despite ongoing anti-corrosion treatments. Protective galvanised coatings have begun to break down on several components including radiators, connecting pipework, control system cabinets, bushing mountings and flanges.

The sealing integrity of numerous joints and valves has been compromised, resulting in an increased observation of oil leaks around the radiator cores, bushings and conservator tanks.

Many of the transformers' mechanical parts are no longer technically supported by the manufacturer, with spares difficult to source. Hence obsolescence becomes an issue with ongoing maintenance of the transformers.

As the transformer systems and components deteriorate, their probabilities of failure increase, leading to decreased transformer availability.

3. 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 options such as, but not limited to, local generation and demand side management (DSM) initiatives.

Powerlink identified in its Transmission Annual Planning Report (TAPR) 2017, an expectation that action would be required at Ingham South Substation to maintain reliability of supply requirements in the Ross zone.[7]

Powerlink has consulted with Registered Participants and interested parties on the proposed investment at Ingham South Substation and potential non-network options as part of the TAPR publication process. 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 TAPR.

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

3.1 Details of potential non-network options

A non-network option that avoids replacement of the transformers at Ingham South would need to replicate the functionality, capacity and reliability of the substation on an enduring basis at a cost that is lower than the network options currently under consideration.

Any non-network option to supply the entire load at Ingham South would require injection to the 66kV network at Ingham of up to 20MW at peak and up to 300MWh per day on a continuous basis.

An alternative potential non-network solution is for the two transformers at Ingham South to be replaced with a single 40MVA transformer, combined with a non-network option and support from the 66kV interconnected network to ensure that Powerlink continued to meet its reliability obligations. The non-network option would need to provide support for any outages of the single transformer, both planned and unplanned.

Such a non-network option must be available at all times and capable of operating continuously to provide injection into the 66kV network at Ingham of up to 10MW at peak and up to 110MWh per day, together with 14MVAr of voltage control services.

Further technical information in relation to the proposed non-network options can be provided upon request.

Powerlink considers a non-network option is unlikely to be economically feasible given the extended availability and operating criteria that it must satisfy. However, Powerlink welcomes any information from a potential non-network provider that may support such a solution, and any information provided would be assessed and compared with the current preferred option. Details of any such assessment would be made available through this consultation process.

3.2 Criteria for proposed non-network options

Powerlink has identified the following common criteria that must be satisfied if any proposed non-network options are to meet supply requirements:

Size and location

- Proposed solutions must be large enough, individually or collectively, to provide the size of injection or demand response set out above from late 2019. However, the level of support is dependent on the location and type of network support offered.
- Due to the bulk nature of the transmission network, aggregation of sub 10MW non-network options will be the sole responsibility of the non-network provider.

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

- 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 over a period of years.
- If a generation service is proposed (either standalone or in conjunction with other services), such operation will be required regardless of the pool price.[8]
- 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.

Reliability

- Proposed services must be capable of reliably meeting electricity demand under a range of conditions and, if a generator must meet all relevant Rules requirements related to grid connection.
- Powerlink has obligations under the 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. 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 need to provide sufficient flexibility to ensure that Powerlink is pursuing the most economic long run investment to address the transformer condition risks at Ingham South.

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

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

4. Potential credible options to address the identified need

Powerlink has considered three credible network options as part of this PSCR:

- Base option – refit both transformers in 2019, replace both transformers in 2032
- Option 1 – replace one transformer and refit one transformer in 2019, replace one transformer in 2032
- Option 2 – replace both transformers in 2019.

All of the credible options address the identified need and are expected to be technically and economically feasible, and able to be implemented in sufficient time. None of these options has been discussed by the Australian Energy Market Operator (AEMO) in its most recent National Transmission Network Development Plan (NTNDP).[9]

Indicative costs for each credible option are presented in Table 4-1, and are based on Powerlink estimates.[10]

Table 4-1: Summary of credible network options

Option	Description	Indicative capital cost ($m, 2017/18)
Base option	Refit both T1 and T2 in 2019, then replace both T1 & T2 in 2032	10.5
Option 1	Replace T1 and refit T2 in 2019, then replace T2 in 2032	8.1
Option 2	Replace both T1 and T2 in 2019	5.7

The ongoing difference in operating and maintenance costs between the refitted and new transformer options is not expected to be material with respect to the overall capital costs and will have no impact on the overall NPV rankings. These costs have been excluded from the economic analysis.

Under all credible options, work would commence in early 2019 with completion of initial works by the end of 2019. This addresses the identified need in a timely manner and avoids a situation where corrective maintenance of obsolete ageing assets is no longer practical.

4.1 Selection of a base option

Powerlink has undertaken this RIT-T assessment using a base case that reflects a conventional approach to ensuring ongoing compliance with its obligations.

As TNSPs are required to meet peak demand, even if a major element of the network was to fail, the conventional option reflects the need to keep the transformers in an acceptable operating state rather than letting them run to failure.

In a worst-case scenario, running a transformer to failure could lead to potential blackouts in Ingham and surrounding areas. Powerlink does not therefore consider that running the transformers to failure, i.e. where no option is implemented, would be a credible base case option against which to conduct the RIT-T assessment, as it is far removed from good practice.

[9] 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.
[10] Powerlink has a robust estimating process that takes into consideration construction costs of recently completed projects, exchange rates on equipment and current labor market trends.

Refit of the transformers minimises capital investment and is considered the "business as usual" approach should no capital investment option be implemented. Given it is technically feasible to refit the transformers as an interim measure; this approach has been adopted as the appropriate base option for this RIT-T, and is discussed further below.

4.2 Base option – refit both transformers in 2019, replace both transformers in 2032

Powerlink is the proponent of this option.

The base option involves refitting both transformers in 2019, and then replacing both in 2032.

This represents the conventional option under which the minimum number of ageing components is replaced, retaining and refitting the more significant components of the transformer that have remaining anticipated life. This will allow the current transformers to remain in service for another 14 years before requiring replacement. Replacement would then occur in 2032.

The work will require the sequential decommissioning and off-site upgrade of each transformer, leaving the substation with only a single ageing transformer in place during the refit process. This approach gives some flexibility in assessing future developments by deferring the replacement of the assets.

The base option will also require multiple deployments of specialist resources to complete the project. The indicative capital cost of this option is $10.5 million in 2017/18 prices.

Table 4-2: Main project components for the base option

Components		Cost ($k, 2017/18)	Construction timetable and commissioning date
STAGE 1 Refit T1 & T2	• De-energise and dismantle transformer T1, and transport to factory • Refit transformer and replace components as required • Undertake factory acceptance testing • Transport transformer T1 to site, assemble, test and commission • Repeat for transformer T2	4,770	2019 – 2020
STAGE 2 Replace T1 & T2	• Design and construct modifications to civil works at Ingham South • Procure, install and commission two (2) new 40MVA transformers • Dismantle and dispose of old transformers • Modify protection settings at Yabulu & Cardwell Substations	5,707	2032 – 2033
TOTAL		**10,477**	

4.3 Option 1 – replace one transformer and refit one transformer in 2019, replace one transformer in 2032

Powerlink is the proponent of this option.

Option 1 involves the 2019 replacement of one transformer followed immediately by the refit of the second, and finally replacement of the second transformer in 2032.

This option allows for the commissioning of a new transformer on site before the second transformer is taken out of service for a refit, but will still requires multiple deployments to site.

This approach has less risk attached than the base option as the substation will be serviced by a new transformer during refit of the second transformer. This approach gives some flexibility in assessing future developments by deferring the replacement of one of the assets.

The indicative capital cost of this option is $8.1 million in 2017/18 prices.

Table 4-3: Main project components for Option 1

Components		Cost ($k, 2017/18)	Construction timetable and commissioning date
Stage 1 Replace T1	• Design and construct modifications to civil works at Ingham South • Procure, install and commission one (1) new 40MVA transformer • Dismantle and dispose of old transformer • Modify protection settings at Yabulu & Cardwell Substations	2,853	2019
Stage 1A Refit T2	• De-energise and dismantle transformer, and transport to factory • Refit transformer and replace components as required • Undertake factory acceptance testing • Transport transformer T1 to site, assemble, test and commission	2,385	2019
Stage 2 Replace T2	• Design and construct modifications to civil works at Ingham South • Procure, install and commission one (1) new 40MVA transformer • Dismantle and dispose of old transformer • Modify protection settings at Yabulu & Cardwell Substations	2,853	2032
TOTAL		**8,091**	

4.4 Option 2 – replace both transformers in 2019

Powerlink is the proponent of this option.

Option 2 involves replacement of both transformers in 2019.

This option allows for the commissioning of a new transformer on site before the second transformer is taken out of service for replacement. Due to the shortened timeframe for which the Ingham region will be supported by a single transformer, this option has less risk than either the base option or Option 1.

Option 2 also has the least call on the mobilisation of resources in that all work will be completed within a single mobilisation to site.

The indicative capital cost of this option is $5.7million in 2017/18 prices.

Table 4-4: Main project components for Option 2

Components		Cost ($k, 2017/18)	Construction timetable and commissioning date
Replace T1 & T2	• Design and construct modifications to civil works at Ingham South • Procure, install and commission two (2) new 40MVA transformers • Dismantle and dispose of old transformers • Modify protection settings at Yabulu & Cardwell Substations	5,707	2019
TOTAL		**5,707**	

4.5 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[11].

[11] 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.

5. Materiality of market benefits

Powerlink does not consider that transformer replacement at Ingham South Substation would provide any market benefits due to the nature of the project.

A discussion of each market benefit under the RIT-T is provided below.

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

The Australian Energy Regulator (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 estimate:[12]

- **changes patterns of generation dispatch**: replacement of the transformers by themselves does not affect transmission network constraints or affect transmission flows that would change patterns of generation dispatch. It follows that changes patterns of generation dispatch are not material to the outcome of the RIT-T assessment
- **changes in voluntary load curtailment**: a transformer fault by itself does not affect prices in the wholesale electricity market. It follows that changes in voluntary load curtailment will not be material for the purposes of this RIT-T
- **changes in involuntary load shedding**: as discussed earlier, a failure of a single transformer does not necessarily lead to unserved energy as redundancies are built into systems and the transmission network at a broader level. These redundancies mitigate the risk of involuntary load shedding in the event of a fault with a single transformer to a negligible level
- **changes in costs for other parties**: the effect of replacing the transformers under the credible options considered are localised to the substation they are located at and do not affect the capacity of transmission network assets and therefore is 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**: credible options for transformer replacement do 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 replacing secondary systems do not affect the characteristics of primary transmission assets
- **changes in ancillary services cost**: there is no expected change to the costs of Frequency Control Ancillary Services (FCAS), Network Control Ancillary Services (NCAS), or System Restart Ancillary Services (SRAS) due to credible 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.

[12] AER, *Final Regulatory Investment Test for Transmission Application Guidelines,* September 2017, version 2, page 13.

5.2 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 PSCR, Powerlink intends on assessing the materiality of market benefits associated with 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.

6. General modelling approach adopted to assess net benefits

6.1 Analysis period

The RIT-T analysis has been undertaken over a 20 year period, from 2019 to 2039. A 20 year period takes into account the size and complexity of the works and the expected life of a new transformer.

Works on transformer replacement under each credible option is expected to begin in 2019, with the base option and Option 1 both having further work modelled in 2032.

6.2 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%[13] 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%[14] and an upper bound discount rate of 10.61% (i.e. a symmetrical upwards adjustment).

6.3 Description of reasonable scenarios

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

The choice of reasonable scenarios must reflect any variables or parameters that[15]:

- are likely to affect the ranking of the credible options, where the identified need is reliability corrective action and
- 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 6.1 below.

Table 6.1: Reasonable scenario assumed

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

[13] This indicative commercial discount rate has been calculated on the assumptions that a private investment in the electricity sector would hold an investment grade credit rating and have a return on equity equal to an average firm on the Australian stock exchange, as well as a debt gearing ratio equal to an average firm on the Australian stock exchange.
[14] 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.
[15] AER, *Final Regulatory Investment Test for Transmission*, June 2010, version 1, paragraph 16, p. 7

7. Cost benefit analysis and identification of the preferred option

7.1 Net present values

Table 7-1 outlines the NPV for each credible option. The table also shows the corresponding ranking of each option, illustrating that the NPV of Option 2 is the lowest cost preferred option.

Table 7-1: Net present values for each credible option (NPV $m, 2017/18)

Option	Central scenario	Ranking
Base option	-4.7	3
Option 1	-4.5	2
Option 2	-4.2	1

Table 7-1 sets out the net present values of options 1 and 2 relative to the base option. It shows that Option 1 and Option 2 are expected to cost $0.23 million and $0.45 million less than the base option respectively in present value terms. Again based on this analysis, Option 2 is the preferred option.

Table 7-1: NPV for options 1 and 2 relative to the base option (NPV $m, 2017/18)

Option	Central scenario	Ranking
Option 1	0.23	2
Option 2	0.45	1

7.2 Sensitivity analysis

Powerlink has investigated the following sensitivities on key assumptions:

- a 25% increase/decrease in capital costs
- a lower discount rate of 3.47% as well as a higher rate of 10.61%.

Given that the only difference between the options relates to the difference in their capital costs, these sensitivity tests show that Option 2 is preferable to both the base option and Option 1 under all sensitivities (both considered individually and in combination).

7.3 Conclusion

The result of the cost benefit analysis indicates that Option 2 is the highest net benefit solution (lowest cost in net present terms) over the 20 year period of analysis. Sensitivity testing shows the analysis is robust to variations in the capital cost and the discount rate assumptions.

Option 2 is therefore considered to satisfy the requirement of the RIT-T and is the proposed preferred option.

8. 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 2 be implemented to address the increasing risk of failure of the transformers at Ingham South Substation.

Option 2 minimises the time that supply to the Ingham region is dependent upon an aging transformer. This option provides for shorter duration replacement outages, thereby reducing reliability of supply risk during implementation. This option also avoids multiple transformer moves which in turn negates the need to undertake multiple resource deployments to site.

Overall the simplified project scope of Option 2 will allow Powerlink to undertake the corrective actions in a timely and cost effective manner.

Powerlink is the proponent of the proposed option with an estimated capital cost of $5.7 million (2017/18 prices).

Construction activities will start on site in early 2019 with completion of the project by the end of 2019.

9. 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.

9.1 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 may 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.

9.2 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 (including PADR exemption)	18 June 2018
	Submissions due on the PSCR Have your say on the credible options and potential non-network options.	12 September 2018
Part 2	Publication of the PACR Responding to any submissions received and making a final recommendation on the preferred option for implementation.	November 2018

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).

Contact us

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