Powerlink Queensland

Project Specification Consultation Report

31 August 2018

Addressing the secondary systems condition risks at Tarong Substation

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.

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Executive Summary

Located approximately 130km north-west of Brisbane, Tarong Substation is a major part of the 275kV transmission backbone connecting generators to the major load centres in the south-east of the State. It also provides the major injection point for local, rural and bulk mining loads in south-west Queensland.

Several 275kV secondary systems at the Tarong Substation are reaching the end of their technical service life and are no longer supported by the manufacturer, with no spares available.

Secondary systems are the control, protection and communications equipment that are necessary to operate the transmission network and prevent damage to primary systems when adverse events occur. Under the National Electricity Rules ('the Rules'), Transmission Network Service Providers (TNSPs) are required to provide sufficient secondary systems, including redundancies, to ensure the transmission system is protected.

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

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

Two credible options have been developed to address the identified need

Table 1: Summary of credible options

Option	Description	Indicative capital cost ($million, 2017/18)	Indicative average annual operating and maintenance costs ($million, 2017/18)
Base Option: Replace selected secondary systems in existing building by late 2022	Single stage replacement of selected secondary systems in free space of existing building	7.8	0.015
Option 1: Replace selected secondary systems using pre-fabricated building by late 2022	Single stage replacement of all obsolete secondary systems and associated panels, using a prefabricated building with new secondary systems equipment and wiring preinstalled. New yard cabling to bay marshalling kiosks	8.7	0.015

The Base Option reflects a conventional approach to ensuring continued compliance with the secondary systems obligations in the Rules, and has been selected to serve as a basis of comparison. Under this option, only those secondary systems that have reached their end of technical service life would be replaced, while existing support infrastructure and allied systems would remain. This has been compared with an alternative option under which all of the secondary systems are replaced using a new prefabricated building, built off-site and then installed at Tarong.

Powerlink has also considered whether non-network options could address the identified need. A non-network option that avoids replacement of the aging and obsolete secondary systems would need to replicate the support that Tarong 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. aging and obsolete secondary systems) limits the number of possible solutions that can be adopted. Powerlink is currently unaware of any technically and economically feasible non-network options.

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

The Base Option has been identified as the preferred option

Due to the nature of the investment neither of the options considered are expected to give rise to market benefits. The difference between the options relates primarily to differences in capital costs. This is supported by the economic net present value (NPV) analysis (refer Table 2).

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

Option	Central Scenario NPV	Ranking
Base Option	-5.6	1
Option 1:	-6.2	2

Powerlink recommends the Base Option for the following reasons:

- least cost in capital and NPV terms
- optimised use of existing infrastructure.

Under the Base Option, work on designing the new systems would commence in early 2019, with on-site installation starting in early 2020 and final commissioning in mid-2022.

The indicative capital cost of this option is $7.8 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 Friday, 30 November 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 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].

Several secondary systems at Tarong Substation are nearing the end of their technical lives and are now obsolete (i.e. no longer supported by the manufacturer and no spares available), or will become obsolete in the near future. Secondary systems are the control, protection and communications equipment that are necessary to operate the transmission network and prevent damage to primary systems[3] when adverse events occur.

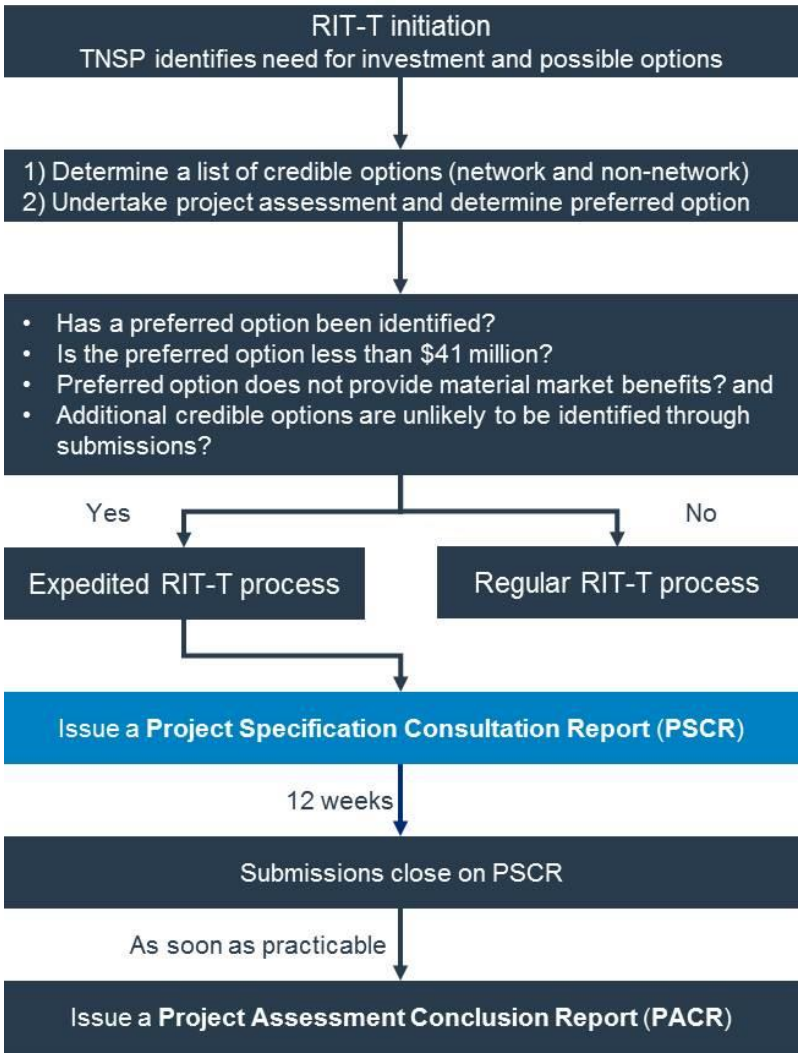
This Project Specification Consultation Report (PSCR) is the first step in the RIT-T process. It:

- describes the reasons why Powerlink has determined that investment is necessary (the 'identified need'), together with the assumptions used in identifying this need
- provides potential proponents of non-network options with information on the technical characteristics that a non-network solution would need to deliver, in order to assist proponents in considering whether they could offer an alternative solution
- describes the credible options that Powerlink currently considers may address the identified need
- discusses why Powerlink does not expect market benefits to be material for this RIT-T[4]
- presents the NPV assessment of each of the credible options (as well as the methodologies and assumptions underlying these results)
- identifies and provides a detailed description of the credible option that satisfies the RIT-T, and is therefore the preferred option
- provides stakeholders with the opportunity to comment on this assessment so that Powerlink can refine the analysis (if required) as part of the Project Assessment 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] Primary systems include the switchgear at Tarong and the transmission lines connected to Tarong
[4] 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.[5]

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

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

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

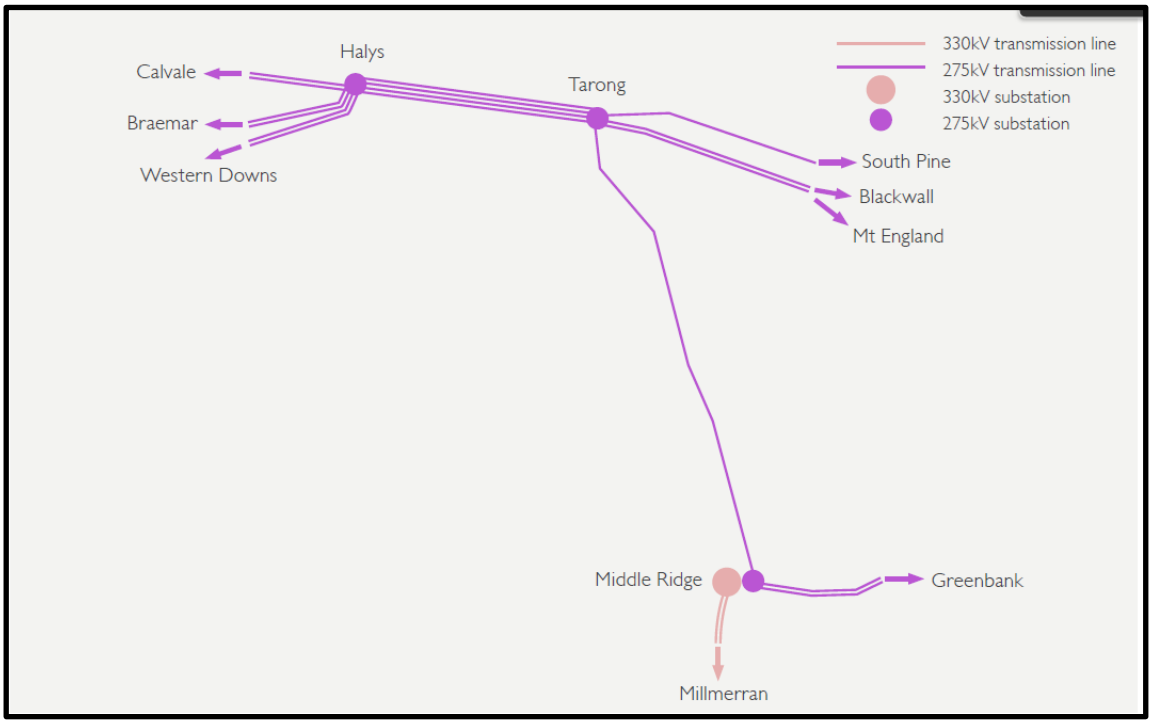
2. Identified need

This section provides an overview of the supply arrangements at Tarong Substation. It then describes the Rules' obligations relating to secondary systems and summarises the asset condition and risks relating to secondary systems equipment at Tarong Substation.

2.1 Geographical and network overview

Tarong substation is situated approximately 130km north-west of Brisbane and was first established in 1982 to connect Tarong Power Station to the transmission network. It now provides a 275kV switching function to five substations on the network, which has resulted in a variety of secondary system components ranging in age from 5 to 20 years, with the majority over 18 years old. The south-west transmission network is shown in Figure 2.1.

Figure 2.1: South-west transmission network



2.2 Description of identified need

Tarong plays a critical switching role for the Moreton, Bulli and Central West transmission zones and is the major injection point for the distribution network in south-west Queensland, where local connection loads are forecast to remain constant over the next 10 years.

Powerlink's condition assessment of the aging 275kV secondary systems at Tarong Substation has highlighted that the majority of the assets are now obsolete and nearing the end of their technical service life.

Under the Rules, TNSPs are required to provide sufficient secondary systems, including redundancies, to ensure the transmission system is protected. This places an obligation on Powerlink to undertake actions that address the risks arising from the obsolete and aging secondary system assets at Tarong Substation, to maintain compliance with the Rules.

2.2.1 Assumptions underpinning the identified need

The need to invest is driven by the risks arising from aging and increasingly obsolete secondary systems at Tarong Substation for which Powerlink has a legal compliance obligation under the Rules. If not addressed, these risks can extend the time taken to recover (or even prevent recovery) from secondary systems faults, due to a lack of support from manufacturers and a lack of spare parts. Under the Rules, Powerlink would be required to disconnect the unprotected primary systems where a secondary systems fault lasts for more than eight hours (in the case of planned maintenance) or 24 hours (in the case of an unplanned outage).

Specifically, S5.1.9(c) of the Rules requires a TNSP to provide sufficient primary protection systems and back-up protection systems (including breaker fail protection systems) to ensure that a fault of any type anywhere on its transmission system is automatically disconnected. This requirement extends to any communications facilities on which protection systems depend.

TNSPs must also ensure that all protection systems for lines at a voltage above 66kV are well maintained so as to be available at all times other than for short periods (less than eight hours), while the maintenance of a protection system is being carried out. The TNSP may need to take primary systems out of service if protection systems are not restored within the required eight hour timeframe for a planned outage. In the event of an unplanned outage, AEMO's Power System Security Guidelines require that the primary network assets must be taken out of service within 24 hours.

2.2.2 Description of asset obsolescence and risks

Many of the 275kV secondary systems at Tarong Substation are approaching the end of their technical service life, while the technology embodied in these systems has also become (or is becoming) obsolete. Consequently, these secondary systems are maintained with an increasingly limited stock of spare parts and without manufacturer support for repairs. This places an obligation on Powerlink to address the risk of system unavailability arising from these aging and obsolete assets remaining in service.

Taking into consideration the most recent analysis and understanding of the risks arising from the secondary systems at Tarong Substation remaining in-service, the proposed network solution has been deferred by approximately 12 months to December 2022 compared to the possible commissioning date of December 2021 as noted in the 2018 TAPR.

Powerlink uses an asset health index rating method that describes asset conditions by reference to:

- equipment functional failure rate (failure to operate as intended)
- environmental condition where the assets are installed
- equipment physical and effective age.

Health indices are modelled in the range from zero (0) to ten (10), where zero represents new assets and ten indicates the asset requires immediate action to address its increasing risk of failure. The impact of equipment obsolescence on availability is also considered when determining the recommended action.

A summary of health index scores and recommended actions for each group of obsolete 275kV secondary systems at Tarong is set out in Table 2.1.

Table 2.1: Summary of 275kV secondary system health index scores at Tarong Substation

Bay	Construction year	Health index (average)	Description
8 x Feeder Bays Protection & Control Equipment	1999-2013	3.4-8.2 (7.1)	Majority of equipment is obsolete, with insufficient spares to support ongoing operation. Remedial action required.
5 x Coupler Bays Protection & Control Equipment	1999-2002	6.8-8.2 (7.5)	All RTUs rank above 8. Majority of equipment is obsolete, with insufficient spares to support ongoing operation. Remedial action required.
OpsWAN	1999-2010	6.5-9.4 (8.1)	The majority of equipment is obsolete, with insufficient spares to support ongoing operation. Remedial action required.

Technology upgrades are also required for the SCADA, metering and high speed monitoring systems to align them with current network standards of operation. The design and condition of the AC & DC distribution boards and cable termination racks in Building 1 present potential safety issues during work activities, and as such also need to be replaced.

Deteriorating asset condition increases the risk of secondary system faults, while obsolescence increases the time needed for Powerlink to address such faults, potentially up to several weeks as panel wiring and test plans are needed on an individual basis. The inabilities to repair, replace, or otherwise resolve secondary system faults in a timely manner can have operational consequences, as this reduces the overall resilience of the transmission network to subsequent forced outages.

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 solutions such as, but not limited to, local generation and Demand Side Management (DSM) initiatives.

Powerlink identified in its 2018 TAPR an expectation that action would be required at Tarong Substation to maintain reliability of supply requirements in the South-West, Bulli and Moreton transmission zones.[6]

Powerlink has consulted with Registered Participants and interested parties on the proposed investment at Tarong 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 TAPRs.

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

3.1 Criteria for proposed network support services

A non-network solution that avoids replacement of the aging 275kV secondary systems at Tarong Substation 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 solution will need to replicate the 275kV grid capabilities of the Tarong Substation, which provides direct connections to the major load centre in south-east Queensland via feeders to Mt England, South Pine, Blackwall and Middle Ridge substations, as well as connections to Tarong Power Station. Tarong Substation also supplies the 66kV Ergon loads at Tarong, which are forecast to remain at approximately 41MW for the next 10 years.

Powerlink has identified the following common criteria that must be satisfied if any proposed non-network solutions are to meet supply requirements[7]:

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 the end of 2022. 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 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.

[6] This relates to the standard geographic definitions (zones) identified within the Transmission Annual Planning Report, 2018, which is published annually by 30 June.
[7] 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 non-network support agreement.
[8] The National Electricity Rules prevent a generator that is providing network support from setting the market price.

Reliability:

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

Timeframe and certainty:

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

Duration:

- The agreement duration for any proposed service will provide sufficient flexibility to ensure that Powerlink is pursuing the most economic long run investment to address the secondary systems condition risks at Tarong Substation.

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

4. Potential credible options to address the identified need

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

- Base Option: Single stage replacement of obsolete secondary system components using new secondary system panels established within the existing building
- Option 1: Single stage replacement of all obsolete secondary systems and associated panels, using a prefabricated building with new secondary systems equipment and wiring preinstalled. Installation of new yard cabling to bay marshalling kiosks.

The following components are to be replaced.

Table 4.1: Summary of components to be replaced

System/Location	Type
Protection and control systems	8x 275kV feeder system replacements – Tarong & remote ends 5x 275kV coupler system replacements
High Speed Monitoring	4x 275kV feeder high speed monitoring upgrades
Metering	4x 275kV feeder A & B Revenue Meter replacements
Ancillary systems	1x SCADA system 1x OpsWAN system, including 2x new Site Infrastructure panels 1x AC & DC distribution boards in existing +1 Building 1x Blade 150 workstation 1x Timing system in +1 Building 5x VT marshalling kiosks in 5 diameter panels 6x Termination racks – *Base Option only* 5x Bay marshalling kiosks – *plus associated cabling in 5 diameters for Option 1 only* 1x Dual fibre interface between new building and +1 Building – *Option 1 only*
Telecommunications	Tarong & remote end multiplexers

Both credible options address the identified need and are expected to be technically and economically feasible, and able to be implemented in sufficient time. Neither 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 4.2, and are based on Powerlink estimates.[10]

Table 4.2: Summary of credible network options in $million, 2017/18

Option	Indicative capital cost ($million, 2017/18)	Indicative average annual operating and maintenance costs ($million, 2017/18)
Base option:	7.8	0.015
Option 1:	8.7	0.015

[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.

Under both options, work would commence in 2019, with completion in late 2022. This addresses the identified need in a timely manner and avoids a situation where corrective maintenance of obsolete and aging 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 the conventional option that would otherwise be implemented by Powerlink to ensure ongoing compliance with the Rules' obligations to maintain operational protection systems.

Given the specific nature of the Rules' obligations relating to protection systems, the conventional option reflects the replacement of the current aging and obsolete secondary systems as and when they reach the end of technical service life, rather than an option in which the current systems are run to failure with an escalating risk of unserved energy and reactive maintenance costs.

The failure of any individual secondary system at the Tarong Substation would not necessarily lead to unserved energy, given the requirement in the Rules to maintain redundancy in protection systems. However, while networks are typically resilient to isolated faults, the assumption of running a fleet of secondary systems to failure leads to a higher likelihood of multiple concurrent systemic faults. This could result in substantial unserved energy and overwhelm Powerlink's capacity to undertake corrective maintenance or replacement projects.

In a worst-case scenario, running fleets of secondary systems to failure could lead to cascading blackouts across the network. Powerlink does not therefore consider that this would be a credible base case against which to conduct the RIT-T assessment, as it is far removed from appropriate practice.

4.2 Base Option: Replace selected secondary systems in existing building by late 2022

Powerlink is the proponent of this option.

The Base Option involves the replacement of all aging and obsolete 275kV secondary systems with new panels installed in the current building, thereby retaining the infrastructure within the existing building. This minimises the amount of work required in the switchyard by retaining the existing cabling. It also avoids the need to run new fibre paths between the current building and the new pre-fabricated building under Option 1.

As part of this option the termination racks inside the current building will be replaced.

Decommissioning will be slightly more complex as the work must be carried out in a space occupied by two sets of secondary system panels (old and new) as opposed to just one set under the alternative option. Major cost components are shown in Table 4.3.

Table 4.3: Main project components for the Base Option

Components	Cost ($k, real 2017/18)	Construction timetable & completion date
Replacement of obsolete protection and control systems within existing building at Tarong	5,406	Design and procurement: 2019 Completion: late-2022
Modification of secondary systems at adjacent substations	830	
Telecommunication works at Tarong & remote ends	354	
Other *Includes project management, design & commissioning coordination, network operations, compliance management and statutory costs (Qleave)*	1,238	
TOTAL	**7,828**	

4.3 Option 1 – Replace selected secondary systems using pre-fabricated building by late 2022

Powerlink is the proponent of this option.

Option 1 involves the replacement of all aging and obsolete 275kV secondary system within a prefabricated building. The building is constructed, fitted out and tested off-site, before being relocated to the substation for commissioning.

This approach provides for a more efficient layout and installation of panels compared to the Base Option. The panels can be tested at Powerlink by internal staff and any issues addressed before the building is shipped to site. It also results in a common start-up date for the panels, internal cabling and DC supplies, making it easier to schedule and carry out maintenance.

The installation of a new building will however require on-site civil works and provision of AC supplies, while new switchyard cabling will also be needed under this Option.

Major cost components are shown in Table 4.4

Table 4.4: Main project components for Option 1

Components	Cost ($k, real 2017/18)	Construction timetable & completion date
Replacement of obsolete protection and control systems within new prefabricated building at Tarong	6,212	Design and procurement: 2019 Completion: late-2022
Modification of secondary systems at adjacent substations	830	
Telecommunication works at Tarong & remote ends	387	
Other *Includes project management, design & commissioning coordination, network operations, compliance management and statutory costs (Qleave)*	1,264	
TOTAL	**8,693**	

4.4 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).

5. Materiality of market benefits

Powerlink does not consider that the 275kV secondary systems replacement at Tarong Substation would provide any market benefits due to the nature of the project.

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

None of the secondary systems replacement options will have an impact on wholesale market outcomes 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.[12]

- **changes in patterns of generation dispatch**: replacement of secondary systems by itself does not affect transmission network constraints or affect transmission flows that would change patterns of generation dispatch. It follows that changes through different patterns of generation dispatch are not material to the outcome of the RIT-T assessment
- **changes in voluntary load curtailment**: a secondary system's 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 above, secondary systems faults by themselves do not necessarily lead to unserved energy as redundancies are built into transmission network at a broader level. These redundancies mitigate the risk of involuntary load shedding in the event of secondary systems faults to a negligible level
- **changes in costs for other parties**: the effect of replacing secondary systems 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 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**: credible options for secondary systems 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 does not affect the characteristics of primary transmission assets
- **changes in ancillary services cost**: there is no expected change to the costs of Frequency Control Ancillary Services (FCAS), Network Control Ancillary Services (NCAS), or System Restart Ancillary Services (SRAS) due to credible 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.

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

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 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.

6. General modelling approach adopted to assess net benefits

6.1 Analysis period

The RIT-T analysis has been undertaken over a 15-year period, from 2020 to 2034. A 15-year period takes into account the size and complexity of the secondary systems.

As new secondary systems have an operational life of 20 years, there will be some remaining asset life by 2034 under each option, at which point a terminal value is calculated to correctly account for capital costs under each credible option.

6.2 Discount rate

Under the RIT-T, a commercial discount rate is applied to calculate the net present value (NPV) of costs and benefits of credible options. Powerlink has adopted a real, pre-tax commercial discount rate of 7.04%[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 the Base Option is the lowest cost preferred option.

Table 7.1: Net present values for each credible option (NPV, $million 2017/18)

Option	Central Scenario NPV	Ranking
Base Option	-5.6	1
Option 1	-6.2	2

When directly comparing Option 1 to the Base Option, Option 1 is $604,000 more expensive in net present terms.

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 the Base Option is the preferred option under all sensitivities (both considered individually and in combination).

7.3 Conclusion

The result of the cost benefit analysis indicates that the Base Option is the highest net benefit solution (lowest cost in NPV terms) over the 15-year period of analysis. Sensitivity testing shows the analysis is robust to variations in the capital cost and the discount rate assumptions.

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 the Base Option be implemented to address the risks arising from the aging and obsolete 275kV secondary systems at Tarong Substation

The Base Option involves replacing all aging and obsolete 275kV secondary systems at Tarong Substation using pre-wired panels installed in the current building. This option retains the existing infrastructure within the building and is the lowest cost option in both capital and net present terms.

The estimated capital cost is $7.8 million (2017/18). Powerlink is the proponent of this proposed option.

Design activities would be expected to commence in early 2019 followed by on-site construction activities commencing by mid-2020, with completion of the project in late 2022.

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 during the PSCR consultation period and 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)	31 August 2018
	Submissions due on the PSCR Have your say on the credible options and potential non-network options.	30 November 2018
Part 2	Publication of the PACR Responding to any submissions received and making a final recommendation on the preferred option for implementation.	January 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).

10. Appendix 1: Options considered but not progressed

Option description	Reason for not progressing option
In-situ replacement of secondary systems components: replacement of individual obsolete components in existing panels.	Replacement of individual secondary system components within existing panels is not technically feasible due to safety requirements and space constraints in the panel layout currently used at Tarong. This option is also not economically feasible as much of the old wiring is “set” and any disturbance would likely damage the insulation, resulting in the need to replace the wiring, and/or rewire the components. This option would therefore have substantially higher costs, but would not provide additional benefits.

Contact us

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