Powerlink Queensland

Project Specification Consultation Report

25 September 2018

Maintaining reliability of supply at Kamerunga 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.

Contents

Executive Summary

Located approximately 10 kilometres north west of Cairns, Kamerunga Substation, established in 1976, is a major injection point into the Ergon Energy distribution network. Planning studies have confirmed there is an enduring need for the substation to maintain the supply of electricity in the Cairns area.

Both the primary plant and secondary systems at Kamerunga Substation are nearing the end of their technical service lives with identified condition and obsolescence issues. The substation is also susceptible to major flooding events which could result in damage to equipment leading to loss of supply.

Much of the substation's primary plant, the equipment through which the electrical power passes, has reached the end of its technical service life, resulting in performance degradation increasing the risk to supply in the Cairns area. In addition, the site has inherent design issues including insufficient electrical clearances (currently managed through temporary measures), poor drainage and a single 125V DC supply system.

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. Many of the secondary systems at Kamerunga Substation are nearing the end of their technical service lives and have become or are becoming obsolete, where they are no longer supported by the manufacturer and have only limited, or no spares available. 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 adequately protected.

In the case of extreme whether events causing flooding such as cyclones, studies have shown the substation would be inundated with 1.25 metres of water during a 1 in 100 year flood event and 1.6 metres for a 1 in 200 year event, resulting in extensive damage to its protection and control systems and loss of supply. This would result in a significant risk to supply in the area, while also leaving Powerlink operating Kamerunga Substation outside the recommended State Planning Policy guidelines for major substation infrastructure to allow the substation to service community needs during and immediately following a flood event.[1]

The state of the primary plant and secondary systems at Kamerunga substation, along with the existing flood risk, presents Powerlink with a range of reliability of supply, safety and compliance risks requiring resolution.

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

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

Four credible options have been identified to address the identified need

A Base Option reflecting a conventional approach to ensuring continued compliance with the secondary systems obligations in the Rules, along with a staged replacement of primary plant has been identified to serve as the basis of comparison between options. This approach involves a full secondary systems and telecommunications equipment replacement, housed in a new prefabricated building, along with the staged replacement of selected primary plant over an eight year period.

This option has then been compared with three other options in which the secondary systems are all fully replaced in a single stage and the primary plant replaced with either the current Air Insulated Switchgear (AIS) technology, or an alternative Gas Insulated Switchgear (GIS) technology, in a single stage.

Options 2 and 3 include improved switching functionality to address the potential for outages on the Barron Gorge feeders and Kamerunga transformers should the Woree feeder trip.

Options 1, 2 and 3 provide improved flood resilience by 2022 while the Base Option does not address the flood issues until 2028.

[1] Queensland Government, Department of Infrastructure, Local Government and Planning – State Planning Policy – state interest guidelines, Natural hazards, risks and resilience, April 2016

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

Table 1: Summary of credible options

Option	Description	Indicative capital cost ($million, 2017/18)	Indicative annual O&M costs ($million, 2017/18)
Base Option	Single stage secondary system replacement. Staged AIS primary plant replacement. Flood operable by October 2028	26.70	0.20
Option 1	Single stage secondary system replacement. Single stage AIS primary plant replacement. Flood operable by October 2022	23.20	0.19
Option 2	Single stage secondary system replacement. Single stage GIS primary plant replacement including additional switching functionality. Flood operable by October 2022	23.88	0.08
Option 3	Single stage secondary system replacement. Single stage AIS primary plant replacement including additional switching functionality. Flood operable by October 2022	23.75	0.12

Powerlink has also considered whether non-network options could address the identified need. A non-network option that avoids replacement of secondary systems and primary plant would need to replicate the support that Kamerunga Substation provides the Ergon Energy 22kV network in meeting the Rule's reliability obligations on an enduring basis.

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

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 21 December 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,[2] optimizing performance and efficiently managing assets through the whole of asset life cycle.[3]

Both the primary plant and secondary systems at Kamerunga Substation are nearing the end of their respective technical service lives and are increasingly at risk of failure. Under the Rules, Powerlink must take action to address this risk within the RIT-T process.

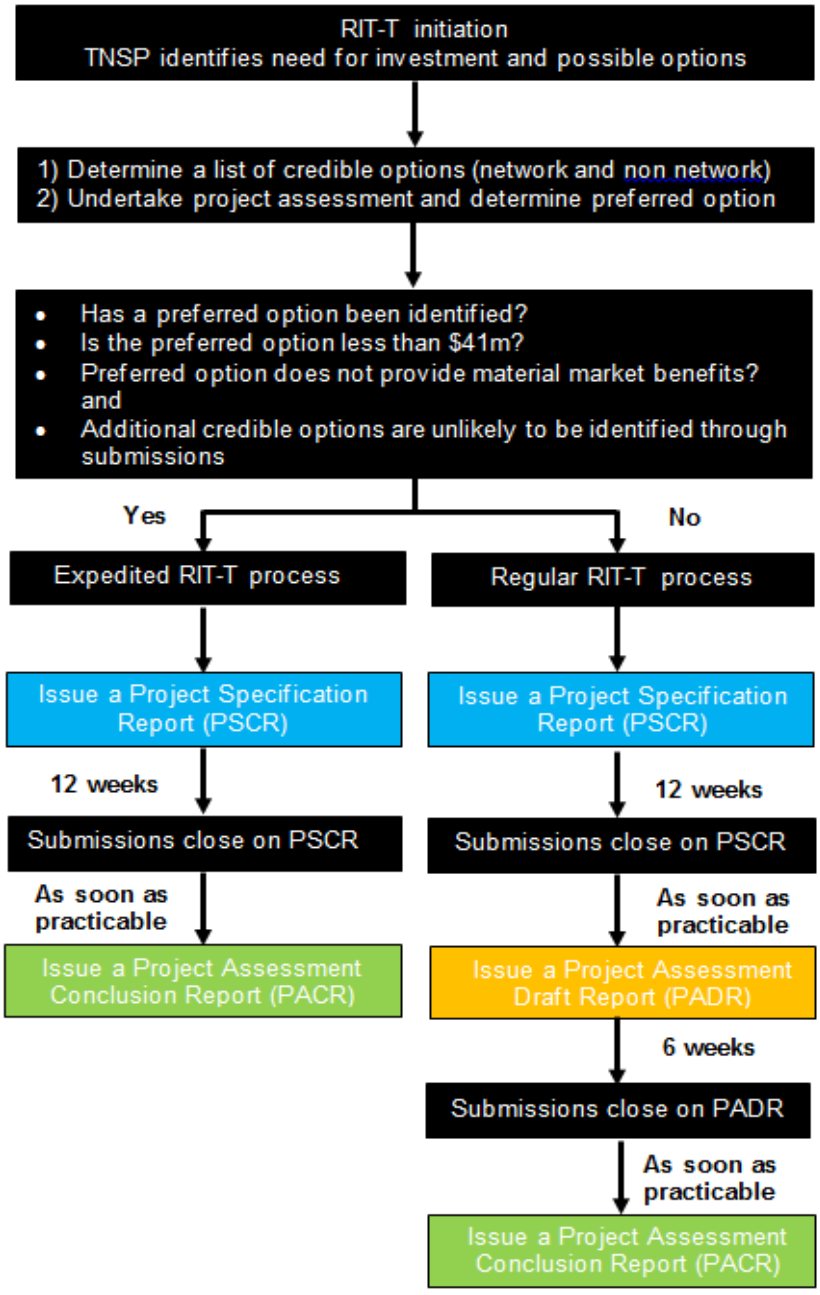
This Project Specification Consultation Report (PSCR) is the first step in the RIT-T process. It:

- 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]
- 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 Draft Report (PADR).

Figure 1.1 outlines the RIT-T process.

[2] Risk assessments are underpinned by Powerlink's corporate risk management framework and the application of a range of risk assessment methodologies set out in AS/NZS ISO31000:2018 *Risk Management Guidelines*.
[3] Powerlink aligns asset management processes and practices with AS ISO55000:2014 *Asset Management – Overview, principles and terminology* to ensure a consistent approach is applied throughout the life cycle of assets
[4] 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 RIT-T process. However, given the flood mitigation considerations in addition to the identified need, and the varied technology of the options, Powerlink considers that this RIT-T 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 will not be sought.

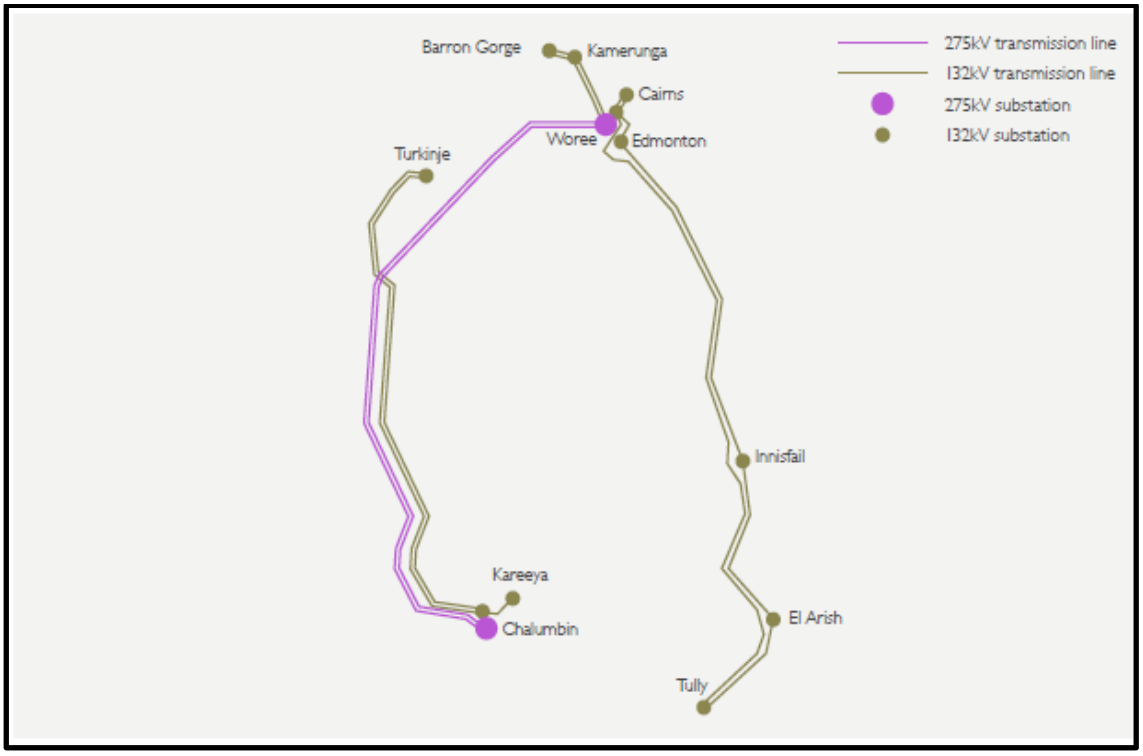
2. Identified need

This section provides an overview of the existing arrangements at Kamerunga Substation and describes the risk to supply from the assessed condition of the transmission assets.

2.1 Geographical and network overview

Kamerunga Substation is located approximately 10 kilometres north west of Cairns. It was established in 1976 and consists of a switchyard operating at 132kV[5]. It provides the only injection point to the 22kV network in the Cairns Northern Beaches area, including Cairns Airport and connects the Barron Gorge Power Station to the transmission network. The Far North Queensland transmission network is shown in Figure 2.1.

Figure 2.1: Far North Queensland transmission network



2.2 Description of identified need

With peak demand in the Cairns area forecast to remain at or slightly above current levels, it is vital that the Kamerunga Substation has the ongoing capacity to satisfy these demands to ensure ongoing reliable supply to customers in the local region.

Powerlink's condition assessment of the aging assets at Kamerunga has highlighted that the majority are nearing the end of their technical service life with much of the substation's primary plant, protection, control and supervisory systems no longer supported by their respective manufacturers.

In addition to the risks posed by aging assets, the substation also has a significant loss of supply risk in the case of a major flood event, as it is currently not built to withstand a 1 in 100 year or 1 in 200 year flood. Further, the current configuration of the substation also poses a risk to the supply of electricity to the Cairns North area, and connection of the Baron Gorge Power Station to the network, should the Woree feeders trip for a fault on one of the feeders.

[5] Kamerunga Substation is supplied by two 132kV feeders from Woree, and connects Barron Gorge through two additional 132kV feeders. The two 132/22kV transformers are connected to Ergon Energy's network via a 22kV underground cable.

2.3 Assumptions underpinning the identified need

The need to invest is driven by Powerlink's obligations to address the increasing risks to supply arising from aging and increasingly obsolete assets as well as the potential for flood inundation at Kamerunga Substation. If not addressed, these risks can extend the time taken to recover (or even prevent recovery) from faults, due to a lack of support from manufacturers and a lack of spare parts.

Powerlink's obligations as a TNSP[6] require it to 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 Kamerunga, this includes ensuring the ongoing availability of its primary switchgear and instrument transformers to ensure the ongoing reliable supply of electricity to customers.

Under the Rules, Powerlink is also required to provide sufficient primary protection systems and back-up protection systems to ensure that a fault of any type anywhere on its transmission system is automatically disconnected.[7] In the event of an unplanned outage, the Power System Security Guidelines published by AEMO, require that the primary network assets must be taken out of service within 24 hours.[8]

It follows that the increasing likelihood of faults associated with aging assets and their obsolescence compels Powerlink to undertake reliability corrective actions at Kamerunga Substation if it is to continue meeting the standards for reliability of supply and comply with obligations for protection system availability as set out in the Rules.

The State Planning Policy guidelines[9] also recommend Powerlink design, site and operate its substations to avoid adverse impacts on the community during and immediately following a 1 in 200 year flood event.

2.4 Description of asset obsolescence and risks

Kamerunga Substation consists of two 132/22kV power transformers and associated 132kV bays, four 132kV feeder bays, and associated secondary systems. It was established in 1976 with the two transformers being replaced in 1990 and 1996 respectively.

The majority of primary plant including circuit breakers, earth switches, disconnectors, bus bars and surge arrestors date back to the late 1970s, and present an increasing risk of failure with very few spares available and no manufacturers' support for repairs. The circuit breakers in both transformer bays are of particular concern given their age, condition and consequences of failure.

The circuit breakers in transformer bay 1 were manufactured in 1981 and installed on site in 1984. These circuit breakers have had increased failure rates due to frequent issues with the air compressors. The circuit breakers in transformer bay 2 have been in service since 1976 and are showing significant age related degradation resulting in slower clearance times and an increased risk of failure to operate. In both cases, these circuit breakers are no longer supported by their manufacturers.

The increasing risk to the reliability of the primary plant has the potential to directly impact supply, whilst the lack of spares and manufacturer support increases significantly the timeframe to rectify such failures and restore the network to a resilient state.

In addition, the absence of any dedicated circuit breakers on the Woree feeders means a trip to either of these results in maintenance crews having to be despatched to site to manually isolate the faulted line.

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[6] Schedule 5.1a System Standards and 5.1.2 Network Reliability of the Rules, and Queensland Transmission Authority T01/98

[7] Clause S5.1.9(c) of the Rules requires that faults are automatically disconnected in accordance with clause S5.1.9 (e) or clause S5.1.9(f)

[8] AEMO Power System Operating Procedure SO_OP_3715 – *Power System Security Guidelines* (the Rules require AEMO to develop and publish Power System Operating Procedures pursuant to clause 4.10.1(b) of the Rules, which Powerlink must comply with per clause 4.10.2(b)).

[9] Queensland Government,Department of Infrastructure, Local Government and Planning – State Planning Policy – state interest guidelines, Natural hazards, risks and resilience, April 2016

In addition to the increased risk to supply due to the deteriorated condition of the primary plant, the site also has inherent design issues. Due to the age of the site, the switchyard was not designed to meet current electrical clearance distances. This is managed on site through temporary earthworks. The control building at Kamerunga has only a single 125V DC supply, impacting the reliability and security of the secondary systems.

The majority of the secondary system equipment at Kamerunga Substation was installed over 20 years ago and is now at or reaching the end of its technical service life. The equipment is no longer supported by the respective manufacturers and spare parts are no longer available. Consequently, these secondary systems are maintained with an increasingly limited stock of spare parts and without manufacturer support for repairs.

The lack of manufacturer support and spare equipment, and the reliability of the aging equipment are becoming an unacceptable risk to ongoing reliable supply of electricity to the local community. Additionally, most devices are located in corridor type panels that present space constraints and potential safety issues during maintenance activities.

Powerlink uses an asset health index rating to categorise at-risk secondary system equipment, based upon the equipment functional failure rate (i.e. failure to operate as intended), the environmental condition where the assets are installed and the 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 that the asset requires immediate action to address its increasing risk of unreliable operation. The impact of equipment obsolescence is also considered when determining the recommended action.

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

Table 2.1: Summary of secondary system health index scores at Kamerunga Substation

Bay	Construction year	Health index range (average)	Description
22kV Earthing Transformers	1990-2010	3.0-10.0 (7.7)	Majority of equipment is obsolete, with insufficient spares to support ongoing operation. Remedial action required
Transformer Bays	1990-2002	6.7 – 10 (8.7)	50% of equipment has a health index of 10, and is subject to increasing failure rates. Majority is obsolete, with insufficient spares to support ongoing operation. Remedial action required
Feeder Bays	1998 and 2006	4.9 – 8.6 (6.6)	Majority of equipment is obsolete, with insufficient spares to support ongoing operation. Remedial action required
Metering Bays	1999-2014	3.3-8.2 (6.0)	Interface switches are obsolete. Equipment is located in constrained corridor panels. Remedial action required
Non-bay secondary systems(incl SCADA & OpsWAN)	1997-2005	6.8-10 (8.9)	Majority of equipment is obsolete, with insufficient spares to support ongoing operation. Remedial action required

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

The Kamerunga Substation site is also susceptible to flooding events and was originally designed with insufficient drainage. The substation is located in low-lying terrain, in tropical North Queensland which is subject to heavy rainfall and cyclonic events. Studies have shown that the substation would be inundated with 1.25 metres of water during a 1 in 100 year flood event and 1.6 metres for a 1 in 200 year event, resulting in extensive damage it its protection and control systems and loss of supply. The current risk of inundation at the substation also leaves Powerlink operating Kamerunga Substation outside the recommendations of the State Planning Policy guidelines[10].

Taking into consideration the most recent analysis and understanding of the risks arising from the primary plant and secondary systems at Kamerunga 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 Powerlink's 2018 Transmission Annual Planning Report (TAPR).

[10] Queensland Government, Department of Infrastructure, Local Government and Planning – State Planning Policy – state interest guidelines, Natural hazards, risks and resilience, April 2016

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 Transmission Annual Planning Reports 2011 to 2018, an expectation that action would be required at Kamerunga Substation to maintain reliability of supply requirements in the Far North Queensland transmission zone.[11]

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

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

3.1 Criteria for proposed network support services

A non-network solution that avoids replacement of the primary plant and secondary systems at Kamerunga Substation would need to replicate the functionality, capacity and reliability of the substation on an enduring basis.

Any non-network option able to provide supply to the 22kV network of up to a peak 60MW, and up to a peak 900MWh per day on a continuous basis would allow for the decommissioning of the Kamerunga substation and bridging of the Woree to Kamerunga Feeders to the Kamerunga to Barron Gorge Feeders.

Powerlink has identified the following common criteria that must be satisfied if any proposed non-network solutions are to meet supply requirements[12].

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. The level of support is however 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[13].
- 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.

[11] This relates to the standard geographic definitions (zones) identified within the *Powerlink's Transmission Annual Planning Report*,, which is published annually by 30 June.
[12] 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.
[13] 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 primary plant and secondary systems condition risks at Kamerunga 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 four credible network options as part of this PSCR: These are outlined in Table 4.1.

Table 4.1: Credible Options

Option	Description	Indicative capital cost ($million, 2017/18)	Indicative annual O&M costs ($million, 2017/18)
Base Option	Full secondary systems replacement with prefabricated building and partial AIS primary plant replacement on existing foundations and structures. Primary plant established at current flood level. Commission by October 2021 Replace Barron Gorge 132kV feeder circuit breakers. Commission by October 2024 Replace remaining AIS primary plant using new foundations and raised structures. Fit new foundations to primary plant installed in 2021. All primary plant established to comply with 1 in 200 year flood level. Flood operable by October 2028. Commission by October 2028	26.70	0.20
Option 1	Single stage secondary system replacement. Single stage AIS primary plant replacement. Flood operable by October 2022. Commission by October 2022	23.20	0.19
Option 2	Single stage secondary system replacement. Single stage GIS primary plant replacement including additional switching functionality. Flood operable by October 2022. Commission by October 2022	23.88	0.08
Option 3	Single stage secondary system replacement. Single stage AIS primary plant replacement including additional switching functionality. Flood operable by October 2022. Commission by October 2022	23.75	0.12

All credible options address the aging secondary systems and primary plant, as well as the risk of flood inundation. Options 1, 2 and 3 address flood operability by 2022, while the Base Option results in the substation becoming flood operable by 2028.

Both the Base Option and Option 1 retain the current switching capabilities in that they do not include circuit breakers on the Woree feeders. None of these options has been discussed by the Australian Energy Market Operator (AEMO) in its most recent National Transmission Network Development Plan (NTNDP).[14]

Additional options that have been considered but not progressed, due to not being either economically or technically feasible, are listed in Appendix 1.

[14] 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.

Any recovered primary plant with a remaining technical service life will be retained as spares for the network.

The primary plant to be installed under each option again reflects the exclusion of circuit breakers on the Woree Feeders under the Base Option and Option 1, as well as the substitution of current live tank circuit breakers with dead tank circuit breakers with integrated current transformers under all but the Base Option.

Table 4.2: Primary Plant to be installed under each network option

	Surge Arrestors	Current Transformers	Voltage Transformers	Circuit Breakers	Isolators	Earth Switches
Base	18	12	12	5	9	3
Option 1	18	12	12	5	9	3
Option 2	18	12	12	7	9	3
Option 3	18	12	12	7	9	3

Secondary systems are essentially the same for each option, with the exception of no circuit breaker protection on the Woree Feeders under the Base Option and Option 1. (See Table 4.3.)

Table 4.3: Secondary systems equipment to be replaced or modified

System	Type
Protection and control systems	4x 132kV feeder systems 2x 132kV transformer systems 2x earthing transformers 1x bus Coupler system 2x 132kV bus zone systems
Telecommunications systems	2x multiplexor systems
Metering	2x transformer systems 2x feeder systems
Non-bay	1x operational wide area network system 2x site infrastructure panels
Remote end substation protection systems	4x remote end feeder protection systems

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. It maximises the technical service life of those primary plant items replaced within the past 15 years and addresses the full flood risk in the final stage of construction when this primary plant is replaced.

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 in a single stage, rather than an option in which the current systems are run to failure with an escalating risk of unserved energy and reactive maintenance costs.

This Base Option provides a benchmark against which to assess other credible options.

4.2 Base Option: Staged AIS primary plant replacement. Flood operable October 2028

Powerlink is the proponent of this option.

Primary plant will be replaced in a staged manner that reflects the difference in age profiles between items of switchgear.

Work planned for completion by October 2021 includes replacement of nine (9) surge arrestors, three (3) circuit breakers, five (5) voltage transformers and the substation strain beam.

Work planned for completion by October 2024 includes replacement of two (2) circuit breakers and associated modifications to the Barron Gorge feeders.

The final work, planned for completion by October 2028 includes the replacement of the balance of the switchgear. All switchgear is to be established above the 1 in 200 year flood level for the Kamerunga substation at this time.

Replacement of all existing secondary systems using a prefabricated control building fitted out with the required panels and factory tested off-site before being relocated to site for commissioning by October 2021. The control building will be established above the 1 in 200 year flood level for the Kamerunga area.

Table 4.4: Main project components for the Base Option

Components	Cost ($k, real 2017/18)	Construction timetable and commissioning date
Full secondary systems and initial AIS on existing foundations + Telecoms for AIS changes	10,274	Completion: October 2021
Modifications to Barron Gorge and Woree feeder protection + temporary changes to Barron Gorge Feeders	887	
Replace Barron Gorge Circuit Breaker	1,408	Completion: October 2024
Modifications to Barron Gorge Feeder	508	
Balance of AIS + balance of telecoms work	10,303	Completion: October 2028
Changes to Barron Gorge and Woree Feeder settings + temporary changes to Barron Gorge Feeders	683	
Other - this includes project management, commissioning coordination, network operations, compliance management and statutory costs (Qleave)	2,636	
Total	**26,699**	

4.3 Option 1: Single stage AIS primary plant replacement. Flood operable October 2022

Powerlink is the proponent of this option.

Primary plant will be replaced in a single stage using AIS technology. All switchgear is to be established above the 1 in 200 flood level for the Kamerunga area.

Replacement of all existing secondary systems using a prefabricated building fitted out with the required panels and factory tested off-site before being relocated to site for commissioning. The building will be established above the 1 in 200 year flood level for the Kamerunga area.

Table 4.5: Main project components for Option 1

Components	Cost ($k, real 2017/18)	Construction timetable and commissioning date
Full secondary systems and new AIS primary plant on new foundations + Telecoms for AIS changes	19,105	Completion: October 2022
Modifications to Barron Gorge and Woree feeder protection + temporary changes to Barron Gorge Feeders	1,556	
Other - this includes project management, commissioning coordination, network operations, compliance management and statutory costs (Qleave)	2,539	
Total	**23,200**	

4.4 Option 2: Single stage GIS primary plant replacement. Flood operable October 2022

Powerlink is the proponent of this option.

Primary plant will be replaced in a single stage using GIS technology, including circuit breakers on the Woree feeders. GIS building to be established above the 1 in 200 flood level for the Kamerunga area. Replacement of all existing secondary systems within a new dedicated GIS building established above the 1 in 200 flood level for the Kamerunga area.

Table 4.6: Main project components for Option 2

Components	Cost ($k, real 2017/18)	Construction timetable and commissioning date
Full secondary systems and full GIS in new Building + Telecoms for GIS changes	19,654	Completion: October 2022
Modifications to Barron Gorge and Woree protection + new underground cables	2,256	
Other - this includes project management, commissioning coordination, network operations, compliance management and statutory costs (Qleave)	1,968	
Total	**23,878**	

4.5 Option 3: Single stage AIS primary plant replacement, with Woree feeder CBs. Flood operable October 2022

Powerlink is the proponent of this option

Primary plant will be replaced in a single stage using AIS technology, including new circuit breakers on the Woree feeders. All switchgear is to be established above the 1 in 200 flood level for the Kamerunga area.

Replacement of all existing secondary systems using a prefabricated building fitted out with the required panels and factory tested off-site, before being relocated to site for commissioning. The building will be established above the 1 in 200 year flood level for the Kamerunga area.

Table 4.7: Main project components for Option 3

Components	Cost ($k, real 2017/18)	Construction timetable and commissioning date
Full secondary systems and full AIS on new foundations, including addition of CBs for Woree feeders + Telecoms for AIS changes	19,636	Completion: October 2022
Modifications to Barron Gorge and Woree protection + temporary changes to Barron Gorge Feeders	1,556	
Other - this includes project management, commissioning coordination, network operations, compliance management and statutory costs (Qleave)	2,559	
Total	**23,751**	

4.6 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 criteria.[15]

[15] 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 the proposed works at Kamerunga Substation will provide any market benefits, due to the nature of the project.

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[16].

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

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

- **changes in patterns of generation dispatch**: replacement of existing assets by itself does not affect transmission network constraints or affect transmission flows that would change patterns of generation dispatch. The inclusion of additional circuit breakers on the Woree Feeders will have an immaterial impact on generation dispatch in the area. 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**: replacement of existing assets 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**: the credible options under consideration will not lead to unserved energy so it follows that changes in involuntary load shedding are not material to the outcome of the RIT-T assessment
- **changes in costs for other parties**: the effect of replacing the aging assets 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 asset 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 the aging assets has no material effect on the characteristics of the asset
- **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.

[16] 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 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. 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.

6.1 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.

6.2 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	25 September 2018
	Submissions due on the PSCR Have your say on the credible options and propose potential non-network options.	21 December 2018
Part 2	PADR Publication Powerlink's response to submissions received and assessment of any viable non-network options for potential inclusion in final solution	January 2019
	Submissions due on the PADR	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.	March 2019

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

7. Appendix 1: Options considered but not progressed

Table A1: Options considered but not progressed

Option description	Reason for not progressing option
Re-establishment of substation on new site to address flood issues and provide future scalability.	Establishing a new high-voltage substation site and associated easements in a semi- urban environment is inconsistent with community expectations and local panning schemes. Any delays in the planning approval process would represent a high level of risk to the required flood mitigation works and ongoing reliability of supply.
New 22kV injection at alternate sites	Under this option the switching function of Kamerunga would be removed and new 132/22kV supplies would need to be established at Smithfield and Redlynch, along with the reconfiguration of the 22kV distribution network. Powerlink does not consider this to be an economically credible option.

Contact us

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