2018-22
POWERLINK QUEENSLAND REVENUE PROPOSAL

Project Pack - PUBLIC

CP.02339
Kemmis No. 2 Transformer Replacement

Delivering better value

ID&TS – Reset 2017/18-2021/22 Project Proposal for CP.02339 T067 Kemmis No. 2 Transformer Replacement

Document Approval		
	Name	Position
Prepared by		Project Manager
Reviewed by		Manager Projects
Approved by		Group Manager Infrastructure Delivery

Contents

1. Executive Summary

T067 Kemmis Substation was originally established on 2002 to support mining development in the North Queensland Region and Ergon Energy's regional distribution network. T067 Kemmis substation has two 132/66/11kV transformers both being rated at 30/40MVA (Tx1 & Tx2).

Transformer 2 was first assembled in 1972 but established in T056 Townsville South in 1996 and subsequently relocated to T067 Kemmis in 2002 as a part of the substation development.

This unit is approaching 42 years of age and is starting to display issues typical of transformers of this age.

A transformer condition assessment was undertaken in 2015 (A2226512) has highlighted a number of issues with the unit.

The objective of this project is to replace the Transformer 2 with a new 40/50/65MVA unit by June 2019.

2. Project Definition

2.1 Project Scope

Briefly, the project consists of replacing the existing 132/66/11kV transformer 2 30/40MVA at T067 Kemmis with a new 132/66/11kV 40/50/65MVA transformer.

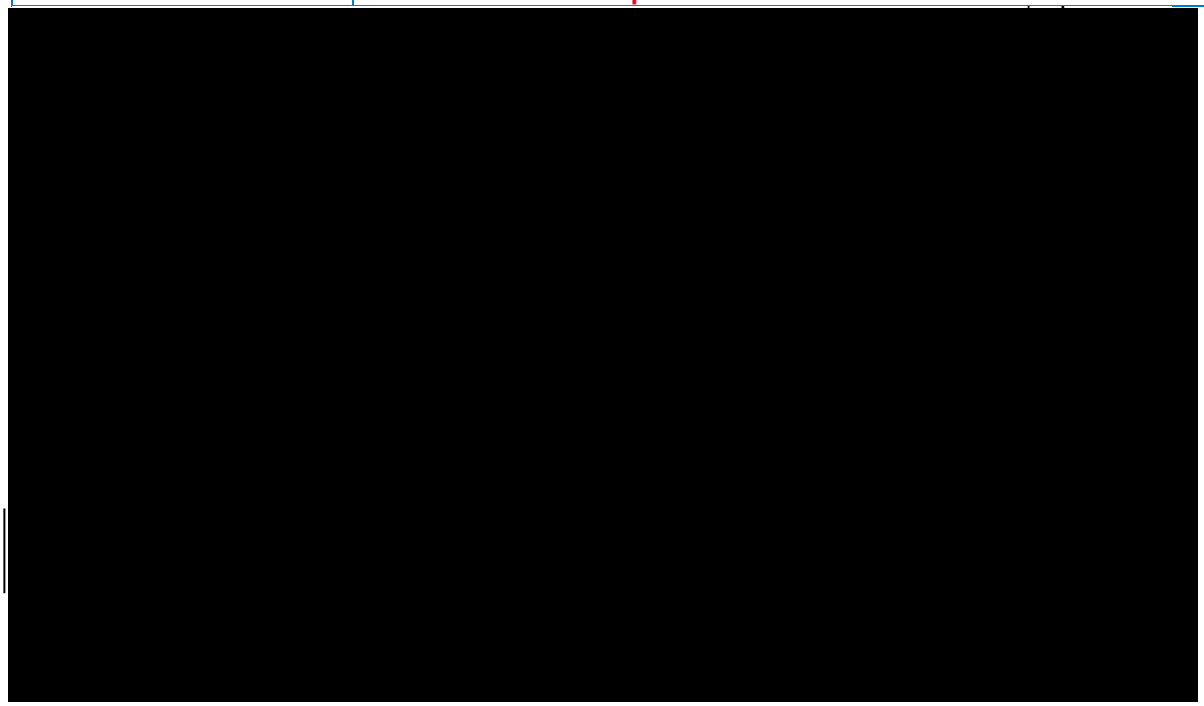
Decommission, remove and dispose of the recovered transformer 2.

2.1.1 Transmission Line Works

Not applicable.

2.1.2 T067 Kemmis Substation Works

- Design, procure, install and commission 1 x 132/66/11kV transformers, including all necessary civil works:
- Procure, supply and install one 132/66/11kV 40/50/65MVA transformers, with on load tap changer and cooling facilities;
- New transformer oil separation tank to allow for increased transformer oil quantity on site;
- Replace existing T2 132/66/11kV transformer with a new 40/50/65MVA transformer;
- Reconnect local supply to new T2 transformer and commission;
- Decommission old Transformer 2 unit, recover and dispose of decommissioned transformer units;
- Modify protection, automation and communication systems as necessary to accommodate the new transformers;



2.2 Major Scope Assumptions

- Existing transformer foundation is suitable for reuse. A high level desktop assessment has been performed however a more detailed on site assessment will be required as part of the detailed design phase;
- Existing 132kV strung bus connections and surge arrestors are suitable for reuse. A high level desktop assessment has been performed however a more detailed on site assessment will be required as part of the detailed design phase;
- Existing 66kV surge arrestors are suitable for reuse. A high level desktop assessment has been performed however a more detailed on site assessment will be required as part of the detailed design phase.
- The existing transformer footing is suitable for reuse. A high level desktop assessment has confirmed the existing foundation is large enough however a more detailed on site assessment will be required as part of the detailed design phase.

2.3 Scope Exclusions

- Upgrade or replacement of the associated 132kV TF bay equipment.

3. Project Execution

3.1 Project Dependencies & Interactions

Project No.	Project Description	Planned Comm Date	Comment
Pre-requisite Projects			
Co-requisite Projects			
Other Related Projects			

3.2 Site Specific Issues

3.3 Project Delivery Strategy

It is expected that the project will be delivered using a Substation Panel Contractor under a Construct Only contract. Powerlink is expected to perform the design with the Maintenance Service Provider performing the testing and commissioning.

Project Delivery Strategy Matrix		
Design	Earthworks Design	Powerlink
	Civil Design	Powerlink
	Electrical Design (Primary)	Powerlink
	Electrical Design (Secondary) – Protection	Powerlink
	Electrical Design (Secondary) – Automation	Powerlink
	Transmission Line Design	N/A
	Telecommunication Design	Powerlink
Construction	Earthworks Construction	SPA Contractor
	Civil Construction	SPA Contractor
	Electrical Construction / Installation	SPA Contractor
	TF Delivery and Installation	TF Manufacturer
Testing	Substation Testing – FAT	TF Manufacturer
	Substation Testing – SAT	Ergon Energy
	Substation Testing – Cut-Over	Ergon Energy
	Telecommunication Testing	Ergon Energy

3.4 Proposed Sequence of Works

3.4.1 Project Schedule

To meet the required commissioning date of 30th June 2019 full project approval will be required by 31st Jan 2018.

High Level Schedule

- Project Approval : 31st Jan 2018
- Order Transformer : Feb 2018
- Design Complete : Oct 2018
- SPA Construct contract awarded : Jan 2019
- Construction : March/April 2019
- Test/commissioning : April/May 2019
- Final decommissioning/Tidy up : June 2019
- Project Completion : 30th June 2019

3.4.2 Project Staging

Major project stages of the project are considered to be:

Stage	Description/Tasks
1	Construct new oil separation tank and connect to transformer 2 drainage system. Remove and dispose of old separation tank and backfill cavity as required.
2	Decommission, remove and dispose of old transformer 2 and install new transformer on existing plinth and foundation including carry out installation of all associated electrical works.
3	Cut over, test and commission new transformer 2 including all associated electrical works.

3.4.3 Network Impacts and Outage Planning

Preliminary outage advice from Network Operations has indicated that the required outages will be available providing the outage occurs outside the summer peak period and assuming the network in the area is intact. Feeder 7117 will need to remain in service during works as it is the only supply to Burton Downs. Agreement will be required from Ergon to have the Kemmis load at risk whilst Kemmis load is only supplied on a single transformer. A backup station services transformer/supply will be required while the transformer is out of service.

3.5 Project Health & Safety

The implications of relevant workplace health & safety legislation in delivering the proposed solution have been considered in preparing this estimate. The estimate includes an allowance for typical safety related activities required in the delivery phase of the project.

3.6 Project Environmental Management

No specific environmental management implications for the delivery of this project have been identified.

4. Project Risk Management

Some allowances have been allowed in the estimate. Please see the estimate for details. Please refer to the assumptions and exclusion as these items have implications for the overall project risk.

5. Project Estimate

5.1 Estimate Summary

Quote Summary

The quotation at current base level and escalated for completion by 30/06/2019 at 2.5% per year plus labour rate revisions, for CP.02339 Kemmis No.2 Transformer Replacement is as follows:

CP.02339 Quotation in $ AUD	Base Levels	Escalated to Compln.	Comment (Costs @ Base Levels)
T067 Kemmis Substation	[redacted]	[redacted]	Replace the existing 132/66/11kV transformer 2 30/40MVA at T067 Kemmis with new 132/66/11kV 40/50/65MVA transformer. Decommission, remove and dispose of the recovered transformer 2. New transformer oil separation tank and Noise wall. Modify protection and automation systems.
Project Management	[redacted]	[redacted]	
Qleave			
Other Costs			
TOTAL QUOTE (EXCL RISKS AND OFFSETS)	**3,116,096**	**3,359,669**	
Offsets Estimate	**0**	**0**	
TOTAL QUOTE (INCL OFFSETS)	**3,116,096**	**3,359,669**	
Climate	[redacted]	[redacted]	
Construction			
Design			
Risk Estimate	**187,000**	**187,000**	
TOTAL QUOTE (INCL RISKS AND OFFSETS)	**3,303,096**	**3,546,669**	

5.2 Asset Disposal Table

The current net book value of assets to be disposed of as a result of this project are set out in the table below.

CP.02339 Asset Disposal Value. Values current at 30th June 2016

Functional Loc.	Description	Asset	Subnumbe	Book val.	% Disposal	Total Disposal	Currency
T067-T02-2TRF	2 TRANSFORMER	106250	0	543,965.32	100%	543,965.32	AUD
					Total	543,965.32	AUD

6. References

Document name and hyperlink (as entered into Objective)	Version	Date
Project Scope Report	1.0	July 2015
Estimate Detail	3.0	Jan 2016

Transformer T2 Condition Assesment
T067 Kemmis Substation

Report requested by:	[redacted]	**Requested Completion Date:**	30/06/2015
Report Prepared by:	[redacted]	**Date of site visit:**	09/06/2015
AUTHOR/S:	[redacted]		
Report Approved by:	[redacted]	**Report Approval Date:**	26/06/2015
Report Reviewed by:	[redacted]	**Review Date:**	08/01/2015
Issue Approved by:	[redacted]	**Issue Date:**	

Date	Version	Objective ID	Nature of Change	Author	Authorisation
11/05/2015	1.0	A2226512	Original		
08/01/2015	2.0	A2371191	Review and small modifications	[redacted]	

IMPORTANT: - This condition assessment report provides an overview of the condition of power transformer/s (excluding internal transformer inspections) and high level indications of their residual reliable service life. As it is a snapshot in time and subject to the accuracy of the assessment methodology and ongoing in-service operating environment, the comments in this report are valid for 3 years from the date of the site visit stated above.

Table of Contents

1. SUMMARY

Transformer T2 is a 43 year old GEC-English Electric Pty Ltd design and in line with the requirements of AM-POL-0056, a condition assessment has been performed towards “end of life” including an on-site visual assessment combined with a desktop analysis of historical oil and insulation test data, maintenance history and through fault data history where available.

Although power transformer condition is monitored closely, the exact point of power transformer failure cannot be accurately predicted. As the consequences associated with catastrophic power transformer failure in electricity transmission are very high in terms of the financial costs, and potential loss of supply, impact on safety of personnel and public and on the environment (fire, gasses, oil disposal, etc.), the asset management strategy employed is to plan and execute replacement before the actual failure occurs.

This is done by assessing condition of the major transformer components and estimating their end of life as well as that of the overall transformer. As the transformer systems and components deteriorate their probabilities of failure increase leading to an increased risk cost and decreased transformer availability. While component repair or replacement may be possible, in many cases they would provide very little or no benefit with regards to the transformer probability of failure. Typically repairs would have to be performed on a number of power transformer components, whilst the major internal components (insulation, core and mechanical enforcement of internal components) cannot be repaired.

No attempt has been made in this report to cover any detailed economic analysis of the viability of rectifying any highlighted issues associated with this transformer but it provides a condition assessment of the “key” parameters for the transformer and what may need to be actioned by Powerlink if in-service operation is to continue for a further 5 years and beyond.

A summary of the findings is shown in Table 1. This suggests that the transformer has an estimated reliable “as is” residual service life of about three to five years. To keep the transformer much beyond this would likely require significant expenditure on repairs which may not be economic due to the poor reliability of the internal active part (the heart) of the transformer.

As a minimum and recommended approach, some routine maintenance would be required over the next few years to try and slow down existing oil leaks and fix localised corrosion in order to keep the transformer operational. This may include addressing additional radiator panel oil leaks which may develop where the oval radiator panel tubes enter the bottom radiator header and through the oval oil tube walls.

This transformer should be classified as having a low level of in-service reliability due to a range of factors, especially due to the condition of the winding insulation and the on-going mechanical stability of the active part.

TABLE 1

Summary of Estimated Residual Life of T2
"Key" Transformer Components

Parameter	Estimated Residual Life	Further Comments
Anti-corrosion system	Completely failed.	Distributed corrosion over main tank, most being minor but some not.
Winding paper life	5 years	Calculated average DP_V =330 Lowest DP_V = 230.
Winding mechanical stability	Cannot be assessed accurately, but is questionable due to design and exposure.	Old clamping structures design, lowering of DPv & moisture exchange.
External Micafil HV & LV bushings	HV bushings - estimated 3 years with increased risk. LV bushings – estimated 15 years.	The HV SRBP bushings are included in a family which have exceeded the OEM age limit for reliability. The LV SRBP bushings were replaced in 2006 as part of OR.0650
Insulating Oil	10 to 15 years	New oil in 2002.
Radiators	1 to 3 years	Oval tubes / headers are the big problem areas.
Repairs to leaking gaskets.	Required now	Cooler bank and main tank.
Overall residual life.	**3 to 5 years**	**For as is condition.**

[redacted]

[redacted]

Planning Statement – Kemmis Transformer Assessment

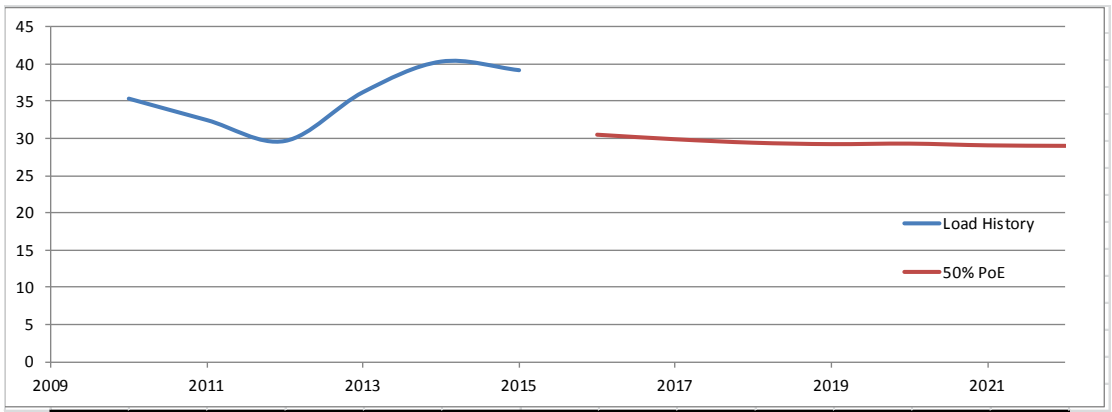
Recommendation: *It is recommended that transformer 2T be replaced with one transformer (minimum 40MVA) at end of life.*

Purpose: The purpose of this paper is to determine the transformation capacity forecast for the Kemmis substation.

Background: Kemmis Substation was established to support the load growth associated with the expansion of mining in the Northern Bowen Basin in 2002. Two 40MVA 132/66kV transformers are installed, with T1 relocated from Proserpine and T2 relocated from Townsville South. The ratings of the transformers are shown below

Transformer Ratings (MVA)	1T	2T
Normal Cyclic	45	40
Emergency Cyclic	49	56
2h Short Term	53	60

The historic and forecast loadings for T067 Kemmis are shown in Figure 1.



	Load History						50% PoE Forecast						
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
MVA	35	32	30	36	40	39	31	30	29	29	29	29	29

Figure 1: Historic and Forecast loads for T067 Kemmis

Latest condition information indicates that transformer T2 is approaching its end of life, and it is proposed that it is to be removed from service within the next 10 years.

The following Options were considered to address the EOL of transformer T2 at Kemmis.

Option: Replace 2T

Under this option the 2T would be replaced with a new (minimum 40 MVA) 132/66kV transformer.

This option provides adequate system intact capacity and ensures that Powerlink's reliability obligations under its Transmission Authority are met.

The use of a lower rated transformer and network support could be considered if it were to be cost effective.

Recommendation*: This option is recommended on the basis that it meets reliability obligations and represents the most economic and efficient investment decision.*

Option: Recover 2T

Under this option it would be proposed to recover 2T, leaving Kemmis supplied through a single transformer (minimum 40 MVA).

This option would meet Powerlink's obligations under its Transmission Authority where under 50MW of load would be at risk for the loss of the single remaining transformer, however, under contingency the energy at risk would violate Powerlink's Transmission Authority obligations as more than 600 MWh would be placed at risk with this proposed scheme.

This option, combined with network support, could be considered, however network support to carry the full load of T067 Kemmis would need to be online within 18 hours to ensure than not more than 600 MWh is placed at risk.

Recommendation*: This option should not be considered further on the basis that it does not meet Powerlink's reliability obligations.*