

NEED/OPPORTUNITY STATEMENT (NOS)



Tamworth 330kV Secondary System Renewal

NOS- 000000001243 revision 2.0

Ellipse project no.: P0005239

TRIM file: [TRIM No]

Project reason: Capability - Asset Replacement for end of life condition

Project category: Prescribed - Replacement

Approvals

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Endorsed	Mark Jones	Secondary Systems and Communications Asset Manager
Approved	Lance Wee	M/Asset Strategy
Date submitted for approval	10 November 2016	

Change history

Revision	Date	Amendment
0	29 April 2016	Initial issue
1	11 October 2016	Update to 2016/17 dollars
2	10 November 2016	Update to format

1. Background

Tamworth 330/132kV Substation comprises 4x 330kV feeders, 3x 330/132kV transformers, 2x 330kV Reactors and 4x 132kV feeders. The site was established in 1968, and the secondary systems assets have install dates between 1968 and 2014.

Tamworth 330kV Substation provides supply to TransGrid's Tamworth 132/66kV Substation and TransGrid's network in Northwest NSW. Tamworth 330kV Substation forms a part of the 330kV backbone of the NSW network and the QNI interconnector. The site will remain a part of the network into the foreseeable future as outlined in the load forecasts of the 2015 Transmission Annual Planning Report.

2. Need/opportunity

In accordance with TransGrid's Renewal and Maintenance Strategies for Automation¹ and Metering Systems², Table 1 shows the following assets at Tamworth 330kV Substation that have been identified for replacement by 2023.

Table 1 – Identified asset replacements at Tamworth 330kV Substation from 2014-2023

Need Description	Quantity of Assets to be addressed	% of Services at Site	Need Driver
Need ID 615 – Replacement of Optimho LFZP112 Protection Relays	4	50% of all 330kV line protection relays on site	<ul style="list-style-type: none"> > Component obsolescence resulting in a lack of spares and no manufacturer support > Inaccurate measurement of fault angles due to deteriorated internal components
Need ID 1380 – Protection - Schweitzer SELxxx Condition	4	50% of all 330kV line protection relays on site	<ul style="list-style-type: none"> > Component obsolescence resulting in a lack of spares and limited manufacturer support
Need ID 1382 – Protection – GE Relay Condition	2	33% of all transformer protections on site	<ul style="list-style-type: none"> > Regular firmware updates required, increasing lifecycle costs > Numerous component failures leading to spurious trips and Circuit Breaker Failure operations
Need ID 629 – Replacement of Remote Terminal Units (RTUs)	7	50% of RTUs on site	<ul style="list-style-type: none"> > Component obsolescence resulting in a lack of spares and no manufacturer support

Additionally, condition assessments for all these individual asset types have been completed³.

¹ Refer SSA Strategy - Renewal and Maintenance - Automation Systems

² Refer SSA Strategy - Renewal and Maintenance - Metering Systems

³ Refer NACA-SSAP - Protection , NACA-SSAC - Control, NACA-SSAM - Metering

The risk cost associated with all secondary systems at Tamworth 330kV Substation is \$3.3m per annum. The most significant element of concern is the reliability consequence associated with a protection system failing to operate during a genuine fault due to the malfunction of the protection relays identified for replacement above. This hazard can result in a number of different outcomes including load shedding, explosive failure of associated primary assets, offloading generation or in the most extreme case, black start of the entire network. The site forms part of the 330kV backbone of the network, is part of the QNI interconnector and carries a risk of a system black event. An estimated 16 hours would be required to recover the site and load after a hazardous event. The risk costs are based on 2015/16 probabilities of failure taken as a trend of existing defect rates of applicable asset types derived from the condition assessments. These probabilities are forecast to continue increasing over the coming years, with the consequence of failure also likely to escalate due to TransGrid's means of mitigating and repairing these failures being almost exhausted.

In accordance with TransGrid's Renewal and Maintenance Strategy for Secondary Systems Site Installations⁴, an opportunity exists to address these risks by performing a partial replacement of the secondary systems servicing the 330kV voltage level at Tamworth 330kV Substation as listed in the risk summary in Attachment 1. This opportunity is due to the high concentration of the secondary system assets required to be addressed. It is expected that this would provide additional benefits for the organisation including:

- > Moving from a centralised Alarm and Control platform to a distributed control architecture that improves operational control and reliability while reducing the consequence of equipment failure
- > Upgrading Auto Reclose facilities to allow better control, indication and fault analysis than what is currently available at the site
- > Upgrading Transformer Control facilities to allow better control, indication and fault analysis than what is currently available at the site
- > Optimising the current investment in TransGrid's High Capacity Telecommunications to the site by upgrading all ancillary systems to TransGrid's latest design standard which provides the greatest amount of real time operational and condition data to better support the planning, operation and maintenance of the Network

3. Related Needs/opportunities

The following related Needs contain works for Tamworth 330kV Substation that could be fulfilled by completing a Secondary Systems Replacement:

- > Need ID 615 – Replacement of Optimho LFZP112 Protection Relays
- > Need ID 1380 – Protection - Schweitzer SELxxx Condition
- > Need ID 1382 – Protection – GE Relay Condition
- > Need ID 629 – Replacement of Remote Terminal Units (RTUs)

4. Recommendation

It is recommended that options be considered to address the identified Need/opportunity.

⁴ Refer SSA Strategy - Renewal and Maintenance - Secondary Systems Site Installations

Attachment 1 – Risk costs summary

Summary of results is attached below. Refer to supporting document in PDGS for full risk assessment

Current Option Assessment - Risk Summary

Project Name: Tamworth 330kV Secondary Systems Renewal

Option Name: 1243 - Base Case

Option Assessment Name: 1243 - Base Case - Assessment 1

Rev Reset Period: Next (2018-23)



Major Component	No.	Minor Component	Sel. Hazardous Event	LoC x CoF (\$M)	Failure Mechanism	NoxLoC xCoF (\$M)	PoF (Yr-1)	Total Risk (\$M)	Risk (\$M) (Rel)	Risk (\$M) (Op)	Risk (\$M) (Fin)	Risk (\$M) (Peo)	Risk (\$M) (Env)	Risk (\$M) (Rep)
Battery and Charger System	2	Battery	Uncontrolled Electrical Contact / Discharge (Battery and Charger System)	\$0.36	Failure	\$0.72	9.20%	\$0.07	\$0.06	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Battery	Unplanned Outage - HV (Battery and Charger System)	\$0.36	Failure	\$0.71	9.20%	\$0.07	\$0.06	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Charger	Uncontrolled Electrical Contact / Discharge (Battery and Charger System)	\$0.36	Failure	\$0.72	9.20%	\$0.07	\$0.06	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Charger	Unplanned Outage - HV (Battery and Charger System)	\$0.36	Failure	\$0.71	9.20%	\$0.07	\$0.06	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Controls	14	Bay Controller	Unplanned Outage - HV (Controls)	\$0.41	Failure	\$5.75	4.65%	\$0.27	\$0.22	\$0.04	\$0.04	\$0.00	\$0.00	\$0.00
Controls	14	Control Cabling	Unplanned Outage - HV (Controls)	\$0.41	Failure	\$5.75	4.65%	\$0.27	\$0.22	\$0.04	\$0.04	\$0.00	\$0.00	\$0.00
Low Voltage AC Supply	2	AC Low Voltage Board/Panel/Box	Uncontrolled Electrical Contact / Discharge (Low Voltage AC Supply)	\$0.63	Failure	\$1.25	31.00%	\$0.39	\$0.21	\$0.17	\$0.17	\$0.00	\$0.00	\$0.00
Low Voltage AC Supply	2	AC Low Voltage Board/Panel/Box	Unplanned Outage - HV (Low Voltage AC Supply)	\$1.26	Failure	\$2.52	31.00%	\$0.78	\$0.61	\$0.17	\$0.17	\$0.00	\$0.00	\$0.00
Low Voltage AC Supply	2	AC Low Voltage Cable	Uncontrolled Electrical Contact / Discharge (Low Voltage AC Supply)	\$0.63	Failure	\$1.25	3.20%	\$0.04	\$0.02	\$0.02	\$0.02	\$0.00	\$0.00	\$0.00
Low Voltage AC Supply	2	AC Low Voltage Cable	Unplanned Outage - HV (Low Voltage AC Supply)	\$1.26	Failure	\$2.52	3.20%	\$0.08	\$0.06	\$0.02	\$0.02	\$0.00	\$0.00	\$0.00
Low Voltage DC Supply	2	DC Low Voltage Board/Panel/Box	Uncontrolled Electrical Contact / Discharge (Low Voltage DC Supply)	\$0.36	Failure	\$0.72	2.00%	\$0.01	\$0.01	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Low Voltage DC Supply	2	DC Low Voltage Board/Panel/Box	Unplanned Outage - HV (Low Voltage DC Supply)	\$0.36	Failure	\$0.72	2.00%	\$0.01	\$0.01	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Low Voltage DC Supply	2	DC Low Voltage Cable	Uncontrolled Electrical Contact / Discharge (Low Voltage DC Supply)	\$0.36	Failure	\$0.72	2.00%	\$0.01	\$0.01	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Major Component	No.	Minor Component	Sel. Hazardous Event	LoC x CoF (\$M)	Failure Mechanism	NoxLoC xCoF (\$M)	PoF (Yr 1)	Total Risk (\$M)	Risk (\$M) (Rel)	Risk (\$M) (Op)	Risk (\$M) (Fin)	Risk (\$M) (Peo)	Risk (\$M) (Env)	Risk (\$M) (Rep)
Low Voltage DC Supply	2	DC Low Voltage Cable	Unplanned Outage - HV (Low Voltage DC Supply)	\$0.36	Failure	\$0.72	2.00%	\$0.01	\$0.01	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Protection - <= 132kV	6	Protection	Unplanned Outage - HV (Protection - <= 132kV)	\$0.45	Failure	\$2.71	3.25%	\$0.09	\$0.07	\$0.02	\$0.02	\$0.00	\$0.00	\$0.00
Protection - <= 132kV	6	Protection Relay	Explosive Failure of Asset (Protection - <= 132kV)	\$0.49	Failure	\$2.96	3.25%	\$0.10	\$0.07	\$0.02	\$0.02	\$0.00	\$0.00	\$0.00
Protection - >= 220kV	11	Protection	Unplanned Outage - HV (Protection - >= 220kV)	\$0.45	Failure	\$4.97	3.62%	\$0.18	\$0.14	\$0.04	\$0.04	\$0.00	\$0.00	\$0.00
Protection - >= 220kV	11	Protection Relay	Explosive Failure of Asset (Protection - >= 220kV)	\$1.93	Failure	\$21.22	3.62%	\$0.77	\$0.72	\$0.03	\$0.03	\$0.00	\$0.00	\$0.01
				\$10.79					\$3.28	\$2.67	\$0.58	\$0.01	\$0.00	\$0.02

Total VCR Risk: \$2.56 Total ENS Risk: \$0.04