

NEED/OPPORTUNITY STATEMENT (NOS)



Wallerawang 330 Secondary System Renewal

NOS- 00000001244 revision 2.0

Ellipse project no.: P0005237

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	18 October 2016	Update to 2016/17 dollars
2	10 November 2016	Update to format

1. Background

Wallerawang 330kV Substation is located adjacent to Wallerawang Power Station and comprises 2x incoming 330kV connections from the power station, 4x 330kV outgoing lines and 2x 330/132kV transformers that supply Wallerawang 132kV Substation via overhead tie feeders. The 330kV site was established in 1975, and the secondary systems assets have install dates between 1975 and 2012.

Wallerawang 330kV Substation is a part of the 330kV backbone interconnecting Mount Piper Power Station to Sydney South as well as supplying 132kV to Wallerawang 132kV Substation which in turn supplies Endeavour Energy. Wallerawang 330kV Substation will remain part of the 330kV backbone of NSW into the foreseeable future.

The adjacent Wallerawang Power Station is currently being decommissioned and upon completion of these works there will no longer remain a requirement for a breaker and a half configuration at the site.

2. Need/opportunity

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

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

Need Description	Quantity of Assets to be addressed	% of Services at Site	Need Driver
Need ID 605 – Replacement of Quadramho (SHPM) Protection Relays	2	25% of all line protection relays on site	> Component obsolescence resulting in a lack of spares and no manufacturer support
Need ID 606 – Replacement of THR Protection Relays	2	25% of all line protection relays on site	> Component obsolescence resulting in a lack of spares and no manufacturer support > Inaccurate measurement of fault angles due to deteriorated internal components
Need ID 1379 – Protection – GE Multilin Condition	2	50% of all transformer protection relays on site	> Regular firmware updates required, increasing lifecycle costs > Numerous component failures leading to spurious trips and Circuit Breaker Failure operations
Need ID 1380 – Protection - Schweitzer SELxxx Condition	2	25% of all line protection relays on site	> Component obsolescence resulting in a lack of spares and limited manufacturer support

¹ Refer SSA Strategy - Renewal and Maintenance - Automation Systems

² Refer SSA Strategy - Renewal and Maintenance - Metering Systems

Need Description	Quantity of Assets to be addressed	% of Services at Site	Need Driver
Need ID 629 – Replacement of Remote Terminal Units (RTUs)	1	100% of RTUs on site	> Component obsolescence resulting in a lack of spares and no manufacturer support

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

The risk cost associated with all secondary systems at Wallerawang 330kV Substation is \$3.7m 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 and carries a risk of a system black event. An estimated 8 hours would be required to recover the site and load after a failure to operate 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.

Several issues have been identified with the condition of Low Voltage (LV) 415V AC systems at the site including exposed parts and conductors and unswitched GPOs. These issues were identified as part of the recent LV safety survey⁴.

In accordance with TransGrid's Renewal and Maintenance Strategy for Secondary Systems Site Installations⁵, an opportunity exists to address these risks by performing a full secondary system replacement at Wallerawang 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 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 standards which provide the greatest amount of real time operational and condition data to better support the planning, operation and maintenance of the network
- > Minimising secondary systems requirements by re-organising the HV switchyard to remove obsolete circuit breakers for the site

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

⁴ Refer AM FS 0006 TWR 125 – Low Voltage Safety Survey

⁵ Refer SSA Strategy - Renewal and Maintenance -Secondary Systems Site Installations

3. Related Needs/opportunities

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

- > Need ID 605 – Replacement of Quadramho (SHPM) Protection Relays
- > Need ID 606 – Replacement of THR Protection Relays
- > Need ID 1379 – Protection – GE Multilin Condition
- > Need ID 1380 – Protection - Schweitzer SELxxx 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.

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: Wallerawang 330kV secondary system renewal

Option Name: 1244 - Base Case

Option Assessment Name: 1244 - 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	\$0.73	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)	\$0.33	Failure	\$0.66	9.20%	\$0.06	\$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	\$0.73	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)	\$0.33	Failure	\$0.66	9.20%	\$0.06	\$0.06	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Controls	9	Bay Controller	Unplanned Outage - HV (Controls)	\$0.38	Failure	\$3.45	6.50%	\$0.22	\$0.19	\$0.04	\$0.00	\$0.00	\$0.00	\$0.00
Controls	9	Control Cabling	Unplanned Outage - HV (Controls)	\$0.38	Failure	\$3.45	6.50%	\$0.22	\$0.19	\$0.04	\$0.00	\$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)	\$0.73	Failure	\$1.45	31.00%	\$0.45	\$0.20	\$0.21	\$0.04	\$0.00	\$0.00	\$0.01
Low Voltage AC Supply	2	AC Low Voltage Board/Panel/Box	Unplanned Outage - HV (Low Voltage AC Supply)	\$1.25	Failure	\$2.50	31.00%	\$0.78	\$0.56	\$0.21	\$0.00	\$0.00	\$0.00	\$0.00
Low Voltage AC Supply	2	AC Low Voltage Cable	Uncontrolled Electrical Contact / Discharge (Low Voltage AC Supply)	\$0.73	Failure	\$1.45	3.20%	\$0.05	\$0.02	\$0.02	\$0.00	\$0.00	\$0.00	\$0.00
Low Voltage AC Supply	2	AC Low Voltage Cable	Unplanned Outage - HV (Low Voltage AC Supply)	\$1.25	Failure	\$2.50	3.20%	\$0.08	\$0.06	\$0.02	\$0.00	\$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)	\$0.35	Failure	\$0.69	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)	\$0.33	Failure	\$0.66	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)	\$0.35	Failure	\$0.69	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)	\$0.33	Failure	\$0.66	2.00%	\$0.01	\$0.01	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Metering	4	Meter	Failed Compliance Obligations (Metering)	\$0.11	Failure	\$0.45	4.40%	\$0.02		\$0.02				
Protection - 330KV	10	Protection	Unplanned Outage - HV (Protection - 330KV)	\$0.42	Failure	\$4.24	4.93%	\$0.21	\$0.16	\$0.05	\$0.05	\$0.02	\$0.01	\$0.02
Protection - 330KV	10	Protection Relay	Explosive Failure of Asset (Protection - 330KV)	\$2.77	Failure	\$27.68	4.93%	\$1.36	\$1.27	\$0.04	\$0.04	\$0.02	\$0.01	\$0.02
				\$10.76		\$52.65		\$3.70	\$2.92	\$0.67	\$0.07	\$0.01	\$0.04	\$0.04

Total VCR Risk: \$2.81 Total ENS Risk: \$0.04