

NEED/OPPORTUNITY STATEMENT (NOS)



Wagga 330kV Secondary Systems Renewal

NOS- 00000001180 revision 3.0

Ellipse project no.: P0005200

TRIM file: [TRIM No]

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

Project category: Prescribed - Asset Renewal Strategies

Approvals

Author	Adam Hoare	Secondary Systems Senior Analyst
Endorsed	Mark Jones	Secondary Systems and Communications Asset Manager
Approved	Lance Wee	M/Asset Strategy
Date submitted for approval	15 November 2016	

Change history

Revision	Date	Amendment
0	3 May 2016	Initial issue
1	17 October 2016	Update to 2016/17 dollars
2	15 November 2016	Update to format

1. Background

Wagga 330/66kV Substation comprises 3x 330kV feeders, 2x 330/132kV transformers, 8x 66kV feeders, and 3x 66kV capacitor banks. The site was established in 1973, and the secondary systems assets have install dates between 1973 and 2013.

Wagga Substation is a customer connection point supplying the Essential Energy 132kV network in the area inclusive of Gadara, Urinquity and Yanco. The site will remain a connection point to Essential Energy 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, **Error! Reference source not found.** shows the assets at Wagga Substation that have been identified for replacement by 2023.

Table 1 - Identified Asset Replacements at Wagga Substation from 2014-2023

Need Description	Quantity of Assets to be addressed	% of services at Site	Need Driver
Need ID 637 – Replacement of YTG Protection Relays	4	18% of all line/feeder protection relays on site	<ul style="list-style-type: none"> > Component obsolescence resulting in a lack of spares and no manufacturer support > Relays known to become trapped in a logic loop, rendering the relay non-auto and initiating the "Relay Inoperative Alarm"
Need ID 606 – Replacement of THR Protection Relays	2	9% of all line/feeder 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 638 – Replacement of THS Protection Relays	2	9% of all line/feeder 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 1356 – Replacement of Reyrolle OHx Protection Relays	4	18% of all line/feeder protection relays on site	<ul style="list-style-type: none"> > Component obsolescence resulting in a lack of spares and no manufacturer support > End of asset life

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 1376 – Replacement of Alstom Pxxx Protection Relays	5	23% of all line/feeder protection relays on site	>	Component obsolescence resulting in a lack of spares and no manufacturer support > End of asset life
Need ID 1379 – Replacement of GE Multilin Protection Relays	2	9% of all line/feeder protection relays on site	>	Increasing numbers of faults across the GE range. > Issues with the front facia failing and analogue module failures.
Need ID 1379 – Replacement of GE Multilin Protection Relays	2	50% of all transformer protection relays on site	>	Increasing numbers of faults across the GE range. > Issues with the front facia failing and analogue module failures.
Need ID 1383 – Replacement of GE FV2 Protection Relays	10	100% of all busbar protection relays on site	>	Degradation of plastic components causing mechanical failure of the pickup adjusting mechanism. > Component obsolescence resulting in a lack of spares and no manufacturer support
Need ID 1387 – Replacement of Capacitor Protection Relays	6	100% of all capacitor protection relays on site	>	Prone to excessive mechanical wear under certain situations, potentially causing a slow reset. > Component obsolescence resulting in a lack of spares and no manufacturer support
Need ID 1359 – Remote Terminal Unit (RTU) Condition	2	25% of all control RTUs onsite	>	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 Wagga is \$3.58m 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. There is a mixed customer load at the site with a forecast 77MW as the average of the summer and winter loads in the Transmission Annual Planning Report and an estimated 16 hours to recover the site and load after a failure to operate event. Wagga substation forms part of the 330kV backbone and carries a risk of a system black 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 full secondary system replacement at Wagga (as listed in

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

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
- > Utilising 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 Wagga that could be fulfilled by completing a Secondary Systems Replacement:

- > Need ID 637 – Replacement of YTG Protection Relays
- > Need ID 606 – Replacement of THR Protection Relays
- > Need ID 638 – Replacement of THS Protection Relays
- > Need ID 1356 – Replacement of Reyrolle OHx Protection Relays
- > Need ID 1376 – Replacement of Alstom Pxxx Protection Relays
- > Need ID 1379 – Replacement of GE Multilin Protection Relays
- > Need ID 1383 – Replacement of GE FV2 Protection Relays
- > Need ID 1387 – Replacement of Capacitor Protection Relays
- > Need ID 1359 – Remote Terminal Unit (RTU) Condition

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: Wagga 330 Secondary Systems Renewal

Option Name: 1180 - Base Case

Option Assessment Name: 1180 - Base Case - Assessment 1

Rev Reset Period: Next (2018-23)



Major Component	No.	Minor Component	Sel. Hazardous Event	LoC x CoF (\$M)	Failure Mechanism	NovLoC 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)	\$0.32	Failure	\$0.65	9.20%	\$0.06	\$0.05	\$0.00	\$0.00	\$0.01	\$0.00	\$0.00
Battery and Charger System	2	Battery	Unplanned Outage - HV (Battery and Charger System)	\$0.27	Failure	\$0.54	9.20%	\$0.05	\$0.05	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Charger	Uncontrolled Electrical Contact / Discharge (Battery and Charger System)	\$0.32	Failure	\$0.65	9.20%	\$0.06	\$0.05	\$0.00	\$0.00	\$0.01	\$0.00	\$0.00
Battery and Charger System	2	Charger	Unplanned Outage - HV (Battery and Charger System)	\$0.27	Failure	\$0.54	9.20%	\$0.05	\$0.05	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Controls	16	Bay Controller	Unplanned Outage - HV (Controls)	\$0.32	Failure	\$5.19	2.80%	\$0.15	\$0.12	\$0.03	\$0.00	\$0.00	\$0.00	\$0.00
Controls	16	Control Cabling	Unplanned Outage - HV (Controls)	\$0.32	Failure	\$5.19	2.80%	\$0.15	\$0.12	\$0.03	\$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)	\$0.71	Failure	\$1.41	31.00%	\$0.44	\$0.16	\$0.21	\$0.06	\$0.00	\$0.01	\$0.01
Low Voltage AC Supply	2	AC Low Voltage Board/Panel/Box	Unplanned Outage - HV (Low Voltage AC Supply)	\$1.08	Failure	\$2.15	31.00%	\$0.67	\$0.45	\$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)	\$0.71	Failure	\$1.41	3.20%	\$0.05	\$0.02	\$0.02	\$0.01	\$0.00	\$0.00	\$0.00
Low Voltage AC Supply	2	AC Low Voltage Cable	Unplanned Outage - HV (Low Voltage AC Supply)	\$1.08	Failure	\$2.15	3.20%	\$0.07	\$0.05	\$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)	\$0.30	Failure	\$0.59	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)	\$0.27	Failure	\$0.54	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)	\$0.30	Failure	\$0.59	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 x CoF (\$M)	PoF (Vr 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)	\$0.27	Failure	\$0.54	2.00%	\$0.01	\$0.01	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Protection - 132kV	14	Protection	Unplanned Outage - HV (Protection - 132kV)	\$0.37	Failure	\$5.12	3.00%	\$0.15	\$0.11	\$0.04	\$0.04	\$0.04	\$0.01	\$0.00
Protection - 132kV	14	Protection Relay	Explosive Failure of Asset (Protection - 132kV)	\$0.59	Failure	\$8.20	3.00%	\$0.25	\$0.14	\$0.04	\$0.04	\$0.03	\$0.01	\$0.04
Protection - 330kV	7	Protection	Unplanned Outage - HV (Protection - 330kV)	\$0.37	Failure	\$2.56	6.34%	\$0.16	\$0.12	\$0.05	\$0.05	\$0.05	\$0.01	\$0.00
Protection - 330kV	7	Protection Relay	Explosive Failure of Asset (Protection - 330kV)	\$2.79	Failure	\$19.56	6.34%	\$1.24	\$1.13	\$0.04	\$0.04	\$0.03	\$0.01	\$0.04
				\$10.65		\$57.61		\$3.58	\$2.63	\$0.70	\$0.13	\$0.02	\$0.10	\$0.10

Total VCR Risk: \$2.51 Total ENS Risk: \$0.04