

NEED/OPPORTUNITY STATEMENT (NOS)



Murrumburrah Secondary Systems Renewal

NOS- 00000001186 revision 3.0

Ellipse project no.: P0005445

TRIM file: [TRIM No]

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

Project category: Prescribed - Replacement

Approvals

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Approved	Lance Wee	M/Asset Strategy
Date submitted for approval	9 November 2016	

Change history

Revision	Date	Amendment
0	22 June 2016	Initial issue
1	6 October 2016	Update to 2016/17 dollars
2	10 October 2016	Minor amendments
3	9 November 2016	Update to format

1. Background

Murrumburrah 132/66kV Substation comprises of 2x 132kV feeders, 2x 132/66/11kV transformers and 6x 66kV feeders. The site was established in 1984, and the secondary systems assets have install dates between 1984 and 2011.

Murrumburrah Substation is a customer connection point supplying the Essential Energy 66kV network in the South and Far West Region. The site will remain a connection point to Essential Energy into the foreseeable future as outlined in the load forecasts of the 2105 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 assets at Murrumburrah that have been identified for replacement by 2023.

Table 1 – Identified asset replacements at Murrumburrah Substation from 2014-2023

Need Description	Quantity of Assets to be addressed	% of services at Site	Need Driver
Need ID 606 – Replacement of THR Protection Relays	8	50% 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 637 – Replacement of YTG Protection Relays	7	44% 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 1380 – Schweitzer SELxxx Condition	1	6% of all line/feeder 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 – GE FAC Condition	6	100% of all busbar protection relays on site	<ul style="list-style-type: none">> Component degradation resulting in mechanical failure

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 620 – Replacement of D Series Protection Relays	2	50% of all transformer protection relays on site	<ul style="list-style-type: none"> > Component obsolescence resulting in a lack of spares and no manufacturer support > Known history of tripping unnecessarily at transformer energisation due to harmonic content inrush currents
Need ID 621 – Replacement of DB Series Protection Relays	2	50% of all transformer protection relays on site	<ul style="list-style-type: none"> > Component obsolescence resulting in a lack of spares and no manufacturer support > Faulty harmonic bias circuitry due to component failure > Internal wiring connection problems
Need ID 610 – Replacement of EDM1 MK3 Energy Meters	1	14% of all market meters on site	<ul style="list-style-type: none"> > Microprocessor Energy Meters failing as they approach 15 years of life > Component obsolescence resulting in a lack of spares and no manufacturer support
Need ID 630 – Siemens 7EC Meter Replacements	4	57% of all market meters on site	<ul style="list-style-type: none"> > Component obsolescence resulting in lack of spares and no manufacturer support > Measurement drift especially when exposed to direct sunlight and heat
Need ID 624 – Replacement of Landis and Gyr ZF and ZMB Meters	2	29% of all market meters on site	<ul style="list-style-type: none"> > Component obsolescence resulting in lack of spares and no manufacturer support > End of service life reached

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

The risk cost associated with all secondary systems at Murrumburrah is \$2.20m 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 34MW 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. 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

³ Refer NACA-SSAP – Protection, NACA-SSAM - Metering

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.

There is additional risk identified from market meters (which considers repair and potential litigation costs).

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 Murrumburrah (as listed in the risk summary in Attachment 1). This opportunity is expected to 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.

3. Related Needs/opportunities

The following related Needs contain works for Murrumburrah that could be fulfilled by completing a Secondary Systems Replacement:

- > Need ID 606 – Replacement of THR Protection Relays
- > Need ID 637 – Replacement of YTG Protection Relays
- > Need ID 1380 – Schweitzer SELxxx Condition
- > Need ID 1382 – GE FAC Condition
- > Need ID 620 – Replacement of D Series Protection Relays
- > Need ID 621 – Replacement of DB Series Protection Relays
- > Need ID 610 – Replacement of EDM I MK3 Energy Meters
- > Need ID 630 – Siemens 7EC Meter Replacements
- > Need ID 624 – Replacement of Landis and Gyr ZF and ZMB Meters

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: Murrumburrah Secondary Systems Renewal

Option Name: 1186 - Base Case

Option Assessment Name: 1186 - 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)	\$0.40	Failure	\$0.79	9.20%	\$0.07	\$0.07	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Battery	Unplanned Outage - HV (Battery and Charger System)	\$0.38	Failure	\$0.76	9.20%	\$0.07	\$0.07	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Charger	Uncontrolled Electrical Contact / Discharge (Battery and Charger System)	\$0.40	Failure	\$0.79	9.20%	\$0.07	\$0.07	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Charger	Unplanned Outage - HV (Battery and Charger System)	\$0.38	Failure	\$0.76	9.20%	\$0.07	\$0.07	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Controls	3	Bay Controller	Unplanned Outage - HV (Controls)	\$0.19	Failure	\$0.58	4.80%	\$0.03	\$0.02	\$0.01	\$0.01	\$0.00	\$0.00	\$0.00
Controls	3	Control Cabling	Unplanned Outage - HV (Controls)	\$0.19	Failure	\$0.58	4.80%	\$0.03	\$0.02	\$0.01	\$0.01	\$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)	\$0.64	Failure	\$1.28	31.00%	\$0.40	\$0.23	\$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)	\$1.38	Failure	\$2.76	31.00%	\$0.85	\$0.69	\$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)	\$0.64	Failure	\$1.28	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)	\$1.38	Failure	\$2.76	3.20%	\$0.09	\$0.07	\$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)	\$0.38	Failure	\$0.76	2.00%	\$0.02	\$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)	\$0.38	Failure	\$0.76	2.00%	\$0.02	\$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)	\$0.38	Failure	\$0.76	2.00%	\$0.02	\$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)	\$0.38	Failure	\$0.76	2.00%	\$0.02	\$0.01	\$0.01	\$0.00	\$0.00	\$0.00	\$0.00
Metering	7	Meter	Failed Compliance Obligations (Metering)	\$0.11	Failure	\$0.78	2.71%	\$0.02			\$0.02			
Protection <=132kV	13	Protection	Unplanned Outage - HV (Protection <=132kV)	\$0.21	Failure	\$2.73	5.39%	\$0.15	\$0.07	\$0.07	\$0.07	\$0.07	\$0.07	\$0.00
Protection <=132kV	13	Protection Relay	Explosive Failure of Asset (Protection <=132kV)	\$0.36	Failure	\$4.64	5.39%	\$0.25	\$0.14	\$0.14	\$0.03	\$0.03	\$0.08	\$0.00
				\$8.17		\$23.53		\$2.20	\$1.60	\$1.60	\$0.52	\$0.00	\$0.08	\$0.00

Total VCR Risk: \$1.59 Total ENS Risk: \$0.00