NEED/OPPORTUNITY STATEMENT (NOS)

Tenterfield Secondary Systems Renewal

NOS- 000000001194 revision 2.0

Ellipse project no.: P0005253
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	9 November 2016	

Change history

Revision	Date	Amendment
0	28 April 2016	Initial issue
1	11 October 2016	Update to 2016/17 dollars
2	9 November 2016	Update to format

1. Background

Tenterfield 132/22kV Substation comprises 2x 132kV feeders, 2x 132/22 transformers and 3x 22kV feeders. The site was established in 1970, and the secondary systems assets have install dates between 1970 and 2013.

Tenterfield Substation is a customer connection point supplying the Essential Energy 22kV networks in the area inclusive of Tenterfield town and the Timbarra mine. 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 Automation[1] and Metering Systems[2], Table 1 shows the assets at Tenterfield Substation that have been identified for replacement by 2023.

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

Need Description	Quantity of Assets to be addressed	% of services at Site	Need Driver
Need ID 1368 – Replacement of Feeder OC Protection Relays	6	60% of all line/feeder 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 1383 – Replacement of GE FV2 Busbar Protection Relays	4	100% of all busbar protection relays 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 completed[3].

The risk cost associated with all secondary systems at Tenterfield is $3.62m per annum. The most significant elements of concern are the cost consequence of an LV AC distribution system failure, and the reliability consequence associated with explosive failure due to malfunction of the protection relays identified for replacement above. The site load has a forecasted 6MW 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 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.

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

[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

There is additional risk identified from several issues with the condition of Low Voltage (LV) 415V AC systems at the site including a lack of Residual Current Devices (RCD) or Earth Leakage Circuit Breaker (ELCB) devices on power circuits. These issues were identified as part of the recent LV safety survey[4].

In accordance with TransGrid's Renewal and Maintenance Strategy for Secondary Systems Site Installations[5], an opportunity exists to address these risks by performing a full secondary system replacement at Tenterfield (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
- 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 Tenterfield that could be fulfilled by completing a Secondary Systems Replacement:

- Need ID 1368 – Replacement of Feeder OC Protection Relays
- Need ID 1383 – Replacement of GE FV2 Busbar Protection Relays

4. Recommendation

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

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

[5] 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: Tenterfield Secondary Systems Renewal

Option Name: 1194 - Base Case

Option Assessment Name: 1194 - 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)	$0.08	Failure	$0.16	9.20%	$0.01	$0.01		$0.00	$0.00		$0.00
Battery and Charger System	2	Battery	Unplanned Outage - HV (Battery and Charger System)	$0.05	Failure	$0.11	9.20%	$0.01	$0.01		$0.00			$0.00
Battery and Charger System	2	Charger	Uncontrolled Electrical Contact / Discharge (Battery and Charger System)	$0.08	Failure	$0.16	9.20%	$0.01	$0.01		$0.00	$0.00		$0.00
Battery and Charger System	2	Charger	Unplanned Outage - HV (Battery and Charger System)	$0.05	Failure	$0.11	9.20%	$0.01	$0.01		$0.00			$0.00
Low Voltage AC Supply	1	AC Low Voltage Board/Panel/Box	Uncontrolled Electrical Contact / Discharge (Low Voltage AC Supply)	$3.09	Failure	$3.09	31.00%	$0.96	$0.83		$0.08	$0.01		$0.03
Low Voltage AC Supply	1	AC Low Voltage Board/Panel/Box	Unplanned Outage - HV (Low Voltage AC Supply)	$6.72	Failure	$6.72	31.00%	$2.08	$1.97		$0.08			$0.03
Low Voltage AC Supply	1	AC Low Voltage Cable	Uncontrolled Electrical Contact / Discharge (Low Voltage AC Supply)	$3.09	Failure	$3.09	3.20%	$0.10	$0.09		$0.01	$0.00		$0.00
Low Voltage AC Supply	1	AC Low Voltage Cable	Unplanned Outage - HV (Low Voltage AC Supply)	$6.72	Failure	$6.72	3.20%	$0.22	$0.20		$0.01			$0.00
Low Voltage DC Supply	2	DC Low Voltage Board/Panel/Box	Uncontrolled Electrical Contact / Discharge (Low Voltage DC Supply)	$0.07	Failure	$0.13	2.00%	$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)	$0.05	Failure	$0.11	2.00%	$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)	$0.07	Failure	$0.13	2.00%	$0.00	$0.00		$0.00	$0.00		$0.00
Low Voltage DC Supply	2	DC Low Voltage Cable	Unplanned Outage - HV (Low Voltage DC Supply)	$0.05	Failure	$0.11	2.00%	$0.00	$0.00		$0.00			$0.00
Metering	4	Meter	Failed Compliance Obligations (Metering)	$0.11	Failure	$0.45	7.60%	$0.03			$0.03			

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)
Protection - 132kV	9	Protection	Unplanned Outage - HV (Protection - 132kV)	$0.15	Failure	$1.33	5.92%	$0.08	$0.02		$0.06			$0.00
Protection - 132kV	9	Protection Relay	Explosive Failure of Asset (Protection - 132kV)	$0.18	Failure	$1.65	5.92%	$0.10	$0.02		$0.02	$0.02	$0.01	$0.04
				$20.57		$24.06		$3.62	$3.16		$0.31	$0.04	$0.01	$0.11

Total VCR Risk: $2.55 Total ENS Risk: $0.56