

# NEED/OPPORTUNITY STATEMENT (NOS)



Tuggerah Secondary Systems Renewal

NOS- 000000001263 revision 2.0

**Ellipse project no.:** P0005393

**TRIM file:** [TRIM No]

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

**Project category:** Prescribed - Replacement

## Approvals

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

## Change history

Revision	Date	Amendment
0	27 April 2016	Initial issue
1	11 October 2016	Update to 2016/17 dollars
2	10 November 2016	Update to format

## 1. Background

Tuggerah 330/132kV Substation comprises 2x 330kV feeders, 2x 330/132/11kV transformer, 5x 132kV feeders and 2x 132kV capacitor banks. The site was established in 1986, and the secondary systems assets have install dates between 1986 and 2014.

Tuggerah Substation is a customer connection point supplying the Ausgrid 132kV network in the area inclusive of Gosford, Ourimbah, Berkeley Vale and Wyong. The site will remain a connection point to Ausgrid 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<sup>1</sup> and Metering Systems<sup>2</sup>, Table 1 shows the assets at Tuggerah Substation that have been identified for replacement by 2023.

**Table 1 – Identified asset replacements at Tuggerah 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	1	7% of all line/feeder protection relays on site	<ul style="list-style-type: none"><li>&gt; Component obsolescence resulting in a lack of spares and no manufacturer support</li><li>&gt; Inaccurate measurement of fault angles due to deteriorated internal components</li></ul>
Need ID 608 – Replacement of 7SD511 Protection Relays	1	7% of all line/feeder protection relays on site	<ul style="list-style-type: none"><li>&gt; Component obsolescence resulting in a lack of spares and no manufacturer support</li><li>&gt; Regular communication signalling failures reducing reliability</li></ul>
Need ID 610 – Replacement of EDM I MKIII Meters	5	50% of all market meters on site	<ul style="list-style-type: none"><li>&gt; Microprocessor Energy Meters failing as they approach 15 years of life</li><li>&gt; Component obsolescence resulting in a lack of spares and no manufacturer support</li></ul>
Need ID 614 – Replacement of LFCB102 Protection Relays	1	7% of all line/feeder protection relays on site	<ul style="list-style-type: none"><li>&gt; Component obsolescence resulting in a lack of spares and no manufacturer support</li></ul>

<sup>1</sup> Refer SSA Strategy - Renewal and Maintenance - Automation Systems

<sup>2</sup> Refer SSA Strategy - Renewal and Maintenance - Metering Systems

Need Description	Quantity of Assets to be addressed	% of Services at Site	Need Driver
Need ID 637 – Replacement of YTG Protection Relays	1	7% of all line/feeder protection relays on site	<ul style="list-style-type: none"> <li>&gt; Component obsolescence resulting in a lack of spares and no manufacturer support</li> <li>&gt; Inaccurate measurement of fault angles due to deteriorated internal components</li> </ul>
Need ID 1379 – Protection - GE Multilin Condition	2	50% of all transformer protections on site	<ul style="list-style-type: none"> <li>&gt; Regular firmware updates required, increasing lifecycle costs</li> <li>&gt; Numerous component failures leading to spurious trips and Circuit Breaker Failure operations</li> </ul>

Additionally, condition assessments for all these individual asset types have been completed<sup>3</sup>.

The risk cost associated with all secondary systems at Tuggerah is \$4.3m 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. There is a mixed customer load at the site with a forecast 186MW 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. Tuggerah 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.

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 Installations<sup>4</sup>, an opportunity exists to address these risks by performing a full secondary system replacement at Tuggerah (as listed in the risk summary in Attachment 1). This opportunity is expected to provide additional benefits for the organisation including:

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

- > Need ID 606 – Replacement of THR Protection Relays

<sup>3</sup> Refer NACA-SSAP - Protection , NACA-SSAC - Control, NACA-SSAM - Metering

<sup>4</sup> Refer SSA Strategy - Renewal and Maintenance -Secondary Systems Site Installations

- > Need ID 608 – Replacement of 7SD511 Protection Relays
- > Need ID 610 – Replacement of EDM I MKIII Meters
- > Need ID 614 – Replacement of LFCB102 Protection Relays
- > Need ID 637 – Replacement of YTG Protection Relays
- > Need ID 1379 – Protection - GE Multilin Condition

## 4. Recommendation

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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: Tuggerah Secondary Systems Renewal

Option Name: 1263 - Base Case

Option Assessment Name: 1263 - 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)	\$0.61	Failure	\$1.22	9.20%	\$0.11	\$0.11	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Battery	Unplanned Outage - HV (Battery and Charger System)	\$0.61	Failure	\$1.21	9.20%	\$0.11	\$0.11	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Charger	Uncontrolled Electrical Contact / Discharge (Battery and Charger System)	\$0.61	Failure	\$1.22	9.20%	\$0.11	\$0.11	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Charger	Unplanned Outage - HV (Battery and Charger System)	\$0.61	Failure	\$1.21	9.20%	\$0.11	\$0.11	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Controls	14	Bay Controller	Unplanned Outage - HV (Controls )	\$0.66	Failure	\$9.23	2.52%	\$0.23	\$0.21	\$0.02	\$0.00	\$0.00	\$0.00	\$0.00
Controls	14	Control Cabling	Unplanned Outage - HV (Controls )	\$0.66	Failure	\$9.23	2.52%	\$0.23	\$0.21	\$0.02	\$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)	\$0.95	Failure	\$1.89	31.00%	\$0.59	\$0.37	\$0.21	\$0.02	\$0.00	\$0.00	\$0.00
Low Voltage AC Supply	2	AC Low Voltage Board/Panel/Box	Unplanned Outage - HV (Low Voltage AC Supply)	\$2.08	Failure	\$4.16	31.00%	\$1.29	\$1.08	\$0.21	\$0.02	\$0.00	\$0.00	\$0.00
Low Voltage AC Supply	2	AC Low Voltage Cable	Uncontrolled Electrical Contact / Discharge (Low Voltage AC Supply)	\$0.95	Failure	\$1.89	3.20%	\$0.06	\$0.04	\$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)	\$2.08	Failure	\$4.16	3.20%	\$0.13	\$0.11	\$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)	\$0.61	Failure	\$1.22	2.00%	\$0.02	\$0.02	\$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)	\$0.61	Failure	\$1.21	2.00%	\$0.02	\$0.02	\$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)	\$0.61	Failure	\$1.22	2.00%	\$0.02	\$0.02	\$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 Metering	2	DC Low Voltage Cable	Unplanned Outage - HV (Low Voltage DC Supply)	\$0.61	Failure	\$1.21	2.00%	\$0.02	\$0.02	\$0.02	\$0.00			\$0.00
	10	Meter	Failed Compliance Obligations (Metering)	\$0.11	Failure	\$1.12	3.50%	\$0.04			\$0.04			
Protection - 132kV	9	Protection	Unplanned Outage - HV (Protection - 132kV)	\$0.70	Failure	\$6.30	2.27%	\$0.14	\$0.12		\$0.02			\$0.00
Protection - 132kV	9	Protection Relay	Explosive Failure of Asset (Protection - 132kV)	\$0.95	Failure	\$8.56	2.27%	\$0.19	\$0.17		\$0.02	\$0.00	\$0.00	\$0.00
Protection - 330kV	4	Protection	Unplanned Outage - HV (Protection - 330kV)	\$0.70	Failure	\$2.80	8.35%	\$0.23	\$0.20		\$0.04			\$0.00
Protection - 330kV	4	Protection Relay	Explosive Failure of Asset (Protection - 330kV)	\$1.73	Failure	\$6.93	8.35%	\$0.58	\$0.54		\$0.03	\$0.00	\$0.00	\$0.01
				\$16.43			\$66.00	\$4.27	\$3.57		\$0.67	\$0.01	\$0.00	\$0.01