

NEED/OPPORTUNITY STATEMENT (NOS)



Ingleburn Secondary Systems Renewal

NOS- 000000001255 revision 2.0

Ellipse project no.: P0005331

TRIM file: [TRIM No]

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

Project category: Prescribed - Replacement

Approvals

Author	David Hughes	Secondary Systems Analyst
	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	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

Ingleburn 330/66kV Substation comprises 2x 330kV feeders, 2x 330/66/11kV transformers and 5x 66kV feeders. The site was established in 1984, and the secondary systems assets have install dates between 1984 and 2013.

Ingleburn Substation is a customer connection point supplying Endeavour Energy's 66kV network in the area inclusive of Macquarie Fields and Minto. The site will remain a connection point to Endeavour 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, Table 1 shows the following assets at Ingleburn Substation that have been identified for replacement by 2023.

Table 1 – Identified asset replacements at Ingleburn 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	7	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	3	21% 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 1379 – Protection – GE Multilin Condition	2	50% of all transformer protections on site	<ul style="list-style-type: none">> 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	1	7% 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

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

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

The risk cost associated with all secondary systems at Ingleburn 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. There is a mixed customer load at the site with a forecast 125MW 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. Ingleburn 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.

Several issues have been identified with the condition of Low Voltage (LV) 415V AC systems at the site including lack of Residual Current Devices (RCD) or Earth Leakage Circuit Breaker (ELCB) devices on power, light and Heating, Ventilation and Air Conditioning (HVAC) circuits. 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 Ingleburn (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 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

3. Related Needs/opportunities

The following related Needs contain works for Ingleburn 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 1379 – Protection – GE Multilin Condition
- > Need ID 1380 – Protection - Schweitzer SELxxx Condition

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: Ingleburn Secondary Systems Renewal

Option Name: 1255 - Base Case

Option Assessment Name: 1255 - 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)	\$0.42	Failure	\$0.85	9.20%	\$0.08	\$0.08	\$0.07	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Battery	Unplanned Outage - HV (Battery and Charger System)	\$0.42	Failure	\$0.84	9.20%	\$0.08	\$0.08	\$0.07	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Charger	Uncontrolled Electrical Contact / Discharge (Battery and Charger System)	\$0.42	Failure	\$0.85	9.20%	\$0.08	\$0.08	\$0.07	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Charger	Unplanned Outage - HV (Battery and Charger System)	\$0.42	Failure	\$0.84	9.20%	\$0.08	\$0.08	\$0.07	\$0.00	\$0.00	\$0.00	\$0.00
Controls	4	Bay Controller	Unplanned Outage - HV (Controls)	\$0.47	Failure	\$1.89	1.83%	\$0.03	\$0.03	\$0.03	\$0.00	\$0.00	\$0.00	\$0.00
Controls	4	Control Cabling	Unplanned Outage - HV (Controls)	\$0.47	Failure	\$1.89	1.83%	\$0.03	\$0.03	\$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)	\$0.69	Failure	\$1.37	31.00%	\$0.43	\$0.25	\$0.17	\$0.00	\$0.00	\$0.00	\$0.00
Low Voltage AC Supply	2	AC Low Voltage Board/Panel/Box	Unplanned Outage - HV (Low Voltage AC Supply)	\$1.44	Failure	\$2.89	31.00%	\$0.90	\$0.73	\$0.17	\$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)	\$0.69	Failure	\$1.37	3.20%	\$0.04	\$0.03	\$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)	\$1.44	Failure	\$2.89	3.20%	\$0.09	\$0.08	\$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)	\$0.42	Failure	\$0.84	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)	\$0.42	Failure	\$0.84	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)	\$0.42	Failure	\$0.84	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	2	DC Low Voltage Cable	Unplanned Outage - HV (Low Voltage DC Supply)	\$0.42	Failure	\$0.84	2.00%	\$0.02	\$0.02		\$0.00			\$0.00
Metering	4	Meter	Failed Compliance Obligations (Metering)	\$0.11	Failure	\$0.45	8.90%	\$0.04			\$0.04			
Protection - 330kV	4	Protection	Unplanned Outage - HV (Protection - 330kV)	\$0.51	Failure	\$2.05	9.90%	\$0.20	\$0.16		\$0.04			\$0.00
Protection - 330kV	4	Protection Relay	Explosive Failure of Asset (Protection - 330kV)	\$2.50	Failure	\$9.98	9.90%	\$0.99	\$0.94		\$0.03	\$0.00	\$0.00	\$0.01
Protection - 66kV	8	Protection	Unplanned Outage - HV (Protection - 66kV)	\$0.51	Failure	\$4.10	5.33%	\$0.22	\$0.17		\$0.04			\$0.00
Protection - 66kV	8	Protection Relay	Explosive Failure of Asset (Protection - 66kV)	\$0.84	Failure	\$6.75	5.33%	\$0.36	\$0.31		\$0.04	\$0.00	\$0.00	\$0.01
				\$13.05		\$42.37		\$3.71	\$3.09		\$0.58	\$0.01	\$0.01	\$0.02
Total VCR Risk:				\$2.99	Total ENS Risk:				\$0.03					