NEED/OPPORTUNITY STATEMENT (NOS)

Haymarket Secondary Systems Replacement

NOS- 000000001493 revision 3.0

Ellipse project no.: P0008692
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	16 November 2016	

Change history

Revision	Date	Amendment
0	2 June 2016	Initial issue
1	17 October 2016	Update to 2016/17 dollars
2	16 November 2016	Update to format

1. Background

Haymarket 330/132kV Substation comprises 1x 330kV feeders, 3x 330/132kV transformers, 14x 132kV feeders, and 1x 132kV reactor. The site was established in 2004, and the secondary systems assets have install dates between 2001 and 2015.

Haymarket Substation is a bulk customer connection point supplying the AusGrid 132kV network in the area inclusive of the Sydney CBD, and as such is a critical substation within the TransGrid network. 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.

This need has excluded works associated with the 132kV low impedance busbar protection upgrade under Need ID 1512.

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 Haymarket Substation that have been identified for replacement by 2023.

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

Need Description	Quantity of Assets to be addressed	% of services at Site	Need Driver
Need ID 610 – Replacement of EDMI MKIII Energy Meters	28	100% of all market meters on site	> 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 1356 – Replacement of Reyrolle OHx Protection Relays	5	17% 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 1376 – Replacement of Alstom Pxxx Protection Relays	1	3% 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	7	23% 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.

[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 1379 – Replacement of GE Multilin Protection Relays	3	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 1381 – Replacement of Siemens 7xx Protection Relays	12	40% 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 1381 – Replacement of Siemens 7xx Protection Relays	2	100% of all reactor protection relays on site	> Component obsolescence resulting in a lack of spares and no manufacturer support > End of asset life
Need ID 1385 – Replacement of Reyrolle DUOBIAS Protection Relays	3	50% of all transformer protection relays on site	> Component obsolescence resulting in a lack of spares and no manufacturer support > End of asset life
Need ID 1359 – Remote Terminal Unit (RTU) Condition	25	71% of all control RTUs onsite	> Component obsolescence resulting in a lack of spares and no manufacturer support > End of asset life

Additionally, condition assessments for all these individual asset types have been completed[3].

The risk cost associated with all secondary systems at Haymarket is $15.3m per annum. The most significant element of concern is a 132kV feeder unplanned outage due to malfunction of the protection relays identified for replacement above. There is a mixed customer load at the site with a forecast 370MW 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. Haymarket 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 Installations[4], an opportunity exists to address these risks by performing a full secondary system replacement at Haymarket (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:

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

[4] Refer SSA Strategy - Renewal and Maintenance - Secondary Systems Site Installations

- Moving away from the existing non-standard GE switching bay control platforms and replacing with standardised implementations. This would reduce the consequence of equipment failure and in particular the downtime required for asset modifications or replacement.

3. Related needs/opportunities

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

- Need ID 610 – Replacement of EDMI MKIII Energy Meters
- 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 1381 – Replacement of Siemens 7xx Protection Relays
- Need ID 1385 – Replacement of Reyrolle DUOBIAS 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.

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: Haymarket Secondary Systems Replacement

Option Name: 1493 - Base Case

Option Assessment Name: 1493 - 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)	$1.21	Failure	$2.41	9.20%	$0.22	$0.21		$0.00	$0.01		$0.00
Battery and Charger System	2	Battery	Unplanned Outage - HV (Battery and Charger System)	$1.17	Failure	$2.34	9.20%	$0.22	$0.21		$0.00			$0.00
Battery and Charger System	2	Charger	Uncontrolled Electrical Contact / Discharge (Battery and Charger System)	$1.21	Failure	$2.41	9.20%	$0.22	$0.21		$0.00	$0.01		$0.00
Battery and Charger System	2	Charger	Unplanned Outage - HV (Battery and Charger System)	$1.17	Failure	$2.34	9.20%	$0.22	$0.21		$0.00			$0.00
Controls	35	Bay Controller	Unplanned Outage - HV (Controls)	$1.22	Failure	$42.82	4.23%	$1.81	$1.71		$0.10			$0.00
Controls	35	Control Cabling	Unplanned Outage - HV (Controls)	$1.22	Failure	$42.82	4.23%	$1.81	$1.71		$0.10			$0.00
Low Voltage AC Supply	2	AC Low Voltage Board/Panel/Box	Uncontrolled Electrical Contact / Discharge (Low Voltage AC Supply)	$1.45	Failure	$2.89	31.00%	$0.90	$0.72		$0.17	$0.01		$0.00
Low Voltage AC Supply	2	AC Low Voltage Board/Panel/Box	Unplanned Outage - HV (Low Voltage AC Supply)	$3.70	Failure	$7.40	31.00%	$2.29	$2.13		$0.17			$0.00
Low Voltage AC Supply	2	AC Low Voltage Cable	Uncontrolled Electrical Contact / Discharge (Low Voltage AC Supply)	$1.45	Failure	$2.89	3.20%	$0.09	$0.07		$0.02	$0.00		$0.00
Low Voltage AC Supply	2	AC Low Voltage Cable	Unplanned Outage - HV (Low Voltage AC Supply)	$3.70	Failure	$7.40	3.20%	$0.24	$0.22		$0.02			$0.00
Low Voltage DC Supply	2	DC Low Voltage Board/Panel/Box	Uncontrolled Electrical Contact / Discharge (Low Voltage DC Supply)	$1.17	Failure	$2.35	2.00%	$0.05	$0.05		$0.00	$0.00		$0.00
Low Voltage DC Supply	2	DC Low Voltage Board/Panel/Box	Unplanned Outage - HV (Low Voltage DC Supply)	$1.17	Failure	$2.34	2.00%	$0.05	$0.05		$0.00			$0.00
Low Voltage DC Supply	2	DC Low Voltage Cable	Uncontrolled Electrical Contact / Discharge (Low Voltage DC Supply)	$1.17	Failure	$2.35	2.00%	$0.05	$0.05		$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)	$1.17	Failure	$2.34	2.00%	$0.05	$0.05		$0.00			$0.00
Metering	14	Meter	Failed Compliance Obligations (Metering)	$0.11	Failure	$1.56	4.40%	$0.07			$0.07			
Protection - 132kV	17	Protection	Unplanned Outage - HV (Protection - 132kV)	$1.26	Failure	$21.50	15.61%	$3.36	$3.07		$0.28			$0.00
Protection - 132kV	17	Protection Relay	Explosive Failure of Asset (Protection - 132kV)	$1.21	Failure	$20.61	15.61%	$3.22	$2.46		$0.22	$0.36	$0.00	$0.17
Protection - 330kV	4	Protection	Unplanned Outage - HV (Protection - 330kV)	$1.26	Failure	$5.06	3.31%	$0.17	$0.15		$0.01			$0.00
Protection - 330kV	4	Protection Relay	Explosive Failure of Asset (Protection - 330kV)	$1.90	Failure	$7.61	3.31%	$0.25	$0.21		$0.01	$0.02	$0.00	$0.01
				$27.94		$181.46		$15.27	$13.51		$1.17	$0.40	$0.00	$0.19

Total VCR Risk: $13.27

Total ENS Risk: $0.07