

NEED/OPPORTUNITY STATEMENT (NOS)



Lower Tumut Secondary Systems Renewal

NOS- 00000001192 revision 2.0

Ellipse project no.: P0005259

TRIM file: [TRIM No]

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

Project category: Prescribed - Replacement

Approvals

Author	Hazem Khamis	Secondary Systems Strategist
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Approved	Lance Wee	M/Asset Strategy
Date submitted for approval	9 November 2016	

Change history

Revision	Date	Amendment
0	3 May 2016	Initial issue
1	10 October 2016	Update to 2016/17 dollars
2	9 November 2016	Update to format

1. Background

Lower Tumut 330kV Switching Station comprises 8x 330kV feeders and 2 x 330kV Busbars. The site was established in 1972, and the secondary systems assets have install dates between 1972 and 2009. The site utilises 250V DC for powering all secondary systems and is only one of two sites within TransGrid's network to do so.

Lower Tumut Switching Station connects Snowy Hydro's Tumut 3 power station to the 330kV transmission network with a generating capacity of 1,500MW. TransGrid's current Connection Agreement with Snowy Hydro that covers Lower Tumut Switching Station expires in 2021. In conjunction with this Need, greater certainty over an extension to the term of the Connection Agreement will be sought from the customer to confirm the validity of any investment proposed as a result.

Lower Tumut Switching Station was previously the Control Centre for the entire Snowy Hydro Scheme and as such, a number of legacy systems have remained since it was transferred to TransGrid ownership. These include integrated and shared control systems, outdated pilot wire protection systems and a building that is significantly larger than required for TransGrid's purposes and in need of significant upgrades to bring it to modern standards. These issues at Lower Tumut were highlighted as significant risks in the Technical Vendor Due Diligence report compiled by Advisian as part of the Transaction process.

2. Need/opportunity

In accordance with TransGrid's Renewal and Maintenance Strategies for Automation¹ and Metering Systems², Table 1 shows the following assets at Lower Tumut Switching Station that have been identified for replacement by 2023.

Table 1 – Identified asset replacements at Lower Tumut Switching Station from 2014 - 2023

Need Description	Quantity of Assets to be addressed	% of services at Site	Need Driver
Need ID 601 – Replacement of MBCI Protection Relays	3	19% of all line/feeder protection relays on site	<ul style="list-style-type: none"> > Component obsolescence resulting in exhausted spares and no manufacturer support > Reliant on proprietary intertripping and CBF systems
Need ID 604 – Replacement of Micromho (SHNB) Protection Relays	2	13% 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 > Known history of tripping during power cycle
Need ID 609 – Replacement of DL910 Protection Relays	3	19% of all line/feeder protection relays on site	<ul style="list-style-type: none"> > Component obsolescence resulting in exhausted spares and no manufacturer support > Reliant on proprietary intertripping and CBF systems

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 1389 – Protection - Busbar Condition	4	100% of all busbar protection relays onsite	<ul style="list-style-type: none"> > Component obsolescence resulting in a lack of spares and no manufacturer support > Excessive mechanical wear resulting in slow reset times
Need ID 610 – Replacement of EDM I MKIII Meters	8	73% of all market meters on site	<ul style="list-style-type: none"> > Component obsolescence resulting in a lack of spares and no manufacturer support
Need ID 629 - Replacement of Remote Terminal Units (RTUs)	1	100% of all RTUs on site	<ul style="list-style-type: none"> > Component obsolescence resulting in a lack of spares and no manufacturer support

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

The risk cost associated with all secondary systems at Lower Tumut is \$1.7m 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 scheduled generation connected to the site and a capacity to interrupt 1296MW of load in the network for an estimated 8 hours following a hazardous event. Lower Tumut Switching Station 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 Installations⁴, an opportunity exists to address these risks by performing a full secondary system replacement at Lower Tumut 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
- > Optimising the current implementation of 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 Refer NACA-SSAP - Protection, NACA-SSAC - Control, NACA-SSAM - Metering

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

- > Reducing system spare requirements by converting the site to TransGrid's standardised secondary systems voltage level of 110V DC.

3. Related Needs/opportunities

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

- > Need ID 601 – Replacement of MBCI Protection Relays
- > Need ID 604 – Replacement of Micromho (SHNB) Protection Relays
- > Need ID 609 – Replacement of DL910 Protection Relays
- > Need ID 1389 – Protection – Busbar Condition
- > Need ID 610 – Replacement of EDM I MKIII Meters
- > Need ID 629 - Replacement of Remote Terminal Units (RTUs)

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: Lower Tumut Substation Renewal

Option Name: 1192 - Base Case

Option Assessment Name: 1192 -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)	\$0.03	Failure	\$0.05	9.20%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Battery	Unplanned Outage - HV (Battery and Charger System)	\$0.01	Failure	\$0.02	9.20%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Charger	Uncontrolled Electrical Contact / Discharge (Battery and Charger System)	\$0.03	Failure	\$0.05	9.20%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Charger	Unplanned Outage - HV (Battery and Charger System)	\$0.01	Failure	\$0.02	9.20%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Controls	5	Bay Controller	Unplanned Outage - HV (Controls)	\$0.08	Failure	\$0.40	6.50%	\$0.03	\$0.00	\$0.00	\$0.02	\$0.00	\$0.00	\$0.00
Controls	5	Control Cabling	Unplanned Outage - HV (Controls)	\$0.08	Failure	\$0.40	6.50%	\$0.03	\$0.00	\$0.00	\$0.02	\$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)	\$0.27	Failure	\$0.54	31.00%	\$0.17	\$0.00	\$0.00	\$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)	\$0.27	Failure	\$0.54	31.00%	\$0.17	\$0.00	\$0.00	\$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)	\$0.27	Failure	\$0.54	3.20%	\$0.02	\$0.00	\$0.00	\$0.02	\$0.00	\$0.00	\$0.00
Low Voltage AC Supply	2	AC Low Voltage Cable	Unplanned Outage - HV (Low Voltage AC Supply)	\$0.27	Failure	\$0.54	3.20%	\$0.02	\$0.00	\$0.00	\$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)	\$0.01	Failure	\$0.02	2.00%	\$0.00	\$0.00	\$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)	\$0.01	Failure	\$0.02	2.00%	\$0.00	\$0.00	\$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)	\$0.01	Failure	\$0.02	2.00%	\$0.00	\$0.00	\$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)	\$0.01	Failure	\$0.02	2.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Metering	6	Meter	Failed Compliance Obligations (Metering)	\$0.11	Failure	\$0.67	3.50%	\$0.02	\$0.02	\$0.00	\$0.02	\$0.00	\$0.00	\$0.00
Protection >=220kV	10	Protection	Unplanned Outage - HV (Protection >=220kV)	\$0.11	Failure	\$1.05	6.49%	\$0.07	\$0.00	\$0.00	\$0.07	\$0.00	\$0.00	\$0.00
Protection >=220kV	10	Protection Relay	Explosive Failure of Asset (Protection >=220kV)	\$1.75	Failure	\$17.52	6.49%	\$1.14	\$1.11	\$0.02	\$0.02	\$0.00	\$0.01	\$0.00
				\$3.33					\$1.67	\$1.12	\$0.53	\$0.00	\$0.01	\$0.00

Total VCR Risk: \$1.11 Total ENS Risk: \$0.00