

NEED/OPPORTUNITY STATEMENT (NOS)



Protection - Transformer Diff Condition

NOS- 000000001386 revision 2.0

Ellipse project no.: P0008045

TRIM file: [TRIM No]

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

Project category: Prescribed - Asset Renewal Strategies

Approvals

Author	Hazem Khamis	Secondary Systems Strategist
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	3 May 2016	Initial issue
1	11 October 2016	Update to 2016/17 dollars
2	9 November 2016	Update to format

1. Background

Transformer protection relays are used throughout the NSW network to isolate transformer faults and their impacts on system stability and network infrastructure. The relays under investigation are installed at the 132kV and 330kV voltage levels. There are currently approximately 24 installed units within TransGrid's asset base with install dates between 1975 and 2002.

Approximately 50% of the relays under investigation will have reached or exceeded their estimated technical life by 2023. Manufacturer support for the all models has ceased meaning no repair or replacement facilities exist and spares currently held by TransGrid for KBCH models are exhausted and for MBCH models are projected to be exhausted. Additionally there are higher costs associated with managing and maintaining spares and the continuing maintenance capability required for obsolete models with a small population.

The use of duplicated protection schemes across all capacitor banks are a continuing requirement of the Australian Energy Regulator (AER) as outlined in the National Electricity Rules (NER). These protection schemes are required into the foreseeable future.

2. Need/opportunity

The relay models in Table 1 are covered by this Need.

Table 1 – Asset quantities

Relay Model	Primary Asset Protected	Quantity Installed
KBCH	Transformers and SVC Plant	12
MBCH	Transformers and SVC Plant	12

The risk cost associated with the transformer differential protection relays is \$0.46m 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. The relays protect a mix of loads and are installed at the 132kV and 330kV voltage levels of the network and those at the 330kV level carry a risk of a system black event. It is estimated that 8 hours would be required to recover any loss of 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 the assessed assets derived from the condition assessment¹. These probabilities are forecast to continue increasing over the coming years as they move past their expected life.

3. Related Needs/opportunities

NIL

¹ Refer NACA-SSAP - Protection

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: Protection - Transformer Diff Condition

Option Name: 1386 - Base Case

Option Assessment Name: 1386 - 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) (Env)	Risk (\$M) (Rep)
Protection <=150MW	5	Protection	Unplanned Outage - HV (Protection <=150MW)	\$0.15	Failure	\$0.73	4.60%	\$0.03	\$0.03	\$0.01	\$0.02		\$0.00
Protection <=150MW	5	Protection Relay	Explosive Failure of Asset (Protection <=150MW)	\$0.08	Failure	\$0.40	4.60%	\$0.02	\$0.02	\$0.01	\$0.01	\$0.00	\$0.00
Protection >=330kV	8	Protection	Unplanned Outage - HV (Protection >=330kV)	\$0.11	Failure	\$0.84	4.60%	\$0.04	\$0.04	\$0.00	\$0.04		\$0.00
Protection >=330kV	8	Protection Relay	Explosive Failure of Asset (Protection >=330kV)	\$1.00	Failure	\$7.99	4.60%	\$0.37	\$0.37	\$0.34	\$0.03	\$0.00	\$0.00
Protection >150MW	0	Protection	Unplanned Outage - HV (Protection >150MW)	\$0.00	Failure	\$0.00	0.00%	\$0.00	\$0.00	\$0.00	\$0.00		\$0.00
Protection >150MW	0	Protection Relay	Explosive Failure of Asset (Protection >150MW)	\$0.00	Failure	\$0.00	0.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
				\$1.33		\$9.96		\$0.46	\$0.46	\$0.36	\$0.10	\$0.00	\$0.00
Total VCR Risk:				\$0.36				Total ENS Risk:	\$0.00				