

NEED/OPPORTUNITY STATEMENT (NOS)



Protection - Siemens 7xx Condition

NOS- 000000001381 revision 3.0

Ellipse project no.: P0008035

TRIM file: [TRIM No]

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

Project category: Prescribed - Asset Renewal Strategies

Approvals

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Endorsed	Mark Jones	Secondary Systems and Communications Asset Manager
Approved	Lance Wee	Manager Asset Strategy
Date submitted for approval	17 November 2016	

Change history

Revision	Date	Amendment
0	28 June 2016	Initial issue
1	17 October 2016	Update to 2016/17 dollars
2	17 November 2016	Update to format

1. Background

Siemens 7xx series relays are used throughout TransGrid's network primarily in line/feeder and capacitor bank protection schemes across all voltage levels. There are currently 123 relays in-service in total with 70 of them being ≥ 8 years old. These 70 relays will either reach or age beyond its nominal asset life of 15 years by 2023. There are various types of relays in this series and the support services for some of them are no longer available or provided by the manufacturer.

During the regulatory period 2019-23, TransGrid needs to target the replacement of these 70 Siemens 7xx series relays.

2. Need/opportunity

This proposed replacement is driven by the need to maintain network reliability and provide reliable and fast protection of transmission lines and capacitor banks. The following relay models are covered by this need:

Relay Model	Primary asset protected	Quantity Installed which are ≥ 8 years old in 2016
7SA511	Transmission lines	1
7SA513	Transmission lines	6
7SA522	Transmission lines	8
7SA610+7SD610	Transmission lines	3
7SD511	Transmission lines	8
7SD522	Transmission lines	10
7SD610	Transmission lines	2
7SJ610	Capacitor Banks and Transmission lines	28
7SJ610+7UT612	Reactors	1
7SK8833	Transformers	2
7SS522	Busbar	1

These relays are mostly used in line/feeder protection schemes where the risk due to bushfire is the predominant concern. There are also few of these relays protecting primary assets at 330kV level and therefore carries a significant risk of system black event in case of relay malfunction.

The associated risk cost is \$4.76m 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 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.

3. Related needs/opportunities

NIL

4. Recommendation

It is recommended that options be considered to address the identified need/opportunity.

¹ Refer NACA-SSAP - Protection

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 - Siemens 7xx Condition

Option Name: 1381 - Base Case

Option Assessment Name: 1381 - 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)
7SA5xx <=150MW	1	Protection	Unplanned Outage - HV (7SA5xx <=150MW)	\$0.11	Failure	\$0.11	3.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SA5xx <=150MW	1	Protection Relay	Explosive Failure of Asset (7SA5xx <=150MW)	\$0.07	Failure	\$0.07	3.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SA5xx >=330kV	4	Protection	Unplanned Outage - HV (7SA5xx >=330kV)	\$0.11	Failure	\$0.42	3.00%	\$0.01	\$0.00	\$0.01	\$0.01	\$0.00	\$0.00	\$0.00
7SA5xx >=330kV	4	Protection Relay	Explosive Failure of Asset (7SA5xx >=330kV)	\$4.21	Failure	\$16.84	3.00%	\$0.51	\$0.49	\$0.01	\$0.01	\$0.00	\$0.00	\$0.00
7SA5xx >150MW	0	Protection	Unplanned Outage - HV (7SA5xx >150MW)	\$1.24	Failure	\$0.00	3.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SA5xx >150MW	0	Protection Relay	Explosive Failure of Asset (7SA5xx >150MW)	\$1.20	Failure	\$0.00	3.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SA610 <=150MW	0	Protection	Unplanned Outage - HV (7SA610 <=150MW)	\$0.00	Failure	\$0.00		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SA610 <=150MW	0	Protection Relay	Explosive Failure of Asset (7SA610 <=150MW)	\$0.00	Failure	\$0.00		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SA610 >=330kV	0	Protection	Unplanned Outage - HV (7SA610 >=330kV)	\$0.11	Failure	\$0.00	33.30%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SA610 >=330kV	0	Protection Relay	Explosive Failure of Asset (7SA610 >=330kV)	\$4.21	Failure	\$0.00	33.30%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SA610 >150MW	0	Protection	Unplanned Outage - HV (7SA610 >150MW)	\$1.31	Failure	\$0.00	33.30%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SA610 >150MW	0	Protection Relay	Explosive Failure of Asset (7SA610 >150MW)	\$1.27	Failure	\$0.00	33.30%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SD511 <=150MW	0	Protection	Unplanned Outage - HV (7SD511 <=150MW)	\$0.00	Failure	\$0.00		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SD511 <=150MW	0	Protection Relay	Explosive Failure of Asset (7SD511 <=150MW)	\$0.00	Failure	\$0.00		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SD511 >=330kV	4	Protection	Unplanned Outage - HV (7SD511 >=330kV)	\$0.11	Failure	\$0.42	12.50%	\$0.05	\$0.00	\$0.00	\$0.05	\$0.00	\$0.00	\$0.00

Major Component	No.	Minor Component	SeI. 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)
7SD511 >=330kV	4	Protection Relay	Explosive Failure of Asset (7SD511 >=330kV)	\$4.21	Failure	\$16.84	12.50%	\$2.10	\$2.05	\$0.04	\$0.00	\$0.01	\$0.00	\$0.00
7SD511 >150MW	2	Protection	Unplanned Outage - HV (7SD511 >150MW)	\$1.22	Failure	\$2.44	12.50%	\$0.30	\$0.28	\$0.03	\$0.00	\$0.00	\$0.00	\$0.00
7SD511 >150MW	2	Protection Relay	Explosive Failure of Asset (7SD511 >150MW)	\$1.18	Failure	\$2.36	12.50%	\$0.29	\$0.28	\$0.01	\$0.00	\$0.01	\$0.00	\$0.00
7SD52x <=150MW	0	Protection	Unplanned Outage - HV (7SD52x <=150MW)	\$0.00	Failure	\$0.00								
7SD52x <=150MW	0	Protection Relay	Explosive Failure of Asset (7SD52x <=150MW)	\$0.00	Failure	\$0.00								
7SD52x >=330kV	0	Protection	Unplanned Outage - HV (7SD52x >=330kV)	\$0.00	Failure	\$0.00								
7SD52x >=330kV	0	Protection Relay	Explosive Failure of Asset (7SD52x >=330kV)	\$0.00	Failure	\$0.00								
7SD52x >150MW	4	Protection	Unplanned Outage - HV (7SD52x >150MW)	\$1.56	Failure	\$6.24	1.60%	\$0.10	\$0.09	\$0.01	\$0.00	\$0.00	\$0.00	\$0.00
7SD52x >150MW	4	Protection Relay	Explosive Failure of Asset (7SD52x >150MW)	\$1.52	Failure	\$5.08	1.60%	\$0.10	\$0.09	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SD610 <=150MW	0	Protection	Unplanned Outage - HV (7SD610 <=150MW)	\$0.11	Failure	\$0.00	20.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SD610 <=150MW	0	Protection Relay	Explosive Failure of Asset (7SD610 <=150MW)	\$0.07	Failure	\$0.00	20.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SD610 >=330kV	1	Protection	Unplanned Outage - HV (7SD610 >=330kV)	\$0.11	Failure	\$0.11	20.00%	\$0.02	\$0.00	\$0.02	\$0.00	\$0.00	\$0.00	\$0.00
7SD610 >=330kV	1	Protection Relay	Explosive Failure of Asset (7SD610 >=330kV)	\$4.21	Failure	\$4.21	20.00%	\$0.84	\$0.82	\$0.02	\$0.00	\$0.01	\$0.00	\$0.00
7SD610 >150MW	0	Protection	Unplanned Outage - HV (7SD610 >150MW)	\$0.00	Failure	\$0.00								
7SD610 >150MW	0	Protection Relay	Explosive Failure of Asset (7SD610 >150MW)	\$0.00	Failure	\$0.00								
7SJxxx <=150MW	7	Protection	Unplanned Outage - HV (7SJxxx <=150MW)	\$0.24	Failure	\$1.69	0.80%	\$0.01	\$0.01	\$0.01	\$0.00	\$0.00	\$0.00	\$0.00
7SJxxx <=150MW	7	Protection Relay	Explosive Failure of Asset (7SJxxx <=150MW)	\$0.18	Failure	\$1.27	0.80%	\$0.01	\$0.01	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SJxxx >=330kV	5	Protection	Unplanned Outage - HV (7SJxxx >=330kV)	\$0.11	Failure	\$0.53	0.80%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SJxxx >=330kV	5	Protection Relay	Explosive Failure of Asset (7SJxxx >=330kV)	\$4.14	Failure	\$20.71	0.80%	\$0.17	\$0.16	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SJxxx >150MW	3	Protection	Unplanned Outage - HV (7SJxxx >150MW)	\$1.49	Failure	\$4.47	0.80%	\$0.04	\$0.03	\$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)
7SJxxx >150MW	3	Protection Relay	Explosive Failure of Asset (7SJxxx >150MW)	\$1.43	Failure	\$4.29	0.80%	\$0.03	\$0.03	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SKxxx <=150MW	0	Protection	Unplanned Outage - HV (7SKxxx <=150MW)	\$0.00	Failure	\$0.00								
7SKxxx <=150MW	0	Protection Relay	Explosive Failure of Asset (7SKxxx <=150MW)	\$0.00	Failure	\$0.00								
7SKxxx >=330kV	0	Protection	Unplanned Outage - HV (7SKxxx >=330kV)	\$0.11	Failure	\$0.00	25.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SKxxx >=330kV	0	Protection Relay	Explosive Failure of Asset (7SKxxx >=330kV)	\$1.00	Failure	\$0.00	25.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SKxxx >150MW	0	Protection	Unplanned Outage - HV (7SKxxx >150MW)	\$0.00	Failure	\$0.00								
7SKxxx >150MW	0	Protection Relay	Explosive Failure of Asset (7SKxxx >150MW)	\$0.00	Failure	\$0.00								
7SSxxx <=150MW	0	Protection	Unplanned Outage - HV (7SSxxx <=150MW)	\$0.00	Failure	\$0.00								
7SSxxx <=150MW	0	Protection Relay	Explosive Failure of Asset (7SSxxx <=150MW)	\$0.00	Failure	\$0.00								
7SSxxx >=330kV	0	Protection	Unplanned Outage - HV (7SSxxx >=330kV)	\$0.00	Failure	\$0.00								
7SSxxx >=330kV	0	Protection Relay	Explosive Failure of Asset (7SSxxx >=330kV)	\$0.00	Failure	\$0.00								
7SSxxx >150MW	0	Protection	Unplanned Outage - HV (7SSxxx >150MW)	\$0.14	Failure	\$0.00	100.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7SSxxx >150MW	0	Protection Relay	Explosive Failure of Asset (7SSxxx >150MW)	\$0.07	Failure	\$0.00	100.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
				\$37.01					\$4.60	\$4.35	\$0.22	\$0.00	\$0.03	\$0.00

Total VCR Risk: \$4.35 Total ENS Risk: \$0.00