

NEED/OPPORTUNITY STATEMENT (NOS)



Protection - Feeder OC Condition

NOS- 000000001368 revision 3.0

Ellipse project no.: P0008004

TRIM file: [TRIM No]

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

Project category: Prescribed - Asset Renewal Strategies

Approvals

| | | |
|-----------------------------|------------------|--|
| Author | H. Khamis | Secondary Systems Strategist |
| Endorsed | M. Jones | Secondary Systems and Communications Asset Manager |
| Approved | L. Wee | M/Asset Strategy |
| Date submitted for approval | 17 November 2016 | |

Change history

| Revision | Date | Amendment |
|----------|------------------|---------------------------|
| 0 | 29 April 2016 | Initial issue |
| 1 | 17 October 2016 | Update to 2016/17 dollars |
| 2 | 17 November 2016 | Update to format |

1. Background

Feeder Overcurrent Protection relays are used through the network to protect transmission lines at voltage levels of 66kV and below. These types of protection installations are a remnant of design standards from the 1960s to 80s. TransGrid's current protection design standards do not facilitate purely Overcurrent protection. There are currently 38 installed units remaining within the network with install dates between 1967 and 1995.

All relays will have reached the end of their estimated life by 2023. Manufacturer support for these has ceased meaning no firmware or hardware upgrades would be available and spares currently held by TransGrid for these models are projected to be exhausted.

The use of duplicated protection schemes across all transmission lines and transformers 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 following assets are covered by this need:

| Relay Model | Primary Asset Protected | Quantity Installed |
|-------------|---|--------------------|
| CDG | Transmission Lines, Cables, Diesel Generators | 20 |
| MCGG | Transmission Lines, Cables | 6 |
| ICM21 | Transmission Lines, Cables | 12 |

The risk cost associated with the 38 Feeder Overcurrent protection relays is \$0.78m per annum. The most significant element of concern is the reliability consequence associated with an unplanned outage due to inadvertent operation of the protection relays. The relays protect a mix of loads and are installed throughout the network voltage levels of 66kV and below with a risk to up to 198MW of load. 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

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 - Feeder OC Condition

Option Name: 1368 - Base Case

Option Assessment Name: 1368 - 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) |
|------------------------------|-----|------------------|---|-----------------|-------------------|-------------------|------------|------------------|------------------|-----------------|------------------|------------------|------------------|------------------|
| CDG - Prot- <=220kV, <=150MW | 9 | Protection | Unplanned Outage - HV (CDG - Prot- <=220kV, <=150MW) | \$0.24 | Failure | \$2.14 | 0.80% | \$0.02 | \$0.01 | \$0.01 | \$0.01 | \$0.00 | \$0.00 | \$0.00 |
| CDG - Prot- <=220kV, <=150MW | 9 | Protection Relay | Explosive Failure of Asset (CDG - Prot- <=220kV, <=150MW) | \$0.20 | Failure | \$1.80 | 0.80% | \$0.01 | \$0.01 | \$0.01 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| CDG-Prot <=220kV, >150MW | 0 | Protection | Unplanned Outage - HV (CDG-Prot <=220kV, >150MW) | \$60.85 | Failure | \$0.00 | 0.80% | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| CDG-Prot <=220kV, >150MW | 0 | Protection Relay | Explosive Failure of Asset (CDG-Prot <=220kV, >150MW) | \$0.69 | Failure | \$0.00 | 0.80% | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| ICM21 - Prot <=150MW | 9 | Protection | Unplanned Outage - HV (ICM21 - Prot <=150MW) | \$0.14 | Failure | \$1.26 | 1.10% | \$0.01 | \$0.00 | \$0.00 | \$0.01 | \$0.00 | \$0.00 | \$0.00 |
| ICM21 - Prot <=150MW | 9 | Protection Relay | Explosive Failure of Asset (ICM21 - Prot <=150MW) | \$0.10 | Failure | \$0.92 | 1.10% | \$0.01 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| ICM21-Prot <=150MW | 1 | Protection | Unplanned Outage - HV (ICM21-Prot >150MW) | \$0.73 | Failure | \$0.73 | 1.10% | \$0.01 | \$0.01 | \$0.01 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| ICM21-Prot <=150MW | 1 | Protection Relay | Explosive Failure of Asset (ICM21-Prot >150MW) | \$0.67 | Failure | \$0.67 | 1.10% | \$0.01 | \$0.01 | \$0.01 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| MCGG-Prot <=220kV, <=150MW | 7 | Protection | Unplanned Outage - HV (MCGG-Prot <=220kV, <=150MW) | \$2.56 | Failure | \$17.92 | 3.80% | \$0.68 | \$0.65 | \$0.65 | \$0.03 | \$0.00 | \$0.00 | \$0.00 |
| MCGG-Prot <=220kV, <=150MW | 7 | Protection Relay | Explosive Failure of Asset (MCGG-Prot <=220kV, <=150MW) | \$0.09 | Failure | \$0.65 | 3.80% | \$0.02 | \$0.01 | \$0.01 | \$0.01 | \$0.00 | \$0.01 | \$0.00 |
| | | | | | | | | \$66.28 | \$26.10 | \$0.78 | \$0.70 | \$0.06 | \$0.01 | \$0.01 |
| Total VCR Risk: | | | | | | | | \$0.70 | Total ENS Risk: | | | | \$0.00 | |