

# NEED/OPPORTUNITY STATEMENT (NOS)



Protection - Busbar Condition

NOS- 000000001389 revision 2.0

**Ellipse project no.:** P0008052

**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 | 10 November 2016 |  |

## Change history

| Revision | Date             | Amendment                 |
|----------|------------------|---------------------------|
| 0        | 29 April 2016    | Initial issue             |
| 1        | 17 October 2016  | Update to 2016/17 dollars |
| 2        | 10 November 2016 | Update to format          |

## 1. Background

Busbar protection relays are used throughout the NSW network to isolate bus faults and their impacts on system stability and network infrastructure. The relays under investigation are installed purely on 330kV busbars located in sites connecting Snowy Hydro generation to the transmission network. There are 8 installed units under investigation with install dates between 1968 and 1985.

All of these relays were installed prior to 1973, and will have reached the end of their estimated life by 2023. Manufacturer support for all these models has ceased meaning no repair facilities are available and additionally, spares have been depleted. These relays lack any form of self-monitoring capabilities resulting in an unknown asset condition between maintenance activities. These relays form a small population of the busbar protection assets base that were inherited from Snowy Hydro and do not conform to TransGrid's design standards. Additionally, due to the small population of the assets, it is costly to manage and maintain continued maintenance capability.

The use of duplicated protection schemes across all busbars 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 |
|-------------|-------------------------|--------------------|
| CAGx        | 330kV Busbars           | 2                  |
| DIFE3110    | 330kV Busbars           | 6                  |

The risk cost associated with the 8 busbar protection relays is \$0.31m 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 busbars installed at Snowy Hydro generation sites. 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 assessment<sup>1</sup>. These probabilities are forecast to continue increasing over the coming years as they move past their expected life.

## 3. Related Needs/opportunities

NIL

<sup>1</sup> Refer NACA-SSAP - Protection

## 4. Recommendation

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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 - Busbar Condition

Option Name: 1389 - Base Case

Option Assessment Name: 1389 - 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) |
|--------------------|-----|------------------|---|-----------------|-------------------|-------------------|------------|------------------|------------------|-----------------|------------------|------------------|------------------|------------------|
| 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           | \$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           | \$0.00           |
| Protection >=330kV | 4   | Protection       | Unplanned Outage - HV (Protection >=330kV)      | \$0.11          | Failure           | \$0.42            | 25.00%     | \$0.11           | \$0.00           | \$0.00          | \$0.11           | \$0.00           | \$0.00           | \$0.00           |
| Protection >=330kV | 4   | Protection Relay | Explosive Failure of Asset (Protection >=330kV) | \$0.20          | Failure           | \$0.81            | 25.00%     | \$0.20           | \$0.12           | \$0.08          | \$0.00           | \$0.00           | \$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           | \$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           | \$0.00           |
|                    |     |                  |   |                 |                   |                   |            |                  | \$0.31           | \$0.12          | \$0.19           | \$0.00           | \$0.00           | \$0.00           |

Total VCR Risk: \$0.12      Total ENS Risk: \$0.00