

NEED/OPPORTUNITY STATEMENT (NOS)



Making the Grid Smarter - Emergency Capacitor Voltage Controls at Gunnedah, Orange and Taree

NOS- 000000001412 revision 2.0

Ellipse project description: P0008175

TRIM file: [TRIM No]

Project reason: Imposed Standards - Control Systems to meet NER requirements

Project category: Prescribed – Augmentation

Approvals

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Date submitted for approval	2 December 2016	

1. Background

The present NER system requirements make it necessary for TransGrid to maintain voltage at any connection point within 10% above or below its nominal voltage. This can be achieved by the switching of reactive plant at the location of the voltage excursion, or via load shedding.

Most of TransGrid's shunt reactive plant is fitted with automatic controls that will switch the plant in or out in response to high or low voltages. The purpose of these controls is to prevent voltage collapse (and thereby secure the network).

In the absence of automatic voltage control schemes, load shedding schemes are installed at Gunnedah, Orange (for Cadia Mine) and Taree substations.

2. Need/opportunity

Capacitors that are switched by a time clock, and do not currently have provision for voltage controlled switching, are installed at Gunnedah, Orange and Taree (see Table 1). As such, following critical outages, the load shedding schemes at Gunnedah, Orange (for Cadia mine), and Taree are triggered before the capacitor banks have time to switch.

Table 1: Capacitors switched by time clock

Location	Capacitor Number	Size (MVar)
Gunnedah	1	6
	2	6
Orange	1	12
Taree	1	7.2
	2	7.2

There is an opportunity to avoid the loss of load by implementing voltage controlled switching of these capacitors following a critical contingency.

Note that there are existing projects under DCN-208 and DCN-530 which include in their scopes of work upgrading the control systems on the capacitors at Orange and Taree respectively.

Therefore this opportunity only applies to upgrading the control system at Gunnedah Substation.

2.1 Risks

The primary risk of TransGrid not addressing this need is a cost of unsupplied demand to customers at Gunnedah due to the under-voltage event described in Table 2.

Table 2 – Gunnedah Event

Under-voltage event

Probability of an under-voltage event due to two (simultaneous) transmission line failures, and Gunnedah capacitors do not switch in.

= probability of failure 2x 132 kV transmission lines

= $0.29 * 0.29 = 0.0841$ events / year.¹

The load at risk is assessed to be 26 MW * load factor of 0.51 = 13.3 MW at Gunnedah.²

The load restoration time is deemed to be 24 hours.³

Therefore, the risk cost is calculated as follows:

$$\text{Risk cost} = P_{\text{under-voltage}} * VCR$$

$$\therefore \text{Risk cost} = 0.0841/\text{yr} * 13.3 \text{ MW} * 24 \text{ hrs} * \$38.35/\text{kWh}$$

$$\therefore \text{Risk cost} = 26.76 \text{ MWh} * \$38,350/\text{MWh}$$

$$\therefore \text{Risk cost} = \$1.03 \text{ million per year}$$

3. Related needs/opportunities

- > NOS 1520 – Over Voltage Control After AUFLS Event
- > DCN-208 – Rebuild of Orange 132/66 kV Substation
- > DCN-530 – Taree Secondary Systems and 33 kV Switchyard Replacement

4. Recommendation

It is recommended that technically viable solutions be investigated, for implementation within the 2018–2023 regulatory period, to remove the potential for under-voltage or over-voltage load shedding events.

¹ Using probability of transmission line outages assumed by IPART in its [Electricity transmission reliability standards – An economic assessment, Energy — Draft Report, May 2016](#).

² Group A load (all of 66 kV busbar). See [RTI GN2U066-0-0.S02](#). Load factor of 0.51 is stipulated by IPART in its reliability standard and applies to all TransGrid BSPs.

³ Using restoration times assumed by IPART in its [Electricity transmission reliability standards – An economic assessment, Energy — Draft Report, May 2016](#).

Attachment 1 Risk costs summary

Current Option Assessment - Risk Summary

Project Name: Emergency Capacitor Voltage Controls Gunnedah, Orange and Taree

Option Name: 1412 - Base Case

Option Assessment Name: 1412 - 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)
Double line trip	1	Conductor (inc Joints)	Unplanned Outage - HV (Double line trip)	\$12.20	Break	\$12.20	8.41%	\$1.03	\$1.03		\$0.00			\$0.00
				\$12.20		\$12.20		\$1.03	\$1.03		\$0.00			\$0.00

Total VCR Risk: \$1.03

Total ENS Risk: \$0.00