

NEED/OPPORTUNITY STATEMENT (NOS)



Making the Grid Smarter – Over Voltage Control after an Automatic Under Frequency Load Shedding (AUFLS) Event

NOS- 000000001520 revision 3.0

Ellipse project description:

TRIM file: [TRIM No]

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

Project category: Prescribed - NICIPAP

Approvals

Author	Son Nguyen	Power System Analyst
	Lulu Shao	Professional Engineer
Reviewed	Hoang Tong	Operations Analysis Manager
	Jahan Peiris	Network Modelling & Performance Manager
Approved	Andrew Kingsmill	Manager/Power System Analysis
Date submitted for approval	[Date]	

1. Background

This proposal forms part of the Network Capability Incentive Parameter Action Plan (NCIPAP), for the 2018/19 to 2022/23 regulatory control period. The NCIPAP portion of the STPIS described in section 5 of the STPIS guideline¹ is a plan consisting of a suite of small projects aimed at improving the capability of transmission assets through operational expenditure and minor capital expenditure on the transmission network which results in:

- > Improved capability of those elements of the transmission system most important to determining spot prices;
OR
- > Improved capability of the transmission system at times when Transmission Network Users place greatest value on the reliability of the transmission system.

This project proposes a *priority project* to improve the limit of the injection point for the benefit of the Transmission Network Users. This *priority project* is consistent with the requirements of the clause 5.2(a)(2) in section 5 of the STPIS guideline and is consistent with the objectives of the NCIPAP scheme².

The National Electricity Rules (NER) requires all market customers with peak demands at connection points in excess of 10 MW to have at least 60% of their load available for shedding by under-frequency relays³. This is required to arrest the fall in frequency in case of non-credible contingencies which result in a sudden large deficiency of generation, such as could occur due to tripping of several generating units, or due to break-up of a system into separate parts some of which would have insufficient generation. Accordingly, arrangements are made in Connection Agreements between TransGrid and various distribution authorities and market customers in this category to ensure the required under-frequency load shedding (UFLS) facilities are provided. At present up to 60% of the state demand is subjected to automatic under-frequency load shedding (AUFLS).

TransGrid studies indicated that overvoltage would occur following an automatic under-frequency load shedding (AUFLS) event due to an oversupply of capacitive reactive support.

2. Need/opportunity

The NSW transmission system includes emergency switching settings for most reactive plant; however these schemes do not appear to be fast enough to cater for widespread under-frequency load shedding.

Implementation of an over-voltage control scheme to configure existing, salient reactive plant, to utilise a reduced time settings when the system frequency is below a certain level, would reduce the capacitive reactive power support in the network during an under-frequency load shedding event.

The benefit is the risk cost savings achieved from avoiding the widespread over-voltage condition in the HV transmission network following an under-frequency load shedding event. These very high over-voltage conditions can lead to flash-overs, resulting in miss-tripping of protection that can cause additional load shed, generator tripping, and safety risks to personnel in the substation switch yard.

Therefore, with this proposed *priority project*, the post contingency capacity at the supply point can be improved as follows:

¹ AER, Final Electricity Transmission Network Service Providers Service Target Performance Incentive Scheme, Version 5 October 2015.

² Explanatory statement section 5.3.1 - AER, Draft Electricity Transmission Network Service Providers Service Target Performance Incentive Scheme, Version 5 June 2015.

³ In accordance with the NER clause 4.3.5

Option	Post contingency (following an automatic under-frequency load shedding event) limit
Do nothing	1200 MW for 4 hours
Implement an over-voltage control scheme	2400 MW for 4 hours ⁴

3. Related needs/opportunities

None.

4. Recommendation

It is recommended that the implementation of an over-voltage control scheme, to switch off salient capacitor banks during an under-frequency load shedding event, be included in TransGrid NCIPAP for the regulatory period 2018 – 2023.

⁴ It is assumed the loss of load = load form factor * (system load - load shed due to UFLS) = 2,400 MW where load form factor is 0.5, system load is 12,000 MW and load shed due to UFLS is 60% of the total system load. Therefore the post contingency capacity if doing nothing is the additional load loss 20% of 1200 MW.

Attachment 1 Risk costs summary

Current Option Assessment - Risk Summary

Project Name: Over voltage control after an AUFLS event

Option Name: 1520 - Base case

Option Assessment Name: 1520 - Option 1 - 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)
Structure	1	Steel Structure	Unplanned Outage - HV (Structure)	\$190.38	Structural Failure	\$190.38	1.00%	\$1.90	\$1.85		\$0.00			\$0.06
				\$190.38		\$190.38		\$1.90	\$1.85		\$0.00			\$0.06

Total VCR Risk: \$1.84

Total ENS Risk: \$0.00