

NEED/OPPORTUNITY STATEMENT (NOS)



Making the Grid More Resilience – Armidale capacitor transfer tripping scheme

NOS- 000000001557 revision 2.0

Ellipse project description:

TRIM file: [TRIM No]

Project reason: Armidale capacitor transfer tripping scheme

Project category: Prescribed - NCIPAP

Approvals

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Approved	Andrew Kingsmill	Manager/Power System Analysis
Date submitted for approval	2 December 2016	

1. Background

This proposal forms part of the Network Capability Incentive Parameter Action Plan (NCIPAP), for the 2018/19 to 2023/24 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.

It is necessary to switch out the Armidale 132kV capacitors during outages of an Armidale 330/132kV transformer. This is to cater for a trip of the remaining in-service transformer and to avoid potential overvoltages in the 132kV subsystem. During periods of high interchange on QNI, the unavailability of these capacitors can impose market constraints due to the voltage stability limit.

2. Need/opportunity

The market impact associated with a transformer outage could be alleviated with the aid of a local tripping scheme at Armidale. This scheme would be armed onsite during the Armidale transformer outages and would trip any in-service Armidale 132kV capacitors immediately following a trip of the adjacent in-service transformer.

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

Option	Post contingency (outage of one Armidale transformer) capacity
Do nothing	New South Wales – Queensland limits 255 MW Queensland - New South Wales limits 993 MW
Installation of a new bus couplers (Will enable full limit of the QNI to be realised).	New South Wales – Queensland limits 400 MW Queensland - New South Wales limits 1078 MW

3. Related needs/opportunities

Need NS-1701 - Capacitors to improve QNI limits

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

4. Recommendation

It is recommended that a transfer tripping scheme be established at Armidale to allow the 132kV capacitor banks to remain in service during planned transformer outages.

And these are to be included in TransGrid NCIPAP for the regulatory period 2018 – 2023.

Attachment 1 Market benefit summary

The market impact due to unavailability of the Armidale capacitor banks is estimated using following assumptions:

Outage rate of an Armidale transformer² = 0.21/year

Average Transformer outage duration³ = 84.2 hours/outage

No. of 330/132 kV transformers at Armidale = 2

Probability of NSW importing from QLD during a transformer outage⁴ = 80%

Market impact due to NSW import limit binding⁵ = \$16/MWh

Probability of NSW import limit binding⁶ = 15%

Probability of NSW exporting to QLD during a transformer outage⁷ = 20%

Market impact due to NSW export limit binding⁸ = \$25/MWh

Probability of NSW export limit binding⁹ = 75%

Market impact = (No. of transformers at Armidale) * (Outage rate of a transformer) * [(Probability of NSW importing) * (Probability of NSW import limit binding) * (Market impact due to NSW import limit binding) * (MW reduction in NSW import on QNI)] + [(Probability of NSW exporting) * (Probability of NSW export limit binding) * (Market impact due to NSW export limit binding) * (MW reduction in NSW export on QNI)] * (Outage duration)

Market impact = (2*0.21)*[{0.8*0.15*16*85} + {0.20*0.75*25*145}]*84.2 = 0.42*[164+544]* 84.2

Market impact = \$0.03 million/year

² Based on the TransGrid Historical Outage Statistics - Refer file "Reliability Analysis - Final Summary.xlsx" in PDGS

³ 50th percentile value from TransGrid Historical Outage Statistics - Refer file "Reliability Analysis - Final Summary.xlsx" in PDGS

⁴ Based on QNI flows from 1 June 2012 to 31 May 2016 – Refer file "nsw-vic-qld-1557.xlsm" in N:\HV System Planning\PUBLIC\NCIPAP\Risk Costs

⁵ Based on the difference between NSW and QLD Black Coal variable costs – refer page 61 of Jacobs report "Retail electricity price history and projections.pdf" filed in PDGS supporting documents. NSW price is expected to be higher than QLD price in this situation. Hence, higher range Black Coal prices in NSW and lower range Black Coal prices in QLD were used. Accordingly, Market impact = \$25 - \$9 = \$16.

⁶ Based on Historical average number of binding NSW import constraints with the reduction due to Armidale capacitors unavailability applied for the period from 1 June 2012 to 31 May 2016 – Refer file "nsw-vic-qld-1557.xlsm" in N:\HV System Planning\PUBLIC\NCIPAP\Risk Costs

⁷ Based on QNI flows from 1 June 2012 to 31 May 2016 – Refer file "nsw-vic-qld-1557.xlsm" in N:\HV System Planning\PUBLIC\NCIPAP\Risk Costs.

⁸ Based on the difference between NSW Black Coal and QLD Gas variable costs – refer page 61 of Jacobs report "Retail electricity price history and projections.pdf" filed in PDGS supporting documents. QLD price is expected to be higher than NSW price in this situation. In addition, it is expected that QLD Gas prices will be setting the dispatch price when QLD is importing from NSW. Hence, Gas prices in QLD and Black Coal prices in NSW were used. Accordingly, Market impact = \$45 - \$20 = \$25/MWh. Note that, the average historical price difference between NSW and QLD is about \$69 when NSW export to QLD – Based on prices from 1 June 2012 to 31 May 2016 when NSW is exporting to QLD – Refer file "nsw-vic-qld-1557.xlsm" in N:\HV System Planning\PUBLIC\NCIPAP\Risk Costs.

⁹ Based on Historical average number of binding NSW export constraints with the reduction due to Armidale capacitors unavailability applied for the period from 1 June 2012 to 31 May 2016 – Refer file "nsw-vic-qld-1557.xlsm" in N:\HV System Planning\PUBLIC\NCIPAP\Risk Costs