

NEED/OPPORTUNITY STATEMENT (NOS)



Armidale and Dumaresq QNI Transpositions

NOS- 000000001460 revision 2.0

Ellipse project description: P0008487 - Armidale and Dumaresq QNI Transposition

TRIM file: [TRIM No]

Project reason: Compliance – Regulatory Obligation

Project category: Prescribed – Augmentation

Approvals

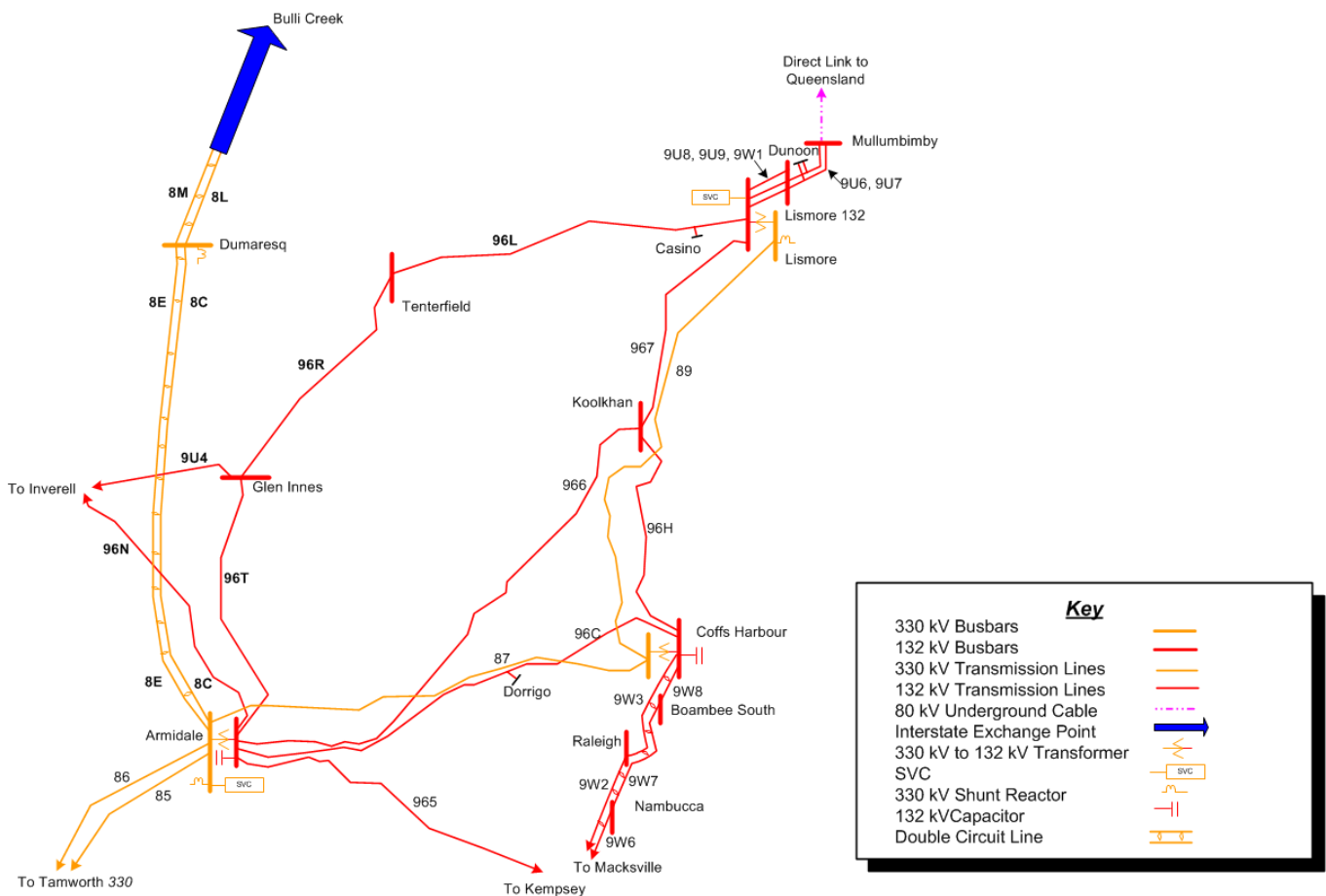
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Date submitted for approval	9 January 2017	

1. Background

Schedule S5.1a.7 of the National Electricity Rules (NER) defines a maximum average negative-sequence voltage of 0.5% of nominal voltage over a 30-minute averaging period, for systems with no contingencies and nominal voltages greater than 100 kV.

The Armidale to Dumaresq 330 kV double circuit transmission line 8E/8C (see Figure 1) was built as part of the Queensland – New South Wales Interconnector (QNI). This double-circuit line was constructed with two transposition points (at which the phase conductors of both circuits are transposed), thereby producing a “full roll” of conductor phasings.

Figure 1: Single line diagram of the Northern NSW transmission network.



2. Need/opportunity

Analysis of voltage unbalance levels at northern NSW 330 kV connection points (Armidale, Coffs Harbour and Lismore) revealed negative-sequence voltage magnitudes of greater than 0.5% of nominal¹.

The outcome of the analysis is that of the three monitored locations, for most levels of QNI power transfer, the highest negative-sequence voltage magnitudes were found at Coffs Harbour 330 kV

This NOS identifies an opportunity to make the network more resilient to the existing negative-sequence voltage levels within the northern NSW transmission network

2.1 Risks

If exceedance of the 0.5% NER negative-sequence voltage limit were used to define the constraint on QNI power transfer (under system normal 'n' operation):

- > No southerly flow on QNI from Queensland to NSW would be permitted; and
- > Northerly flow on QNI from NSW to Queensland would need to be constrained to between 200 and 600 MW.

Historical average southerly flows on QNI have been around 425 MW for around 74% of the year.

Historical average northerly flows on QNI have been greater than 200 MW (i.e. the maximum allowable flow) for around 9% of the year at an average level of 263 MW.

We have assumed the voltage limit violations occur for 1 hour at a time.

Therefore the risk cost has been calculated as that amount of energy unavailable to the market, thus:

$$\text{Risk cost} = \{P_{\text{import unavailable}} + P_{\text{export constrained}}\} * VCR$$

$\therefore \text{Risk cost} =$

$\{[\text{southerly average flow} * \text{percent of the year southerly flows occur}] + [(\text{northerly average flow} > \text{northerly lowest allowable flow} - \text{northerly lowest allowable flow}) * \text{percent of the year northerly flows occur}]\} * \text{violation duration} * VCR$

$$\therefore \text{Risk cost} = \{[425 \text{ MW} * 0.74] + [(263 - 200) \text{ MW} * 0.09]\} * 1 \text{ hr} * VCR$$

$$\therefore \text{Risk cost} = 320.2 \text{ MW} * \$38.35/\text{kWh}$$

$$\therefore \text{Risk cost} = \$12.28 \text{ million per year}$$

In order for the network to be resilient, it would be opportune for AEMO to appropriately amend the constraint equations and for TransGrid to pre-emptively enable this by doing any necessary works in coordination with AEMO.

3. Related needs/opportunities

Nil.

4. Recommendation

It is recommended that this opportunity be addressed by June 2019 (as an earliest practical date).

¹ Voltage Unbalances at the Renewable Hub 330 kV Connection Point -2016.

Attachment 1 Risk costs summary

Current Option Assessment - Risk Summary

Project Name: Improve Main Grid Resilience

Option Name: 1460 - Base Case

Option Assessment Name: 1460 - 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)
Conductor	1	Conductor (inc Joints)	Unplanned Outage - HV (QNI NER violations)	\$16.30	Break	\$16.30	74.00%	\$12.06	\$12.06		\$0.00			\$0.00
Conductor case2	1	Conductor (inc Joints)	Unplanned Outage - HV (Conductor case2)	\$2.42	Break	\$2.42	9.00%	\$0.22	\$0.22		\$0.00			\$0.00
				\$18.71		\$18.71		\$12.28	\$12.28		\$0.00			\$0.00

Total VCR Risk: \$12.28

Total ENS Risk: \$0.00