

NEED/OPPORTUNITY STATEMENT (NOS)



Armidale and Dumaresq QNI Transpositions

NOS- 00000001460 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

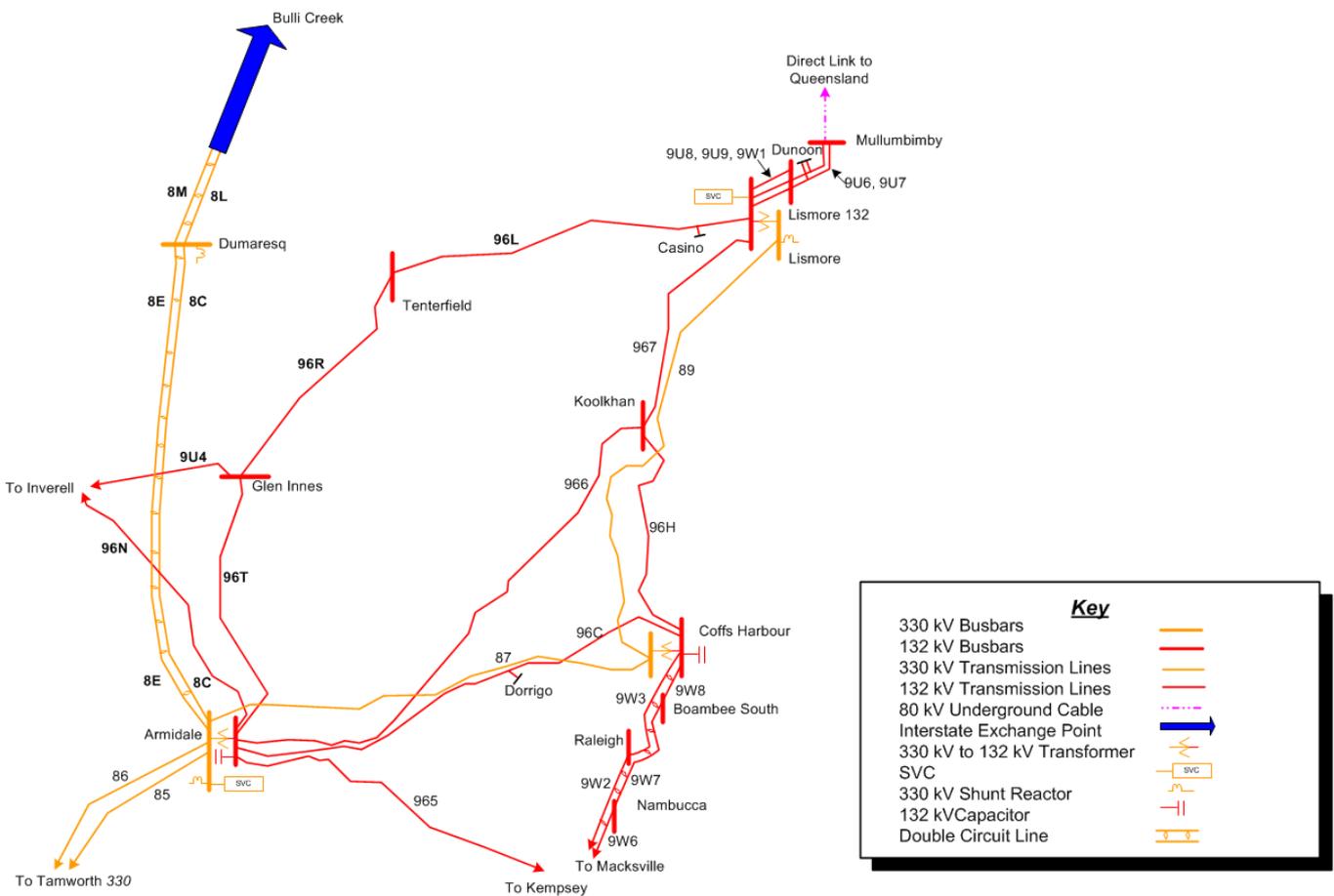
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Date submitted for approval	9 January 2017	

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

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

\therefore **Risk cost = \$12.28 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