

NEED/OPPORTUNITY STATEMENT (NOS)



EE connection for Narrabri Gas

NOS- 000000001693 revision 0.0

Ellipse project no(s): P0010122

TRIM file: [TRIM No]

Project reason: Reliability - To meet connection point reliability requirements

Project category: Prescribed - Augmentation

Approvals

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Approved	Andrew Kingsmill	Manager / Network Planning
Date submitted for approval	12 December 2016	

Change history

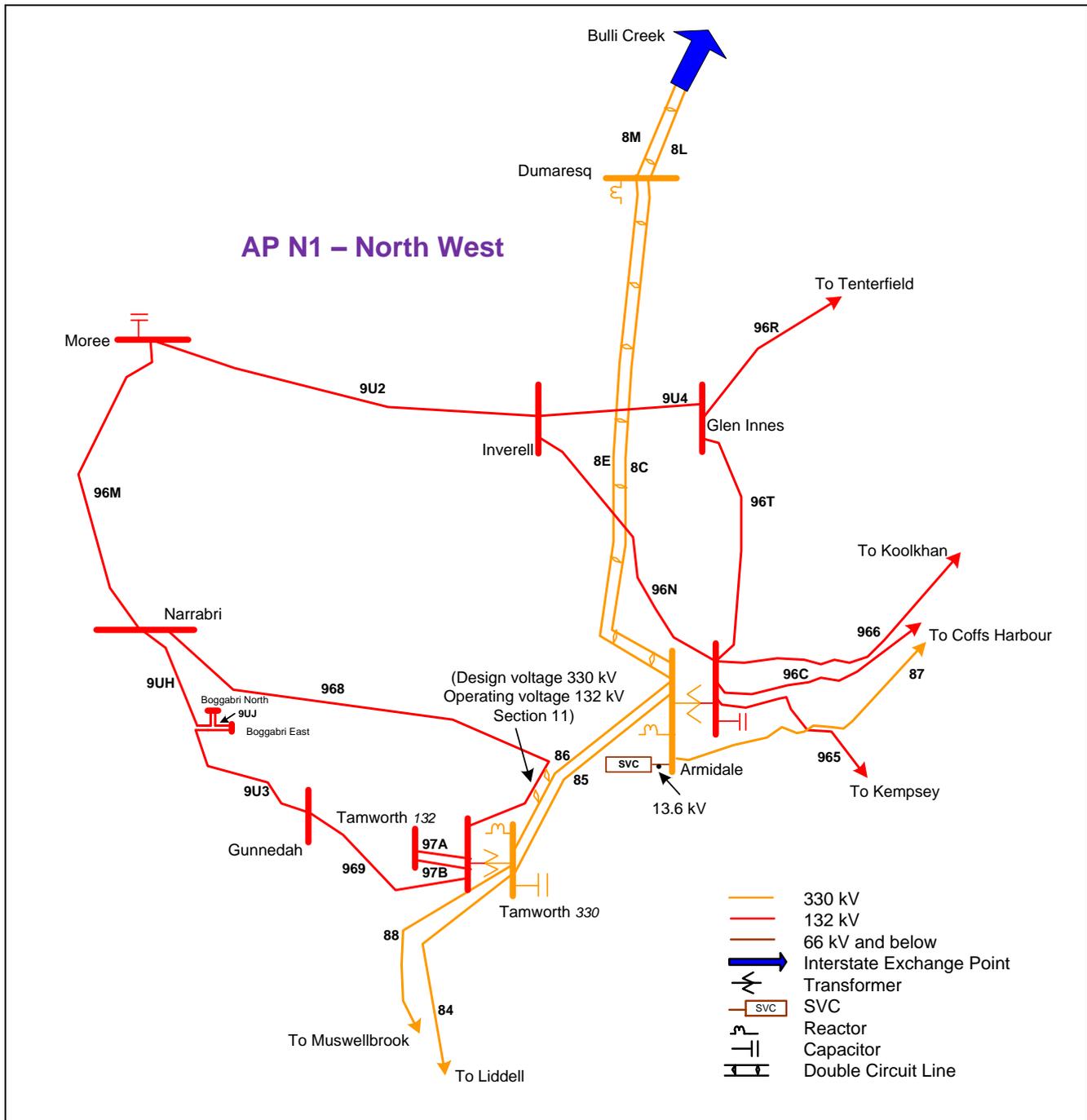
Revision	Date	Amendment
0	27/10/2016	Initial issue
1	12/12/16	General update to the document

1. Background

The Gunnedah/Narrabri area in north west NSW is primarily supplied by 969 Tamworth to Gunnedah and 968 Tamworth to Narrabri 132 kV lines, supplied from Tamworth 330/132 kV Substation. This part of the network is parallel to the 330 kV main system, connected to QLD, hence power flows on 969 and 968 lines are affected by power flows on the NSW/QLD interconnectors QNI and Direct Link. At times of heavy import/export conditions, the power flows on 968 and 969 lines can change significantly. Narrabri Substation has two 60 MVA 132/66 kV transformers connected to 66 kV busbars supplying Essential Energy's loads.

Error! Reference source not found. depicts the existing network in the north-west area network of NSW.

Figure 1: Schematic Diagram of the North West Subsystem



The Boggabri Coal and Maules Creek mines are connected to the TransGrid network via the Boggabri East and Boggabri North switching stations. The agreed maximum capacity of these two mines is 5 MVA and 15 MVA respectively. Prior to the connection of these two mines, line 969 was approaching its thermal limit at times of high load on outage of line 968. Connection of these mines would have resulted in the thermal ratings of line 969 being exceeded under an N-1 situation. The mines were connected on an opportunity basis (that is, they would be disconnected if necessary) prior to the 969 line thermal limitation being relieved. This is currently managed¹ by line overload load shedding schemes installed at the two mines. However, TransGrid indicated to the mines prior to their connections that the north west transmission network would be reinforced post their connections and they would be released from the load shedding requirement once the thermal limitation of 969 line is addressed.

Moree Solar Farm (MSF) is connected to TransGrid's Moree 132/66 kV Substation via Essential Energy's 66 kV network. It has a maximum generation capacity of 56 MW and was completed in February 2016.

White Rock Wind Farm (WRWF) is committed and will connect into 9U4 Glen Innes to Inverell 132 kV line. It has a maximum generation capacity of 170 MW.

2. Need/opportunity

In a study commissioned by TransGrid², Ernst & Young (EY) has identified a number of projects which, should they eventuate, would result in additional spot loads imposed on the TransGrid network and may impact the TransGrid network development plan. The EY study identified, as a minimum, a total of 354 MW of potential uncommitted load that was not included within TransGrid's in demand forecasts over the upcoming planning horizon. This localised load growth may result in additional network limitations, within the planning horizon, that would need to be managed by TransGrid.

One of these projects is a possible gas project, connected within Essential Energy's 66 kV network near Narrabri, supplied from TransGrid's Narrabri 132/66 kV Substation. Santos NSW (Eastern) Pty Ltd (Santos) is proposing to develop the Narrabri Gas Project, extracting natural gas from coal seams in the Gunnedah Basin in New South Wales (NSW), southwest of Narrabri. The EY study provides probabilities of completion of individual projects for the high, medium and low load demand growth scenarios as well as estimated project completion dates:

Table 1: Additional potential future loads

Project	Location	Additional Load	Estimated Date
Narrabri Gas Project	Narrabri	+40 MW	2020 ³
Shenhua Mine	Gunnedah	+40 MW	2023

TransGrid is considering the impact of the Shenhua Coal Project in the Narrabri/Gunnedah region in separate Need-1489.

TransGrid has analysed the impact of the additional Narrabri spot load in conjunction with the high, medium and low growth forecasts as described in the North West Area Plan⁴. It would be reasonable to include the spot load in the high and medium growth scenarios, as the probability is greater than 50% for each of these growth scenarios.

¹ Up to 1 MW of load in addition to the Boggabri Coal and Maules Creek mine loads could be at risk. However, it is considered to be within the error margin of the 50% PoE BSP forecasts for the area and the forecasts for the mines.

² EY 2016, Expansion of demand scenarios, Ernst and Young, 10 October 2016.

³ Note the EY have estimated a date of 2018, however TransGrid have allowed for an additional 2 years based on discussions with Essential Energy. EY have not provided an estimate date for Shenhua mine, TransGrid has estimated load by 2023.

⁴ AP N1 – North West December 2016

From this analysis, TransGrid has identified that, using the 2020 low, medium and high growth forecasts with the delivery of the Narrabri Gas Project, there would be the following network constraints:

- > Voltages at the TransGrid Narrabri Substation would be operating outside of planning criteria for an outage of one of the 132 kV transmission lines supplying Narrabri and Gunnedah from Tamworth (968 or 969 lines). TransGrid's planning criteria for reactive support and voltage stability is as follows:

"It is necessary to maintain voltage stability, with voltages within acceptable levels, following the loss of a single element in the power system at times of peak system loading. The single element includes a generator, a single transmission circuit, a cable and single items of reactive support plant.

To cover fluctuations in system operating conditions, uncertainties of load levels, measurement errors and errors in the setting of control operating points, it is necessary to maintain a margin from operating points that may result in a loss of voltage control. A reactive power margin is maintained over the point of voltage instability or alternatively a margin is maintained with respect to the power transfer compared to the maximum feasible power transfer"

Specifically it was found that voltage collapse would occur in the region following a contingency on line 968 or 969.

- > The loading of line 969 will exceed its contingency rating for an outage of line 968 during peak demand. This is despite the load shedding schemes employed at the Boggabri Coal and Maules Creek mines as a demand management solution. TransGrid are obliged as a transmission network services provider to comply with the relevant clauses of the National Electricity Rules. Relevant to this Need is that TransGrid must operate the network in a *satisfactory operating state* as defined in the NER section 4.2.2, specifically:

"The power system is defined as being in a satisfactory operating state when:

(c) the current flows on all transmission lines of the power system are within the ratings (accounting for time dependency in the case of emergency ratings) as defined by the relevant Network Service Providers in accordance with schedule 5.1"

The above two network constraints provide an opportunity to strengthen the Narrabri area to manage emerging voltage and thermal limitation due to the possible Narrabri Gas Project in 2020.

2.1 Date to Address the Need

The timing is dependent on the demand in the area with an estimated Need date of winter 2020 for high, medium and low load growth scenarios as detailed in the North West Area Plan⁵.

2.2 Risks

The primary risk of not addressing this Need is voltage instability resulting in a loss of load, that is unserved energy (USE), in the Narrabri and Gunnedah area following a single critical contingency of TransGrid line 969 between Tamworth and Gunnedah or 968 between Tamworth and Narrabri.

The load at risk which is being assessed here is the forecast peak load of 84 MW in 2023 (comprising the Narrabri Gas Plant of 40 MW and the Narrabri area load⁶ 44MW), multiplied by a load factor of 0.8. As this is a new development and there is no load data available yet, the 0.8 factor is used as a reasonable estimate of the likely average demand over summer 2022/23. This equates to
 $84 * 0.8 = 67 \text{ MW}$.

The risk cost of not addressing this Need is therefore composed of the following components:

- > exposing area load of 84 MW (peak) to risk of being lost upon an outage event on line 968
- > exposing area load of 84 MW (peak) to risk of being lost upon an outage event on line 969

⁵ AP N1 – North West December 2016

⁶ TransGrid Transmission Annual Planning Report 2016 Table A1.6 – Essential Energy (North) bulk supply point winter maximum demand

- > damage to TransGrid's reputation (negative media coverage).
- > litigation by customers/consumer groups.

The risk components are a reliability risk (\$15.03 million), financial risk (\$0.20 million) and a reputational risk (\$0.01 million).

A risk-cost summary extract from the Investment Risk Tool appears in Attachment 1.

The expected total risk cost will be \$15.24 million per annum.

Probability of Need emerging in 2018-23

EY has assigned a probability to the identified projects for inclusion in a Low, Medium or High demand growth scenario and also for the likelihood of the project proceeding. These are shown in Table 2. Within the table, the demand scenario corresponds with those used in the North West Area Plan. The demand probability corresponds to the relative likelihood of each demand scenario occurring and the project probability in demand scenario corresponds to EY's estimate of the likelihood of the uncommitted projects occurring coincident with the demand scenario. The demand probability and project probability in demand scenario are multiplied together to determine a project probability for each demand scenario.

Table 2: Calculation of probability weighted likelihood of additional block loads

Demand scenario likelihood	Demand Probability	Project probability in demand scenario	Project probability
High	10.0%	70.0%	7.0%
Medium	60.0%	60.0%	36.0%
Low	30.0%	35.0%	10.5%
Overall weighted likelihood (sum):			53.5%

The impact on the Need is that there is an estimated overall 53.5% weighted likelihood of the Need occurring within the 2018-23 regulatory period. TransGrid will use the calculated overall project probability, together with the consequence to assess the overall risk of the Need and the requirement for risk mitigation measures.

3. Related needs/opportunities

- > Need 1489 - Thermal Limitation on 969 Line
 - This project is for upgrading of the 969 Gunnedah to Tamworth 132 kV transmission line in order to remove a thermal limitation at times of high load in the Narrabri and Gunnedah areas.
- > Establishment of Shenhua Liverpool Plains mine
 - Potential 40 MW load connected in the region of Narrabri – approval granted, however license not yet acquired and commencement date unknown.

4. Recommendation

It is recommended that options be considered to address the identified Need to manage the emerging voltage limitation at Narrabri and thermal limitations on line 969.

Attachment 1 Risk cost summary



Current Option Assessment - Risk Summary

Project Name: Narrabri Gas Project

Option Name: Base Case do nothing

Option Assessment Name: 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)
968 Circuit Breaker	1	Electrical	Unplanned Outage - HV (968 Circuit Breaker)	\$16.33	Failure	\$16.33	67.86%	\$11.08	\$10.93		\$0.14			\$0.01
969 Circuit Breaker	1	Electrical	Unplanned Outage - HV (969 Circuit Breaker)	\$16.33	Failure	\$16.33	25.47%	\$4.16	\$4.10		\$0.05			\$0.00
				\$32.67		\$32.67		\$15.24	\$15.03		\$0.20			\$0.01

Total VCR Risk: \$15.03

Total ENS Risk: \$0.00

