NEED/OPPORTUNITY STATEMENT (NOS)

Reinforcement of Southern Network

NOS- 000000001528 revision 1.0

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Project reason: Market benefit - To realise market benefits
Project category: Prescribed - Augmentation

Approvals

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1. Background

This Need/Opportunity statement documents the triggers, limitations, needs and potential options for the TransGrid's Southern NSW network.

The existing transmission network between Snowy area and Sydney is shown in Figure 1. The dotted lines represent different cut-sets in this area.

Figure 1: Existing System (including completed wind farm generators) in the Canberra/Yass - Bannaby/Marulan/Kangaroo Valley - Sydney area

The transmission system between Snowy and Sydney can be divided by four cut-sets. Table 1 shows the lines and their rating information included in each cut-set.

Cut-set	Cut-set Name	Line No.	Line Name	Normal Rating	Contingency Rating	Design Temp
1	Snowy-Yass/ Canberra	1	Upper Tumut – Canberra	915 L	995 L	85°C
		2	Upper Tumut – Yass	915 L	995 L	85°C
		3	Lower Tumut – Yass	972 L	1132 L	100°C
		7	Lower Tumut - Canberra	972 L	1132 L	100°C
2	Yass/Canberra – Bannaby/Marulan/	61	Yass – Bannaby	1008 L	1008 L	85°C

Cut-set	Cut-set Name	Line No.	Line Name	Normal Rating	Contingency Rating	Design Temp
	Kangaroo Valley	4*	Yass – Marulan	697 L	880 L	68°C
		5*[1]	Yass – Marulan	697 L	880 L	68°C
		6/3W	Canberra – Capital WF – Kangaroo Valley	915 L	995 L	85°C
3	Marulan/ Kangaroo Valley – Dapto/ Avon	8	Marulan – Dapto	915 L	995 L	85°C
		16	Marulan – Avon	915 L	995 L	85°C
		18	Kangaroo Valley – Dapto	915 L	995 L	85°C
4	Bannaby/Dapto/ Avon – Sydney West/South/ Macarthur	39	Bannaby – Sydney West	915 L	995 L	85°C
		11	Dapto – Sydney South	1280 L	1428 H	120°C
		17	Avon - Macarthur	1280 L	1428 H	120°C

Table 1: Line List of Snowy - Sydney 330 kV network

Presently the power transfer limit from Snowy to Yass/Canberra is 2670 MW. Studies have shown the transfer capability can be improved by the upgrade of Line 01 and 02 to 100°C operating temperature.

2. Need/Opportunity

2.1 Assessment of Generation Capacity

AEMO's generation information reports were a key input to select the generation retirement options. In particular, both Liddell and Smithfield are noted by AEMO to be "committed" to retirement. AEMO states that Smithfield Power Partnership advised them that the Smithfield energy facility would be retired in 2017 and AGL advised that Liddell power station would be shut down in 2022.

The reserve plant margins and energy balances within NSW are heavily impacted by the retirement of Liddell, to the point that it is unlikely that renewable projects can fulfil the need for energy and capacity (especially if wind generation cannot contribute significantly at peak demand times). This is particular the case for Medium and especially High demand growth outlooks, where substantial open cycle and combined cycle capacity will almost certain be required.

The ability of NSW existing generation to meet demand was assessed based on the following assumptions:

- NSW 10% POE medium demand growth forecast[2]
- The full capacity of all existing coal, gas and hydro generations is available for dispatch
- Maximum interconnector import capacity (1200 MW import from Queensland, 600 MW import from Victoria)
- Network losses are assumed to be 4% of the maximum demand level

The generator retirements are assumed:

[1] Line 4 and 5 are based on OM304 with issue date on 24/09/2015.

[2] AEMO National Electricity Forecasting Report 2015

- Smithfield generator with total capacity 162MW will retire in 2017
- Liddell power station with total capacity 2000MW will retire in 2022.

The NSW demand, available generation and potential surplus / shortfall is summarised in Table 2. A shortfall in generation is observed in 2022 as a result of the retirement of Liddell Power Station.

Year	Demand (MW)	Total Generation (MW)	Total Interconnector Flow (MW)	Network Losses (MW)	Surplus / Shortfall (MW)
2019/20	14666	15079.8	1800	600	1613.8
2020/21	14887	15079.8	1800	600	1392.8
2021/22	15086	15079.8	1800	600	1193.8
2022/23	15219	13079.8	1800	600	-939.2
2023/24	15457	13079.8	1800	600	-1177.2
2026/27	16168	13079.8	1800	600	-1888.2
2028/29	16591	13079.8	1800	600	-2311.2

Table 2: NSW Generation Surplus / Shortfall Based on Existing Generations for the Medium Growth Demand Scenario

Based on the assessment, it is concluded that after the retirement of Liddell power station, NSW existing local generation with full interconnector support from other state will not able to meet NSW demand. To meet the reliability of supply, new generation or interconnector upgrade will be required.

AEMO also suggests in their 2015 Electricity Statement of Opportunities (ESOO) report that the unserved energy (USE) level in NSW could exceed the Reliability Standard from 2021 under the high scenario and from 2022 under the medium scenario as shown in Figure 2. The increase in USE is primarily driven by the capacity withdrawal from NSW and an increase in maximum demand.

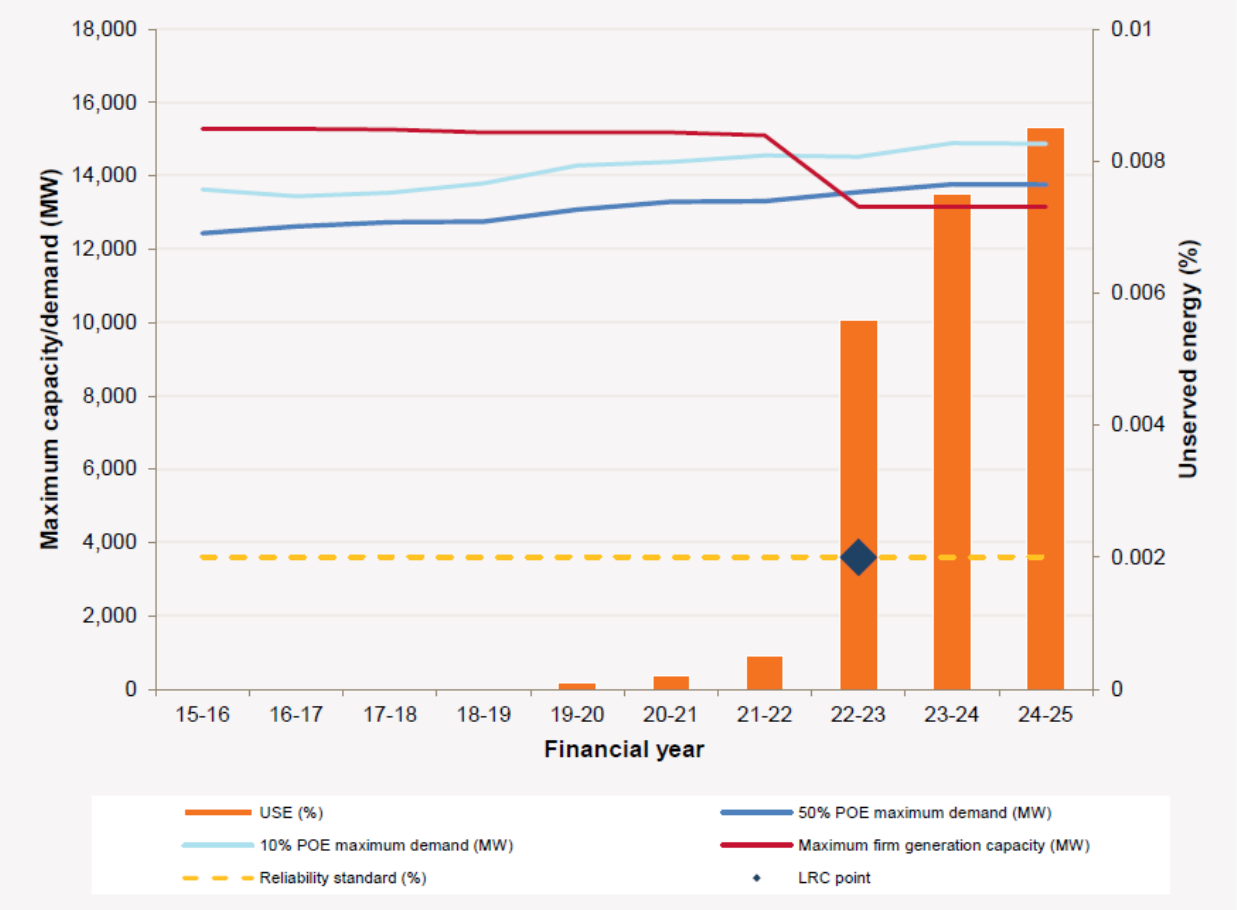

Figure 2: NSW Supply Adequacy (Medium Scenario)[3]

2.2 Generation Development Scenarios

Ernst & Young (EY) developed the generation development scenarios for TransGrid's 2018/29 to 2023/24 revenue proposal. EY identified key influencing factors likely impact on generator developments over the period of interest. The factors adopted in the analysis are:

- Demand Growth
- Renewables penetration and emission response
- Interconnector augmentation
- Small-scale, distributed energy resource (DER) uptake, including consideration of storage

Combining these factors leads to a set of future "worlds" which are called outlooks that EY believes are possible ways in which the electricity system may evolve over the coming years. The drivers for new capacity and the retirement of existing capacity are different and should be examined individually. This leads to a range of different plausible future planting scenarios, which TransGrid selected 5 "most likely" scenarios and based on which will draw transmission requirements in the future. The top 5 generating planting scenarios include 3 medium demand growth outlooks 38, 29 and 39; 1 low demand growth outlook 65 and 1 high demand growth outlook 11 as shown in Table 3.

[3] 2015 Electricity Statement of Opportunities Version 2.0

Outlook Number	Outlook Name	Demand	NSW Renewables and Emissions Response	Interconnector Augmentation	Small Scale Distributed Energy Resource Uptake
38	Medium 1	Medium	Medium Penetration	None	Medium
29	Medium 2	Medium	High Penetration	None	Medium
39	Medium 3	Medium	Medium Penetration	None	Low
65	Low	Low	High Penetration	None	Medium
11	High	High	Medium Penetration	None	Medium

Table 3: Top 5 Selected Scenarios

Three wind farms and one solar farm have recently been completed and in full commercial operations.

Wind Farm	Capacity (MW)	Commissioning Date
Gullen Range WF	165.5	November 2014
Boco Rock WF	113	March 2015
Taralga WF	106.7	May 2015
Broken Hill Solar	53	October 2015
Moree Solar Farm	56	Early 2016

Table 4: Recently Connected Wind Farms

Generation investment interest in NSW is focused on wind generation projects, mainly through the Marulan – Yass – Bannaby network and New England areas. Solar generation investment remains strong in NSW.

2.2.1 Medium 1 scenario

Under medium 1 scenario, the new generation injections in the Marulan – Yass - Bannaby network are shown in Figure 3. For the network adequacy assessment, it is assumed the renewable cluster in southern NSW is dispatched at 100% while all other wind generators are dispatched at 1.2% of rated capacity and solar generators are dispatched at 25% of rated capacity. The total wind and solar generation dispatched in this cluster is shown in Table 5. Only transitions in renewable generation dispatch are shown, with right pointing arrows indicating that renewable generation dispatch within the cluster is unchanged from the previous year.

Scenario	2019/20	2020/21	2021/22	2022/23	2023/24	2026/27	2028/29
Medium 1	1565	→	1665	→	1695	→	→

Table 5: Marulan - Yass - Bannaby Renewable Cluster Dispatch under Medium 1 scenario (MW)

Figure 3: New Generation Injection Points (Medium1)

2.2.2 Medium 2 scenario

Under medium 2 scenario, the new generation injections in the Marulan – Yass - Bannaby network are shown in Table 5Figure 4. The total wind and solar generation dispatch in this cluster is shown in Table 6.

Scenario	2019/20	2020/21	2021/22	2022/23	2023/24	2026/27	2028/29
Medium 2	2145	→	→	2245	→	2255	2305

Table 6: Marulan - Yass - Bannaby Renewable Cluster Dispatch under Medium 2 scenario (MW)

Figure 4: New Generation Injection Points (Medium2)

2.2.3 Medium 3 scenario

Under medium 3 scenario, the new generation injections in the Marulan – Yass - Bannaby network are shown in Figure 5Table 5. The total wind and solar generation dispatch in this cluster is shown in Table 7.

Scenario	2019/20	2020/21	2021/22	2022/23	2023/24	2026/27	2028/29
Medium 3	1939	→	1949	→	→	→	→

Table 7: Marulan - Yass - Bannaby Renewable Cluster Dispatch under Medium 3 scenario (MW)

Figure 5: New Generation Injection Points (Medium 3)

2.2.4 Low scenario

Under low scenario, the new generation injections in the Marulan – Yass - Bannaby network are shown in Figure 6Table 5. The total wind and solar generation dispatch in this cluster is shown in Table 8.

Scenario	2019/20	2020/21	2021/22	2022/23	2023/24	2026/27	2028/29
Low	1422	→	→	→	1472	1502	→

Table 8: Marulan - Yass - Bannaby Renewable Cluster Dispatch under Low scenario (MW)

Figure 6: New Generation Injection Points (Low)

2.2.5 High scenario

Under low scenario, the new generation injections in the Marulan – Yass - Bannaby network are shown in Figure 7Table 5. The total wind and solar generation dispatch in this cluster is shown in Table 9.

Scenario	2019/20	2020/21	2021/22	2022/23	2023/24	2026/27	2028/29
High	1731	→	1831	→	1931	→	1999

Table 9: Marulan - Yass - Bannaby Renewable Cluster Dispatch under High scenario (MW)

Figure 7: New Generation Injection Points (High)

2.3 Description of Need

2.3.1 Need Contingent to the New Generator Connections to provide market benefits

Using the five generation development scenarios described in Section 2.2, the following table outlines the most critical lines when Snowy to Yass/Canberra transfer capability is at its limit and new generators in the region are at their maximum installed capacity.

Constrained line	Critical contingency	Scenarios	New connection capacity to reach 100% thermal capability (MW)	Date to reach 100% thermal capacity[4]	Loading Level
Line 61	Line 4	Medium1	335	2017/18	189%
		Medium2	335	2017/18	203%
		Medium3	335	2017/18	194%
		Low	325	2017/18	130%
		High	335	2017/18	207%
Line 4/5	Line 61	Medium1	335	2017/18	157%
		Medium2	335	2017/18	168%
		Medium3	335	2017/18	157%
		Low	325	2017/18	125%
		High	335	2017/18	171%
Line 18	Line 5/1	Medium1	1227	2019/20	119%
		Medium 2	1310	2018/19	134%
		Medium3	567	2018/19	126%
		Low	587	2018/19	121%
		High	1291	2018/19	114%
Line 39	Line 11	Medium1	385	2017/18	122%
		Medium2	385	2017/18	126%
		Medium3	335	2017/18	122%

[4] Based on the generation scenarios

Constrained line	Critical contingency	Scenarios	New connection capacity to reach 100% thermal capability (MW)	Date to reach 100% thermal capacity[4]	Loading Level
		Low	325	2017/18	110%
		High	385	2017/18	126%

This shows that there is possibility that these lines could constrain the power can be imported from Snowy/Victoria and the potential new renewable connections in Southern NSW during the time the cost of generations is low in these areas.

Therefore upgrading the above listed circuits may provide market benefits (i.e. reduced energy cost by dispatch of lower cost generating plant, increased competition of generators etc.)

2.3.2 TransGrid proposes this project as a contingent project with the following triggers:

- New generation of more than 350 MW is committed in southern NSW at any current or future connection point(s) south of Bannaby and Marulan[5] or NSW import capacity from Southern Interconnectors is determined to be increased by more than 350 MW due to committed expansion of southern interconnections
- Successful completion of the RIT-T which will be initiated in the event of occurrence of any of the above triggers, including a comprehensive assessment of credible options demonstrating positive net market benefits
- Determination by the AER under clause 5.16.6 of the NER that the proposed investment satisfies the RIT-T.
- TransGrid Board commitment to proceed with the project subject to the AER amending the revenue determination pursuant to the Rules.

2.4 Indicative Date to Address Need

The indicative date would be determined by detailed market modelling.

2.5 Type of Service

The system reinforcement would be prescribed service.

3. Related needs/opportunities

Nil

4. Recommendation

It is recommended that options including all feasible network and non-network be considered to address the identified need/opportunity.

Further planning and market modelling studies are to be undertaken to define the market benefit of upgrading the identified circuits.

[5] AEMO classification of generation developments as being at the 'committed' stage of development on their 'Generator Information' webpage at https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Generation-information