

NEED/OPPORTUNITY STATEMENT (NOS)



Making the Grid More Resilient - Operational Telephone Network (OTN) Capability

NOS- 000000001423 revision 3.0

Ellipse project description:

TRIM file: [TRIM No]

Project reason: Imposed Standards - Communications Systems to meet AEMO requirements

Project category: Prescribed - Augmentation

Approvals

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Date submitted for approval	8 December 2016	

1. Background

The existing Very High Frequency (VHF) network was designed in the 1980's to service seven distinct regions, each with their own system control centre. However, the final configuration of the network was completed in 2002. The VHF mobile radio network was originally designed for system operators to communicate with substation staff and power stations and other control centres, as well as to provide communications between transmission line maintenance crews and their depots. The radio system is completely independent of any other telecommunications network and operates on frequency allocations that are considered to be robust, whilst providing good long-distance communications.

In case of a system emergency causing widespread loss of supply throughout NSW (a 'black start'), the VHF mobile radio system will be the backup operational voice facility between the System Controllers, other control centres and field staff¹². AEMO has recently awarded the black start functions to a generator in the north and a generation source in Victoria to the South of the state. The location of these restart sources implies that restoration of supply to several TransGrid substations in the rural areas will be slow, and supplies will not be restored for a prolonged period of time (more than 24 hours). This is likely to affect the availability of other primary communications systems as their battery life is normally designed to last for 12 hours.

The existing radio network coverage area is provided in Appendix 1.

NER Requirements

As per the NER clause 4.11.2(c) of the NER, the Network Service Providers must maintain the necessary primary and, where nominated by AEMO, back-up communications facilities to enable AEMO to discharge its market and power system security functions. Experience from the recent blackouts in the Northern territory and South Australia have shown that a robust and reliable Operational Telephone Network (OTN) is essential in enabling rapid restoration of supplies to the network customers.

2. Need/opportunity

The existing radio network is primarily required to provide secure and sustained voice communications during a black start event. These communications are required between the TransGrid control centres, other NSP control centres, power stations and all of the TransGrid substations.

TransGrid does have other operational voice services for day-to-day communication. These include mobile telephony, Telstra's PSTN network and TransGrid's Operational Telephone Network (OTN). The OTN telephone system is well designed and has associated batteries at Wallgrove and Waratah to provide up to 12 hours of backup.

In comparison, the radio network is expected to provide effective voice communication for more than 12 hours to all substations, transmission lines, repeater sites, control rooms and power stations within the coverage area depicted in Appendix A. This service is regularly tested in accordance with the sustained supply testing regime.

Recent global (and Australian) experience demonstrates that most mobile and PSTN networks cannot provide more than around 20 min of congested service following a major interruption. For this reason, all communication would be restricted to the OTN and radio systems. Recent loss-of-load events have highlighted 'avalanche' conditions on telephone networks³⁴, while field crews have been forced to rely on the Government Radio Network

¹ TransGrid, "OM666 – Restart of the New South Wales System"

² TransGrid, "OM801 – Operational Communications Facilities"

³ Energy Australia (now Ausgrid), "Sydney CBD supply interruptions – 30 March, 4 April and 28 April 2009". Final Report, May 2009

⁴ ABC News Article "Hunter flooding: Man spends two days in isolated cabin with dog during torrential rain" Available Online: <http://mobile.abc.net.au/news/2016-01-08/hunter-floods-man-dog-found-in-abandoned-cabin-after-two-days/7075520>

(GRN) or the Telstra mobile network⁵ have reported “black spots” and congestion issues. The Government Radio Network is utilised by fire brigades, police, ambulance crews and authorities and each organisation competes for available channels during system emergencies. In particular, the report into the 2015 Pinery Fire in South Australia noted the requirement for an independent review into the communications failures. A news article from the day noted that the “The radio network, when we needed it most, was not there. We had no communications at the height of the fire”, even when utilising the emergency channel. Similarly, the mobile phone coverage during these conditions was also “very problematic”; “In the northern part of the fire the communications were terrible.”

The TransGrid VHF radio network presently provides the most robust communications channel between the substations, power stations and external control centres during all power system emergencies. However, it will be necessary to initiate a program to increase the capability of the base stations and repeater sites batteries and chargers as the manufacturer will cease supporting the hardware by 2018⁶. The existing VHF radio network is a valuable asset that could not be replaced if it were ever decommissioned as the VHF frequency licences would not be re-issued by AMCA.

A system restart event will have severe economic impacts within NSW, and possibly the NEM and is likely that losses will be in excess of \$2 billion (market capitalisation) without effective communications links between all power station and DNSP control rooms⁷. The wider economic impacts are harder to quantify as these include disruptions to the financial and economic sectors, loss of life within intensive care units, property damage and theft. It should be noted that the economic impact of cyclone Larry to Northern Queensland in 2006 was estimated to be half a billion dollars⁸. In fact, the final Queensland Government report into this event recommended the development of a communication plan, which included the establishment of an “enhanced radio network”.

As shown in Table 1, it is reasonable to expect that a system restart event would occur in NSW every 50 years; however a conservative estimate would be a 1 in 100 year event. For reference, the last widespread outage occurred in 1958⁹. When assessing the economic benefit of any modifications, it is worth remembering that severe power system events are notoriously difficult to predict and that the societal economic implications can be appreciably higher than anticipated¹⁰.

Table 1: The Most Significant System Disturbances [18]

Millions of People Affected	Location	Date
620	India	30 & 31 July 2012
230	India	2-Jan-01
150	Bangladesh	1-Nov-14
140	Pakistan	26-Jan-15
100	Indonesia	18-Aug-05
97	Brazil	11-Mar-99

⁵ ABC News Article “SA bushfire emergency communications failed in Pinery blaze, CFS says, as independent review promised” Available Online: <http://www.abc.net.au/news/2015-12-01/bushfire-communications-failed-review-promised/6989576>

⁶ NS-9513 Rev 0 “Tumut VHF Network Augmentation for Control Room Access”

⁷ TransGrid, “OM666 – Restart of the New South Wales System”

⁸ Queensland Government “Severe Tropical Cyclone Larry – The Final Report of the Operation Recovery Task Force” April 2007

⁹ Electricity Commission of NSW “Technical Committee of Enquiry into the System Disturbance of September 11, 1958 – Interim Report” November 1958

¹⁰ N. N. Taleb “The Black Swan – The Impact of the Highly Improbable” Second Edition, Random House Trade Paperbacks, New York, 2010

Millions of People Affected	Location	Date
87	Brazil, Paraguay	10–11 Nov 2009
70	Turkey	31-Mar-15
55	United States, Canada	15-Aug-03
55	Italy, Switzerland, Austria, Slovenia, Croatia	28-Sep-03
40	Thailand	Mar-78
30	United States, Canada	9-Nov-65

2.1 Risks

The primary risk of TransGrid not addressing this need is a cost of unsupplied demand to customers in NSW.

The risk cost is predominately made up of the reliability risk caused by extended delays to recovering load from a black start event due to the unavailability of the existing operational voice services beyond the 12 hours mark¹¹.

The following assumptions were used in the calculation:

- > The probability of a black system event is conservatively estimated at 1% (1 in 100 year event)
- > The % amount of load not restored at 12 hours mark = 20% of the system load (it is expected that about 80% of the system load will be restored by the 12 hours mark¹²)
- > Time to restore this remaining load due to unavailability of appropriate telecommunications = 12 hours
- > The historical system average demand = 8,577 MW¹³
- > Value of Customer Reliability (VCR) = \$38,350/MWh

The total cost of these risks has been calculated in TransGrid's Investment Risk Tool thus:

VCR Risk Cost (Unserved Energy)

*VCR risk cost = probability of black start * amount of load not restored @ 12 hours mark * average historical state demand * load restoration scaling factor¹⁴ * remaining load restoration time * VCR¹⁵*

*∴ VCR risk cost = 1% * 20% * 8,577 MWh * 0.5 * 12 hrs * \$38,350/MWh*

∴ VCR risk cost = \$3.95 million per annum

There is a reputational and financial risk cost of \$0.01 million (as derived in the Investment risk tool).

The total risk cost is \$3.96 million.

Refer Attachment 2 for risk cost summary.

¹¹ Design standard for operational telephone network

¹² Based on the historical event restoration times and TransGrid annual black start training simulation experiences

¹³ Historical system average demand from AEMC draft report "Review of the System Restart Standard" 25 August 2016 Figure 6.5

¹⁴ A factor of 0.5 is used assuming gradual restoration of load

¹⁵ TransGrid's Investment Risk Tool bases the Value of Customer Reliability (VCR) on figures published by AEMO in its *Value of Customer Reliability Review - Final Report*, September 2014. In this case we use the mixed residential/industrial figure of \$38,350/MWh.

3. Related needs/opportunities

Nil

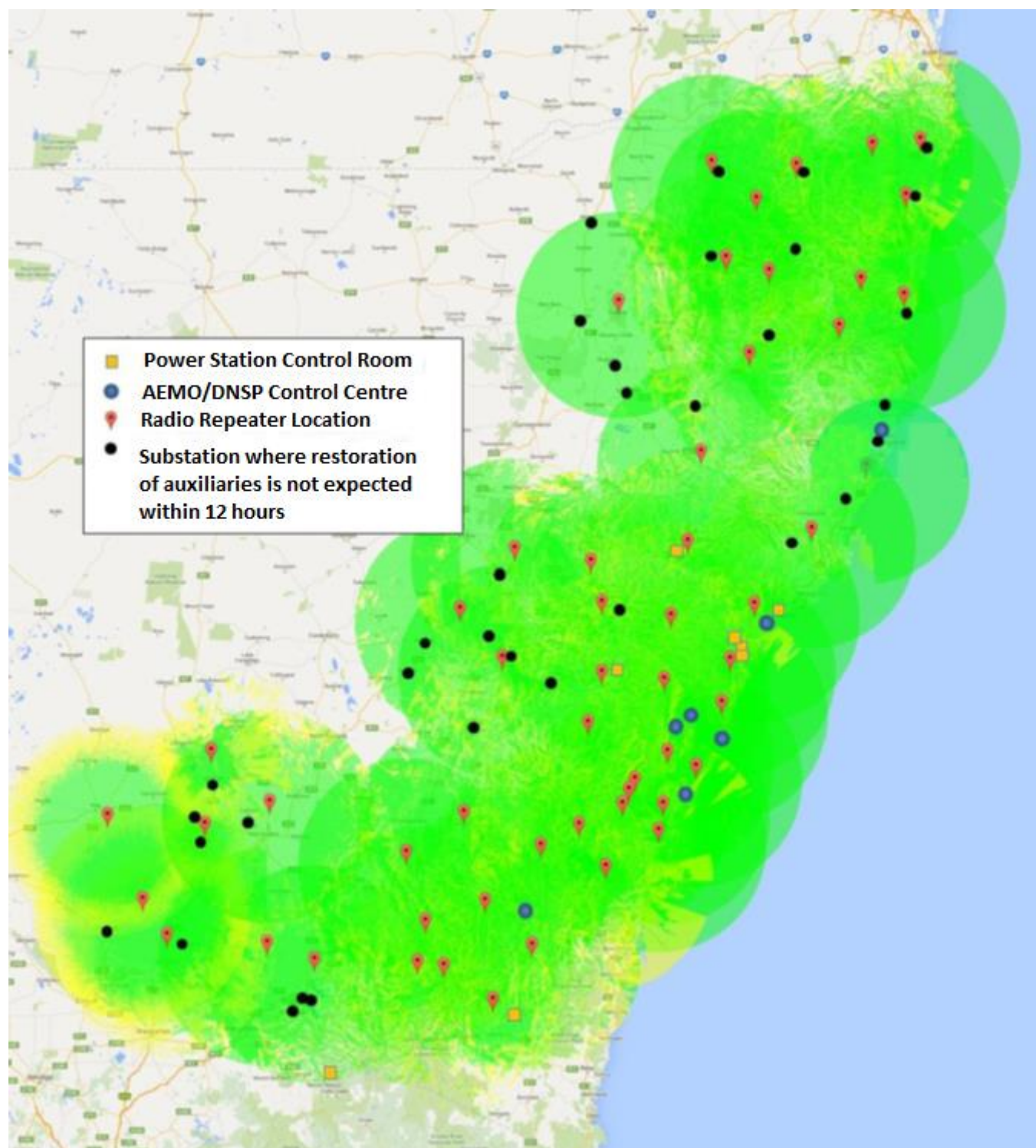
4. Recommendation

The VHF Radio Network is required for providing voice communication channels primarily for a system restart event. It can be used for communications to staff in remote areas with poor coverage from alternative technologies to enable the complete restoration of the NSW loads following a system black.

It is recommended that options be considered to determine if there are benefits in upgrading the operational capacity of the VHF network in the next regulatory period 2018-23.

Attachment 1 - The Existing VHF Radio Network

The following map is based on the assumed restoration progress in accordance with Appendix A of OM666. It should also be noted that the coverage from individual repeaters only been calculated out to a radius of 100km using the parameters contained in the Radio Communications Site Management Book.



Attachment 2 - Risk costs summary

Current Option Assessment - Risk Summary

Project Name: VHF Radio Network Capability

Option Name: 1423 - Base Case

Option Assessment Name: 1423 - 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)
NEM system restart Stage 3 event	1	Busbar	Unplanned Outage - HV (Structure)	\$395.64	Structural Failure	\$395.64	1.00%	\$3.96	\$3.95		\$0.00			\$0.00
				\$395.64		\$395.64		\$3.96	\$3.95		\$0.00			\$0.00

Total VCR Risk: \$3.95

Total ENS Risk: \$0.00