OPTIONS EVALUATION REPORT (OER)

FY24-28 Operation Comms Renewal

OER- N2020 revision 0.0

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Approvals

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Change history

Revision	Date	Amendment
0	09/11/2021	First Issue

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Executive summary

Operational Communications infrastructure forms a critical component of operating and maintaining the transmission network. The systems available provide a crucial link between our remote sites and the operational control room to ensure information and directions are clearly and effectively communicated to address all activities within the network.

Currently deployed operational communications infrastructure is comprised of a comprehensive VHF radio network to cover the state, a PSTN/Copper based telephony network to cover all high voltage transmission stations and a BT telephony system for the control room. All assets have reached the end of their serviceable life and have limited or no manufacturer support. As the TNSP of NSW we have a compliance obligation to facilitate the reliable and secure operation of the network and the rapid restoration from a major system event. To achieve this, a reliable communications system is required to facilitate the coordinated activities of a system restart.

The assessment of the options considered to address the need appears in Table 1, which includes communications alarm systems evaluated as NPV positive, and reaching end of life by 2027/28. A summary of all options considered are detailed below.

Under the Base Case TransGrid continues to operate and maintain (O&M) the existing computer systems as required. This approach will not address the obsolescence and health of the obsolete and unsupported assets.

Option B involves the upgrade of each sub-system to the latest available technologies. The option does not leverage any additional system modifications or improvements.

Option C involves the deployment of a digital VHF network consolidating operational telephony functionality. The option would facilitate the withdrawal of the telephony sub-system within substations.

Option D involves the deployment of VOIP telephony systems and Satellite Phone handsets consolidating the VHF network functionality. The option would facilitate the withdrawal of the VHF network.

Table 1 - Evaluated options

Option	Description	Direct capital cost ($m)	Overheads ($m)	Total capital cost[1] ($m)	Weighted NPV (PV, $m)	Rank
Option B – N2020B	Renew systems to modern technologies	20.38	3.43	23.81	-11.81	3
Option C – N2020C	Renew systems and consolidate functionality	19.34	3.25	22.59	-10.74	2
Option D – N2020D	Renew systems and eliminate VHF	8.76	1.40	10.16	0.59	1

It is the recommendation that Option D – Renew systems and eliminate VHF, be scoped in detail.

[1] Total capital cost is the sum of the direct capital cost and network and corporate overheads. Total capital cost is used in this OER for all analysis.

1. Need/opportunity

Operational Communications infrastructure forms a critical component of operating and maintaining the transmission network. The systems available provide a crucial link between our remote sites and the operational control room to ensure information and directions are clearly and effectively communicated to address all activities within the network.

Currently deployed operational communications infrastructure is comprised of a comprehensive VHF radio network to cover the state, a PSTN/Copper based telephony network to cover all high voltage transmission stations and a BT telephony system for the control room.

All assets have reached the end of their serviceable life with the following attributes:

- Control Room BT System - notifications for end of support in 2026 received
- PSTN/Copper Telephony System - notifications for end of support received from hardware manufacturers, Telstra's conversion to NBN has identified the obsolescence of third party copper connections
- VHF system - operating on obsolete technology that is becoming increasingly difficult to obtain spares

The use of the operational communications infrastructure is a continuing requirement of the network into the foreseeable future.

There is a Need to maintain communications between Network Sites, the SCADA Control Room and third parties such as AEMO, generators and distributors.

Grid Operating Manual OM801 – Operational Communications Facilities highlights the requirements for a direct communications system and a backup communications system for the day-to-day operations of the network. The manual further highlights system requirements to meet emergency response requirements during a major system disturbance.

The System Restart Communication Protocol published by AEMO sets the requirement for operational communications capabilities between various market participants for the purposes of emergency communication capabilities.

As the TNSP of NSW we have an obligation to facilitate the reliable and secure operation of the network and the rapid restoration from a major system event.

The current operational communications deployments throughout the network are unlikely to continue to meet these requirements into Regulatory Control Period (RP3). Due to significant technological changes in communications systems and the integrated nature of the available systems, a wholesale renewal of assets is required to address the manufacturer and technological obsolescence identified.

Table 2 - Identified condition of systems

Asset components	Issues	% of services at site
Control Room BT System	- Component technology obsolescence resulting in a withdrawal of manufacturer support - End of serviceable life	100% of the system
PSTN/Copper Telephony System	- Component technology obsolescence resulting in a lack of spares and no manufacturer support - End of serviceable life	100% of the system
VHF Radio System	- Component technology obsolescence resulting in a lack of spares and no manufacturer support - End of serviceable life	100% of the system

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2. Related needs/opportunities

There are no related needs that would benefit from coordination or consideration.

3. Options

3.1 Base case

The Base Case for this Need is to continue with TransGrid's business as usual operations and maintenance (O&M) for the assets. This approach does not address the deteriorating condition of the telephony and radio systems within the network or the risk cost associated with maintaining aging assets. The risk will likely increase due to:

- The probability of failure increasing as assets move further along their failure curves.
- TransGrid's inability to recover from asset failure in the future due to withdrawn manufacturer support, and depletion of spares availability that would otherwise limit the overall consequence of asset failure.

Key drivers for this risk cost are:

- The majority of assets identified have reached their end of technical life and no manufacturer support as highlighted in previous sections. This therefore increases the likelihood of a hazardous event occurring and decreases TransGrid's ability to mitigate or repair failures.
- Assets have increasing numbers of failure as they progress along their failure curves, increasing the likelihood of a hazardous event occurring.

Increasing maintenance on telephony and radio equipment cannot reduce the probability of failure or reduce risk costs. This is because maintenance of telephony and radio assets is focused on device inspection and functional performance checks only, the conduct of maintenance at a component level is neither feasible nor practicable.

3.2 Options evaluated

Option B — Renew systems to modern technologies [NOSA N2020, OFS N2020B]

This option involves targeted replacements of all identified assets up to 2027/28. The option is based on a targeted approach whereby identified assets are replaced by a modern equivalent utilising the latest technology and with minimal impact to infrastructure.

This option would deliver benefits to consumers and the network only by targeting the probability of failure of targeted assets and improving supportability from manufacturers. This option will not provide additional operational benefits.

This option is planned for deployment across the 2023/24-2027/28 regulatory control period. Targeted assets will be in service for approximately 10 years.

Option C — Renew systems and consolidate functionality [NOSA N2020, OFS N2020C]

This option involves targeted replacements of all identified assets up to 2027/28. The option is based on a consolidated approach whereby substation telephony assets are consolidated by a modern digital VHF network utilising the latest technology and with minimal impact to infrastructure.

This option would deliver the benefits to consumers and the network by targeting the probability of failure of targeted assets. This option will provide additional operational benefits such as reductions in operating costs.

This option is planned for deployment across the 2023/24-2027/28 regulatory control period. Targeted assets will be in service for approximately 10 years.

Option D — Renew systems and eliminate VHF [NOSA N2020, OFS N2020D]

This option involves leveraging modern technologies and capabilities to consolidate what was historically independent functionality. This would see the VHF radio network replaced with digital satellite phones and these integrated into the Operator's telephony system as a dialling point.

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This option would deliver the benefits to consumers and the network by targeting the probability of failure of targeted assets. This option will provide additional operational benefits such as improved capabilities for remote interrogation and withdrawal of the VHF network.

This option is planned for deployment across the 2023/24-2027/28 regulatory control period. Targeted assets will be in service for approximately 10 years.

3.3 Options considered and not progressed

Table 3 – Options not progressed

Option	Reason for not progressing
Upgrade existing systems to latest hardware	This option involves a direct update of systems to latest hardware with no changes in technology, infrastructure or approach. This option cannot address the obsolescence of our PSTN/Copper solution and would render the renewal of the communications architecture as defunct.
Asset Retirement	This can only be achieved by retiring the electricity transmission network, which is not technically or economically feasible. The electricity transmission network will remain an essential component of the National Electricity Market into the foreseeable future as detailed within TransGrid's 2021 TAPR.
Non-network solutions	It is not technically feasible for non-network solutions to provide the functionality of secondary systems assets for protection, control, communications and metering

4. Evaluation

4.1 Commercial evaluation methodology

The economic assessment undertaken for this project includes three scenarios that reflect a central set assumptions based on current information that is most likely to eventuate (central scenario), a set of assumptions that give rise to a lower bound for net benefits (lower bound scenario), and a set of assumptions that give rise to an upper bound on benefits (higher bound scenario).

Assumptions for each scenario are set out in the table below.

Table 4 – Scenario assumptions

Parameter	Central scenario	Lower bound scenario	Higher bound scenario
Discount rate	4.8%	7.37%	2.23%
Capital cost	100%	125%	75%
Operating expenditure benefit	100%	75%	125%
Risk costs benefit	100%	75%	125%
Other benefit	100%	75%	125%
Scenario weighting	**50%**	**25%**	**25%**

Parameters used in this commercial evaluation:

Table 5 - Commercial evaluation parameters

Parameter	Parameter Description	Value used for this evaluation
Discount year	Year that dollar values are discounted to	2020/21
Base year	The year that dollar value outputs are expressed in real terms	2020/21 dollars
Period of analysis	Number of years included in economic analysis with remaining capital value included as terminal value at the end of the analysis period.	10 years
Safety disproportionality	Multiplier of the safety risk cost included in NPV analysis to demonstrate implementation of obligation to reduce safety to ALARP.	Refer to section 4.3 for details.

The capex figures in this OER do not include any real cost escalation.

4.2 Commercial evaluation results

The commercial evaluation of the technically feasible options is set out in Table 6. Details appear in Appendix A.

Table 6 - Commercial evaluation ($ million)

Option	Capital Cost PV	Central scenario NPV	Lower bound scenario NPV	Higher bound scenario NPV	Weighted NPV	Ranking
Option B	18.93	-12.31	-17.12	-5.50	-11.81	3
Option C	18.43	-11.22	-16.38	-4.14	-10.74	2
Option D	8.17	0.11	-4.25	6.42	0.59	1

4.3 ALARP evaluation

TransGrid manages and mitigates bushfire and safety risk to ensure they are below risk tolerance levels or 'As Low As Reasonably Practicable' ('ALARP'), in accordance with the regulation obligations and TransGrid's business risk appetite. The need for these assets is not driven by these risks. There is no quantifiable safety risk reduction by addressing the condition of these assets.

4.4 Preferred option

The preferred option to meet the identified need by 2027/28 is Option D. Option D is the most prudent and economically efficient solution to enable TransGrid to continue meeting its regulatory obligations set out in clause 4.11.1[2] of the NER. This option maximises net economic benefits to all those who produce, consume and transport electricity in the market, and will ensure performance standards applicable to the site's secondary systems continue to remain met.

[2] As per clause 4.6.1(b) of the NER, AEMO must ensure that there are processes in place, which will allow the determination of fault levels for normal operation of the power system and in anticipation of all credible contingency events and protected events that AEMO considers may affect the configuration of the power system, so that AEMO can identify any busbar which could potentially be exposed to a fault level which exceeds the fault current ratings of the circuit breakers associated with that busbar.

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Option D involves an on-site renewal (replacement) of the individually assessed components in an old for new replacement. Efficiencies will be achieved by reusing the existing building, tunnel boards, and the cabling where practicable.

Capital and Operating Expenditure

There is an estimated saving of $300k per annum in ongoing planned routine operational expenditure between the option and the Base Case. This saving is the result of the withdrawal of the VHF network.

Resultant corrective maintenance under the base case strategy is anticipated to result in higher expenditure over the upcoming regulatory period. Delivery of proposed works under Option A will reduce the risk of increasing direct defect response costs.

It has been modelled that under corrective maintenance, those components with no manufacturer support and limited spares could incur significant costs associated with design and preparation, and likely augmentation of linking systems required to move to a different design solution. Such costs would not be present in cases where a like-for-like replacement is feasible.

These operating expenditure benefits have been captured in the economic evaluation.

Regulatory Investment Test

The program and estimate allows for the appropriate Regulatory approvals as required.

5. Optimal Timing

The test for optimal timing of the preferred option has been undertaken. The approach taken is to identify the optimal commissioning year for the preferred option where net benefits (including avoided costs and safety disproportionality tests) of the preferred option exceeds the annualised costs of the option. The commencement year is determined based on the required project disbursement to meet the commissioning year based on the OFS.

The results of optimal timing analysis are:

- Optimal commissioning year: 2027/28
- Commissioning year annual benefit: $6.34 million
- Annualised cost: $1.30 million

The project is expected to commence in the 2023/24-2027/28 Regulatory Period based on the optimal timing.

6. Recommendation

It is the recommendation that Option D – Renew systems and eliminate VHF be scoped in detail.

The total project cost is $10.16 million including $1.00 million to progress the project from DG1 to DG2.

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Appendix A – Option Summaries

Project Description	FY24-28 Operation Comms Renewal		
Option Description	Option B - Renew systems to modern technologies		
Project Summary			
Option Rank	*4*	Investment Assessment Period	*10*
Asset Life	*10*	NPV Year	2020/21
Economic Evaluation			
NPV @ Central Benefit Scenario (PV, $m)	-12.31	Annualised CAPEX @ Central Benefit Scenario ($m)	Annualised Capex - Standard (Business Case) 3.05
NPV @ Lower Bound Scenario (PV, $m)	-17.12	Network Safety Risk Reduction ($m)	Network Safety Risk Reduction 0.00
NPV @ Higher Bound Scenario (PV, $m)	-5.50	ALARP	ALARP Compliant? No
NPV Weighted (PV, $m)	-11.81	Optimal Timing	Optimal timing (Business Case) 2023/24
Cost (Central Scenario)			
Total Capex ($m)	23.81	Cost Capex (PV,$m)	18.93
Terminal Value ($m)	0.00	Terminal Value (PV,$m)	0.00
Risk (Central Scenario)	**Pre**	**Post**	**Benefit**
Reliability (PV,$m)	Reliability Risk (Pre) 0.00	Reliability Risk (Post) 0.00	Pre – Post 0.00
Financial (PV,$m)	Financial Risk (Pre) 0.00	Financial Risk (Post) 0.00	Pre – Post 0.00
Operational/Compliance (PV,$m)	Operational Risk (Pre) 0.00	Operational Risk (Post) 0.00	Pre – Post 0.00
Safety (PV,$m)	Safety Risk (Pre) 0.00	Safety Risk (Post) 0.00	Pre – Post 0.00
Environmental (PV,$m)	Environmental Risk (Pre) 0.00	Environmental Risk (Post) 0.00	Pre – Post 0.00
Reputational ($m)	Reputational Risk (Pre) 0.00	Reputational Risk (Post) 0.00	Pre – Post 0.00
Total Risk (PV,$m)	Total Risk (Pre) 0.00	Total Risk (Post) 0.00	Pre – Post 0.00
OPEX Benefit (PV,$m)			OPEX Benefit 0.00
Other benefit (PV,$m)			Incremental Net Benefit 6.62
Total Benefit (PV,$m)			Business Case Total Benefit 6.62

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Project Description	FY24-28 Operation Comms Renewal		
Option Description	Option C - Renew systems and consolidate functionality (Eliminate OTN)		
Project Summary			
Option Rank	*3*	Investment Assessment Period	*10*
Asset Life	*10*	NPV Year	2020/21
Economic Evaluation			
NPV @ Central Benefit Scenario (PV, $m)	-11.22	Annualised CAPEX @ Central Benefit Scenario ($m)	Annualised Capex - Standard (Business Case) 2.90
NPV @ Lower Bound Scenario (PV, $m)	-16.38	Network Safety Risk Reduction ($m)	Network Safety Risk Reduction 0.00
NPV @ Higher Bound Scenario (PV, $m)	-4.14	ALARP	ALARP Compliant? No
NPV Weighted (PV, $m)	-10.74	Optimal Timing	Optimal timing (Business Case) 2023/24
Cost (Central Scenario)			
Total Capex ($m)	22.59	Cost Capex (PV,$m)	18.43
Terminal Value ($m)	0.00	Terminal Value (PV,$m)	0.00
Risk (Central Scenario)	**Pre**	**Post**	**Benefit**
Reliability (PV,$m)	Reliability Risk (Pre) 0.00	Reliability Risk (Post) 0.00	Pre – Post 0.00
Financial (PV,$m)	Financial Risk (Pre) 0.00	Financial Risk (Post) 0.00	Pre – Post 0.00
Operational/Compliance (PV,$m)	Operational Risk (Pre) 0.00	Operational Risk (Post) 0.00	Pre – Post 0.00
Safety (PV,$m)	Safety Risk (Pre) 0.00	Safety Risk (Post) 0.00	Pre – Post 0.00
Environmental (PV,$m)	Environmental Risk (Pre) 0.00	Environmental Risk (Post) 0.00	Pre – Post 0.00
Reputational ($m)	Reputational Risk (Pre) 0.00	Reputational Risk (Post) 0.00	Pre – Post 0.00
Total Risk (PV,$m)	Total Risk (Pre) 0.00	Total Risk (Post) 0.00	Pre – Post 0.00
OPEX Benefit (PV,$m)			OPEX Benefit 0.00
Other benefit (PV,$m)			Incremental Net Benefit 7.20
Total Benefit (PV,$m)			Business Case Total Benefit 7.20

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Project Description	FY24-28 Operation Comms Renewal		
Option Description	Option D - Renew systems and eliminate VHF		
Project Summary			
Option Rank	*1*	Investment Assessment Period	*10*
Asset Life	*10*	NPV Year	2020/21
Economic Evaluation			
NPV @ Central Benefit Scenario (PV, $m)	0.11	Annualised CAPEX @ Central Benefit Scenario ($m)	Annualised Capex - Standard (Business Case) 1.30
NPV @ Lower Bound Scenario (PV, $m)	-4.25	Network Safety Risk Reduction ($m)	Network Safety Risk Reduction 0.00
NPV @ Higher Bound Scenario (PV, $m)	6.42	ALARP	ALARP Compliant? No
NPV Weighted (PV, $m)	0.59	Optimal Timing	Optimal timing (Business Case) 2023/24
Cost (Central Scenario)			
Total Capex ($m)	10.16	Cost Capex (PV,$m)	8.17
Terminal Value ($m)	0.00	Terminal Value (PV,$m)	0.00
Risk (Central Scenario)	**Pre**	**Post**	**Benefit**
Reliability (PV,$m)	Reliability Risk (Pre) 0.00	Reliability Risk (Post) 0.00	Pre – Post 0.00
Financial (PV,$m)	Financial Risk (Pre) 0.00	Financial Risk (Post) 0.00	Pre – Post 0.00
Operational/Compliance (PV,$m)	Operational Risk (Pre) 0.00	Operational Risk (Post) 0.00	Pre – Post 0.00
Safety (PV,$m)	Safety Risk (Pre) 0.00	Safety Risk (Post) 0.00	Pre – Post 0.00
Environmental (PV,$m)	Environmental Risk (Pre) 0.00	Environmental Risk (Post) 0.00	Pre – Post 0.00
Reputational ($m)	Reputational Risk (Pre) 0.00	Reputational Risk (Post) 0.00	Pre – Post 0.00
Total Risk (PV,$m)	Total Risk (Pre) 0.00	Total Risk (Post) 0.00	Pre – Post 0.00
OPEX Benefit (PV,$m)			OPEX Benefit 1.65
Other benefit (PV,$m)			Incremental Net Benefit 6.62
Total Benefit (PV,$m)			Business Case Total Benefit 8.27

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