Options Evaluation Report (OER)

Line 94U - Refurb
OER- **N2582** revision **3.0**

Ellipse project no(s):

TRIM file: [TRIM No]

Project reason: Reliability - To meet overall network reliability requirements

Project category: Prescribed - Replacement

Approvals

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Change history

Revision	Date	Amendment
0	07/10/2021	Initial Issue
1	14/112021	Minor Formatting
2	12/10/2022	Update analysis and evaluation including: • Update cost and risk with FY22 values • Update on discount rates • Amendment of environmental disproportionality factor • Removal of reputational risk
3	31/10/2022	Revision number updating

Executive summary

Line 94U is a 30.4 km 132 kV wood pole line between Parkes and Forbes. It was commissioned in 1986 as Line 94K between Wellington and Forbes. It was cut into Parkes Substation in 1992. The northern section, Wellington to Parkes retained 94K line number whilst the southern section, Parkes to Forbes was given the new number 94U. When 94H Manildra to Parks was built in 2011, the 94U Parkes outlet was rebuilt. The first seven (7) structures out of Parkes are now concrete pole. There are 138 structures between those concrete poles and Forbes.

Detailed analysis of asset condition information indicates that the line has several condition issues which require refurbishment to address its health and maintain appropriate risk levels across the network. These issues primarily concern the wood pole structures which are approaching an end of life condition. This is in spite of the relatively low age, having experienced an accelerated deterioration in asset condition due to use of early vintage Pressure Impregnated (PI) poles on the line.

Given the extent of condition issues across the wood pole structures on Line 94U, it is considered that the entire line is approaching the end of its serviceable life. In 2025, the asset will have reached 39 years of age. While this is a relatively low age, the use of early vintage Pressure Impregnated (PI) poles has contributed to an accelerated deterioration in asset condition.

The total number of structures expected to be replaced is 138.

The main drivers of the need to remediate these issues are:

- Manage network safety risk levels “As-Low-As Reasonably-Practicable” in accordance with the regulation obligations and TransGrid’s business risk appetite. Under the Electricity Supply (Safety and Network Management) Regulation 2014 Section 5 ‘A network operator must take all reasonable steps to ensure that the design, construction, commissioning, operation and decommissioning of its network (or any part of its network) is safe’; and
- Provide economic benefit to consumers through reduction in safety and bushfire risks.

Table 1 - Evaluated options

Option	Description	Direct capital cost ($m)	Network and corporate overheads ($m)	Total capital cost[1] ($m)	Weighted NPV (PV, $m)	Rank
Option A	Replace known wood pole structures exhibiting ground line degradation with steel or concrete pole structures only.	5.09	0.49	5.58	52.82	2
Option B	Replace all wood pole structures with steel or concrete poles.	18.71	1.26	19.97	102.41	1

[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.

The preferred option is Option B, as it has the highest weighted NPV result of the technically and commercially feasible options which were considered. It is therefore recommended that Option B be scoped in detail and progressed from DG1 to DG2.[2] In consideration of the delivery requirements and the economic benefit NPV analysis for the need, its optimal timing is 2025/2026.

[2] DG stands for 'decision gate' that forms a part of TransGrids investment decision process.

1. Need/opportunity

Line 94U, between Parkes and Forbes, is a single circuit section. The line has widespread condition issues on various line components, all of which increase the probability of asset failure. These issues present a bushfire and safety risk which Transgrid is obligated to manage.

The most significant element of concern is the condition of the wood pole structures on the line. Despite only being built in 1986, Line 94U has seen higher than typical wood pole deterioration for its age. This is due to the use of early vintage Pressure Impregnated (PI) poles. Line 94K Wellington to Parkes was built under the same contract and underwent a pole replacement program in 2021FY, replacing 141 structures (28% of the line). Before project completion a structure fall over event on one of the deteriorated structures occurred in December 2020.

Detailed analysis of asset condition information has identified that 23 structures, or 16% of the line are currently having deteriorating condition issues. A further 9 structures will have decayed to the point of requiring replacement by 2028, based on the average defect rates of structures assessed to require additional monitoring due to their condition (also known as “conditionally serviceable”) over the past 10 years on this line.

Flying angle and tension structures with the structure type LSP and LSQ have the insulators connected to the pole via eyebolts. These bolts can “pull through” defected timber causing a conductor drop. There are seven (7) of these on 94U.

Given the extent of condition issues across the wood pole structures on Line 94U, it is considered that the entire line is approaching the end of its serviceable life. In 2025, the asset will have reached 39 years of age. While this is a relatively low age, the use of early vintage Pressure Impregnated (PI) poles has contributed to an accelerated deterioration in asset condition.

For the 94K project, additional defective poles were found during the project that were not previously identified. The rapid deterioration from “not deteriorated” to condemned happened over just a couple of years shows poor performance of poles installed under that contract (which included 94U). Accordingly pole replacement options for the entire line is to be considered.

Total number of structure expected to be replaced is 138.

There is a need to remediate condition issues in order to:

- Manage network safety risk levels “As-Low-As Reasonably-Practicable in accordance with the regulation obligations and Transgrid’s business risk appetite. Under the Electricity Supply (Safety and Network Management) Regulation 2014 Section 5 ‘A network operator must take all reasonable steps to ensure that the design, construction, commissioning, operation and decommissioning of its network (or any part of its network) is safe.’
- Provide economic benefit to the consumers through safety and bushfire risks reductions. The direct impact of asset failure can result in a conductor drop event with potential fire ignition and/or safety hazard consequences to the general public, as evaluated in the associated modelling.

If the condition issues on the line are not addressed in sufficient time, then the asset will operate with increasing risk of failure as it continues to deteriorate. The level of reactive corrective maintenance needed to keep the line operating within required standards may also increase, particularly when asset failures ultimately occur.

Consequently, the proposed project has an economic benefits need, and addressed this need will provide avoidable cost savings from unserved energy penalties, reduced in bushfire and safety risk, and maintenance costs that would otherwise occur without refurbishment.

2. Related needs/opportunities

Nil

3. Options

The base case for this assessment is a ‘do nothing’ scenario, where the assets are left in service until they fail and require replacement. In addition to the base case, two other options have been considered. The Option A involves a targeted replacement of wood pole structures that experience the greatest deterioration with steel or concrete poles. Option B involves rebuilding of the entire line.

3.1. Base case

It is noted that a ‘run to fail’ scenario, where the issues are addressed through increased asset monitoring and preventative maintenance tasks, is not a valid base case for this Need. The condition issues on the asset have already been identified through maintenance inspections, and increasing the frequency of inspections to monitor the condition issues will not necessarily address them.

The base case will instead be defined as a ‘do nothing’ scenario, where the assets are left in service until they fail and require replacement. The replacement cost has been captured in the NPV assessment under financial risk cost.

3.2. Options evaluated

Option A — Replace known wood pole structures exhibiting ground line degradation with steel or concrete pole structures only. [NOSA N2582, OFS N2582A]

This option is a targeted replacement and address the known wood pole structures exhibiting ground line degradation with steel or concrete pole including the Flying angle and tension structures with the structure type LSP and LSQ have the insulators connected to the pole via eyebolts. These bolts can “pull through” defected timber causing a conductor drop.

Number of structures to be replaced for the option: 38

It is estimated that this option would cost $5.58 million ± 25% ($2021-22). This option is expected to be completed within the 2024 – 2028 regulatory period, and is expected to be completed within 23 months following DG1.

Option B — Replace all wood pole structures with steel or concrete poles. [NOSA N2582, OFS N2582B]

Given the extent of condition issues across the wood pole structures on Line 94U, it is considered that the entire line is approaching the end of its serviceable life. In 2025, the asset will have reached 39 years of age. While this is a relatively low age, the use of early vintage Pressure Impregnated (PI) poles has contributed to an accelerated deterioration in asset condition.

Number of structures to be replaced for the option: 138.

It is estimated that this option would cost $19.97 million ± 25% ($2021-22). This option is expected to be completed within the 2024 – 2028 regulatory period, and is expected to be completed within 27 months following DG1.

3.3. Options considered and not progressed

The following options were considered but not progressed:

Table 2: Options considered and not progressed

Option	Reason for not progressing
Increased inspections	The condition issues have already been identified and cannot be rectified through increased inspections, and therefore is not technically feasible.
Elimination of all associated risk	This can only be achieved through retirement and decommissioning of the associated assets which is not technically feasible.
Non-network solutions	TransGrid does not consider non-network options to be commercially and technically feasible to assist with meeting the identified need, as non-network options will not mitigate the environment (bushfire) and safety posed as a result of corrosion-related asset deterioration.

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 3 Scenario parameters

Parameter	Central scenario	Lower bound scenario	Higher bound scenario
Discount rate	5.5%	7.5%	2.3%
Capital cost	100%	125%	75%
Risk cost benefits	100%	75%	125%
Scenario weighting	**50%**	**25%**	**25%**

Parameters used in this commercial evaluation are set out in the table below:

Table 4 Key parameters

Parameter	Parameter Description	Value used for this evaluation
Discount year	Year that dollar values are discounted to	2021/2022
Base year	The year that dollar value outputs are expressed in real terms	2021/2022 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.	25 Years
Expected asset life	Period of depreciation of the asset	50 years
ALARP disproportionality (repex only)	Multiplier of the environmental and safety related risk cost included in NPV analysis to demonstrate implementation of obligation to reduce 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 5. Details appear in Appendix A.

Table 5 - Commercial evaluation (PV, $ million)

Option	Capital Cost PV	Central scenario NPV	Lower bound scenario NPV	Higher bound scenario NPV	Weighted NPV	Ranking
Option A	4.76	43.60	20.42	103.65	52.82	2
Option B	16.99	82.81	33.46	210.57	102.41	1

4.3. ALARP evaluation (REPEX Only)

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. Under the Electricity Supply (Safety and Network Management) Regulation 2014 Section 5 'A network operator must take all reasonable steps to ensure that the design, construction, commissioning, operation and decommissioning of its network (or any part of its network) is safe.' TransGrid maintains an Electricity Network Safety Management System (ENSMS) to meet this obligation.[3]

In its Network Risk Assessment Methodology, under the ALARP test with the application of a gross disproportionate factor[4], the weighted benefits are expected to exceed the cost. TransGrid's analysis

[3] TransGrid's ENSMS follows the International Organization for Standardization's ISO31000 risk management framework which requires following hierarchy of hazard mitigation approach

[4] The values of the disproportionality factors were determined through a review of practises and legal interpretations across multiple industries, with particular reference to the works of the UK Health and Safety Executive. The methodology used to determine the disproportionality factors in this document is in line

concludes that the costs are less than the weighted benefits from mitigating bushfire and safety risks. The proposed investment will enable TransGrid to continue to manage and operate this part of the network to a safety and risk mitigation level of ALARP.

Evaluation of the above options has been completed in accordance with As Low As Reasonably Practicable (ALARP) obligations. The Network Safety Risk Reduction is calculated as 1 x Bushfire Risk Reduction (Non-Safety Bushfire Risk) + 6 x Safety Risk Reduction (Public Safety and Bushfire Safety) + 0.1 x Reliability Risk Reduction.

Results of the ALARP evaluation are set out in Table 6.

Table 6 - Reasonably practicable test ($ million)

Option	Network Safety Risk Reduction	Annualised Capex	Reasonably Practicable?[5]
A	0.14	0.33	N
B	0.41	1.18	N

The ALARP (economic) evaluation result is that neither option meets the ALARP criteria.

4.4. Preferred option

The preferred option is Option B, as it has the highest weighted NPV result of all the technically and commercially feasible options considered as part of this need. The optimal delivery date for this option is 2025/2026 based on an optimal timing analysis (see Section 5).

Capital and Operating Expenditure

The required capex expenditure is $19.97 million ($2021-22).

Regulatory Investment Test

A regulatory investment test for transmission (RIT-T) is required at this stage, as the estimated capital cost for the preferred option is above the threshold of $7 million.

5. Optimal Timing

In consideration of the delivery requirements and the economic benefit NPV analysis for the need, its optimal timing is 2025/2026.

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 risk costs and safety disproportionality tests) of the preferred option exceeds the annualised costs of the option. The optimal timing assessment considers the delivery requirements of the project and the estimated delivery timeline of three years in the OFS.

The commencement year is determined based on the required project disbursement to meet the commissioning year based on the OFS.

with the principles and examples presented in the AER Replacement Planning Guidelines and is consistent with TransGrid's Revised Revenue Proposal 2023/24- 2027/28.

[5] Reasonably practicable is defined as whether the annualised CAPEX is less than the Network Safety Risk Reduction.

The results of optimal timing analysis is:

- Optimal commissioning year: 2025/26
- Commissioning year annual benefit: $1.53 million
- Annualised cost: $1.18 million

Based on the optimal timing, the project is expected to commence in the 2023-2028 Regulatory Period.

6. Recommendation

The preferred option is Option B, as it has the highest weighted NPV result of all the technically and commercially feasible options considered as part of this need.

It is therefore recommended that this option be scoped in detail, so that it can be progressed from DG1 to DG2. Total project cost is $19.97 million ($2021-22) including an amount of $1.0 million to progress the project from DG1 to DG2.

Appendix A – Option Summaries[6]

Project Description	94U refurbishment		
Option Description	Option A - Replace known wood pole structures exhibiting ground line degradation with steel or concrete pole structures only.		
Project Summary			
Option Rank	*2*	Investment Assessment Period	*25*
Asset Life	*50*	NPV Year	2022
Economic Evaluation			
NPV @ Central Benefit Scenario (PV, $m)	43.60	Annualised CAPEX @ Central Benefit Scenario ($m)	Annualised Capex - Standard (Business Case) 0.33
NPV @ Lower Bound Scenario (PV, $m)	20.42	Network Safety Risk Reduction ($m)	Network Safety Risk Reduction 0.14
NPV @ Higher Bound Scenario (PV, $m)	103.65	ALARP	ALARP Compliant? No
NPV Weighted (PV, $m)	52.82	Optimal Timing	Optimal timing (Business Case) 2025
Cost (Central Scenario)			
Direct Capex ($m)		Network and Corporate Overheads ($m)	
Total Capex ($m)	5.58	Cost Capex (PV,$m)	4.76
Terminal Value ($m)	2.79	Terminal Value (PV,$m)	0.62
Risk (Central Scenario)	**Pre**	**Post**	**Benefit**
Reliability (PV,$m)	Reliability Risk (Pre) 8.20	Reliability Risk (Post) 4.18	Pre – Post 4.02
Financial (PV,$m)	Financial Risk (Pre) 64.83	Financial Risk (Post) 33.16	Pre – Post 31.67
Operational/Compliance (PV,$m)	Operational Risk (Pre) 0.00	Operational Risk (Post) 0.00	Pre – Post 0.00
Safety (PV,$m)	Safety Risk (Pre) 0.30	Safety Risk (Post) 0.30	Pre – Post 0.00
Environmental (PV,$m)	Environmental Risk (Pre) 27.49	Environmental Risk (Post) 15.43	Pre – Post 12.06
Reputational ($m)	Reputational Risk (Pre) 0.00	Reputational Risk (Post) 0.00	Pre – Post 0.00
Total Risk (PV,$m)	Total Risk (Pre) 100.81	Total Risk (Post) 53.07	Pre – Post 47.74
OPEX Benefit (PV,$m)			OPEX Benefit 0.00
Other benefit (PV,$m)			Incremental Net Benefit 0.00
Total Benefit (PV,$m)			Business Case Total Benefit 47.74

Commissioning year annual benefit ($k): 538.51

[6] Figures may not add due to rounding.

Project Description	94U refurbishment		
Option Description	Option B - Replace all wood pole structures with steel or concrete poles.		
Project Summary			
Option Rank	*1*	Investment Assessment Period	*25*
Asset Life	*50*	NPV Year	2022
Economic Evaluation			
NPV @ Central Benefit Scenario (PV, $m)	82.81	Annualised CAPEX @ Central Benefit Scenario ($m)	Annualised Capex - Standard (Business Case) 1.18
NPV @ Lower Bound Scenario (PV, $m)	33.46	Network Safety Risk Reduction ($m)	Network Safety Risk Reduction 0.41
NPV @ Higher Bound Scenario (PV, $m)	210.57	ALARP	ALARP Compliant? No
NPV Weighted (PV, $m)	102.41	Optimal Timing	Optimal timing (Business Case) 2026
Cost (Central Scenario)			
Direct Capex ($m)		Network and Corporate Overheads ($m)	
Total Capex ($m)	19.97	Cost Capex (PV,$m)	16.99
Terminal Value ($m)	10.39	Terminal Value (PV,$m)	2.32
Risk (Central Scenario)	**Pre**	**Post**	**Benefit**
Reliability (PV,$m)	Reliability Risk (Pre) 8.20	Reliability Risk (Post) 0.27	Pre – Post 7.93
Financial (PV,$m)	Financial Risk (Pre) 64.83	Financial Risk (Post) 2.19	Pre – Post 62.64
Operational/Compliance (PV,$m)	Operational Risk (Pre) 0.00	Operational Risk (Post) 0.00	Pre – Post 0.00
Safety (PV,$m)	Safety Risk (Pre) 0.30	Safety Risk (Post) 0.00	Pre – Post 0.30
Environmental (PV,$m)	Environmental Risk (Pre) 27.49	Environmental Risk (Post) 0.87	Pre – Post 26.62
Reputational ($m)	Reputational Risk (Pre) 0.00	Reputational Risk (Post) 0.00	Pre – Post 0.00
Total Risk (PV,$m)	Total Risk (Pre) 100.81	Total Risk (Post) 3.33	Pre – Post 97.48
OPEX Benefit (PV,$m)			OPEX Benefit 0.00
Other benefit (PV,$m)			Incremental Net Benefit 0.00
Total Benefit (PV,$m)			Business Case Total Benefit 97.48

Commissioning year annual benefit ($k): 1530.03