

OPTIONS EVALUATION REPORT (OER)



Line 20 330kV Transmission Line Renewal

OER- 000000001427 revision 1.0

Ellipse project no.: P0008208

TRIM file: [TRIM No]

Project reason: Capability - Asset Replacement for end of life condition

Project category: Prescribed - Replacement

Approvals

Author	Edward Luk	Transmission Lines and Cables Analyst
Endorsed	Steve Stavropoulos	Transmission Lines and Cables Asset Manager
	Azil Khan	Investment Analysis Manager
Approved	Lance Wee	Manager/Asset Strategy
Date submitted for approval	7 December 2016	

Change history

Revision	Date	Amendment
0	21 October 2016	Initial issue
1	7 December 2016	Update to format

1. Need/opportunity

Line 20 is a single circuit steel tower 330kV transmission line between Sydney North and Sydney West 330kV Substations, with a route length of 33.2 km and a total of 98 structures. The transmission line is a key link within the Sydney metro area, passing through urban areas of Sydney.

Field Services conducted a desktop condition assessment of the line in March 2016 based on intimate field knowledge and information captured during routine inspections identifying a number of corrosion related issues which require rectification in the short-medium term to ensure that the asset remains operational in the longer term.

This transmission line falls within a zone of low¹ steel corrosion.

2. Related Needs/opportunities

> Need 1556 – TL Low Spans Stage 2. Consideration should be given to combining the works in this Need.

3. Options

All dollar values in this document are expressed in un-escalated 2016/17 dollars.

Base Case

The condition assessment undertaken has identified existing issues with the line involving insulators which require rectification. A summary of these can be found in Need/Opportunity Statement (NOS) [NS 1427](#).

Under a Base Case 'run-to-fail' option, the associated risk cost from the issues identified in Table 1 is \$0.86m per annum. A breakdown of the Base Case risk cost by category is shown in Table 1.

Table 1 – Base Case risk cost by category (\$ million)

Risk Category	Annual Risk Cost
Reliability (System)	0
Financial	0.01
Operational/Compliance	0
People (Safety)	0.21
Environment	0.64
Reputation	0
Total	0.86

It can be seen from Table 1 that the category with the highest risk cost is 'environment', mainly due to the significant consequences of a bushfire event resulting from conductor drop. The other significant contributor to the overall risk cost is the 'people (safety)' category, again mostly due to the consequences of conductor drop failure.

The risk cost per kilometre of line is \$0.026m per annum.

¹ Steel corrosion rate as defined in AS 4312 – Atmospheric corrosivity zones in Australia

Option A — Line Refurbishment [[OFR 1427A](#), [OFS 1427A](#)]

This option involves the refurbishment of Line 20 via the replacement of components which have reached end of life due to corrosion. The scope of this option is summarised in Table 2.

Table 2 – Transmission Line 20 Option A scope of works

Issue	Qty	Remediation
Corrosion of insulators – suspension strings	203 insulator strings	> Replacement with composite longrod insulators

It is estimated that the capital expenditure associated with the refurbishment outlined in this option is \$0.34m ±25%. Details can be found in Section 6 of Option Feasibility Study (OFS) [OFS 1427A](#).

Following the refurbishment under this option, the risk cost associated with the remediated line is \$0.01m per annum. A breakdown of the Option A risk cost by category is shown in Table 3.

Table 3 – Option A Risk cost by category (million \$)

Risk Category	Annual Risk Cost
Reliability (System)	0
Financial	0
Operational/Compliance	0
People (Safety)	0
Environment	0.01
Reputation	0
Total	0.01

The total projected risk reduction as a result of implementing Option A is \$0.85m per annum. It can be seen from Table 3 that the largest components of the reduction are in the ‘environment’ and ‘people (safety)’ categories, due to the reduced likelihood of conductor drop failure.

The total projected risk reduction per kilometre of line is \$0.026m per annum.

Both the Base Case option and Option A detailed above are considered to be technically feasible².

4. Evaluation

4.1 Commercial evaluation

The commercial evaluation of the technically feasible options is set out in Table 4. Details of the Net Present Value (NPV) calculation for Option A are provided in Attachment 1.

² An option is technically feasible if TransGrid reasonably considers that there is a high likelihood that the option, if developed, will provide the relevant service while complying with all relevant laws.

Table 4 — Commercial evaluation (\$ million)

Option	Description	Total capex	Annual opex	Annual post project risk cost	Economic NPV @10%	Financial NPV @10%	Rank
Base Case	Run-to-fail	N/A	N/A	0.86	N/A	N/A	2
A	Line refurbishment	0.34	-	0.01	5.68	5.68	1

The commercial evaluation is based on:

- > A 10% discount rate
- > A life of the investment of 20 years and a corresponding residual/terminal value

Discount rate sensitivities based on TransGrid's current AER-determined pre-tax real regulatory Weighted Average Cost of Capital (WACC) of 6.75% and 13% appear in Table 5.

Table 5 — Discount rate sensitivities (\$ million)

Option	Description	Economic NPV @13%	Economic NPV @6.75%
A	Line refurbishment	4.40	7.74

4.2 SFAIRP/ALARP evaluation

In the context of the Network Asset Risk Assessment Methodology, the SFAIRP (So Far As Is Reasonably Practicable)/ALARP (As Low As Reasonably Practical) principle is applicable to the following Key Hazardous Events:

- > Conductor drop

Options to reduce the network safety risk as per the risk treatment hierarchy have been considered in other lifecycle stages of the asset, and it has been determined that no reasonably practicable options exist to reduce the risk further than those capital investment options listed in Table 6.

Evaluation of the proposed options has been completed against the SFAIRP (So Far As Is Reasonably Practicable)/ALARP (As Low As Reasonably Practical) obligation, as required by the Electricity Supply (Safety and Network Management) Regulation 2014 and the Work Health and Safety Act 2011. The Key Hazardous Events and the disproportionality multipliers considered in the evaluation are as follows:

- > Conductor drop – 6 times the environment (bushfire) risk, 6 times the safety risk and 10% of the reliability risk (applicable to safety)

Table 6 – Feasible options (\$ thousand)

Option	Description	CAPEX	Expected Life	Annualised CAPEX
Base	Run-to-fail	N/A	N/A	N/A
A	Line refurbishment	340	20 years	17

Table 7 – Annual risk calculations (\$ thousand)

Option	Annual Residual Risk			Annual Risk Savings		
	Safety Risk	Reliability Risk	Bushfire Risk	Safety Risk	Reliability Risk	Bushfire Risk
Base	212	0	637	N/A	N/A	N/A
A	3	0	8	210	0	629

Table 8 – Reasonably practicable test (\$ thousand)

Option	Network Safety Risk Reduction ³	Annualised CAPEX	Reasonably practicable ⁴ ?
A	5,032	17	Yes

From the above evaluation, it is considered that the line refurbishment under Option A is reasonably practicable.

4.3 Preferred option

From the SFAIRP/ALARP evaluation, it is considered that Option A is reasonably practicable and in order to satisfy the organisation's SFAIRP/ALARP obligations, is required to be undertaken. Option A is also considered to be commercially viable (as per the commercial evaluation), and it is proposed that detailed scoping be undertaken.

Capital and operating expenditure

The estimated capital expenditure associated with the refurbishment outlined in this option is \$0.34m ±25%. The vast majority of this expenditure is proposed to be carried out in 2019-2020.

Should the Option A (Line Refurbishment) works not occur by the Need date, an increase in corrective maintenance and subsequent operating expenditure is expected.

Regulatory Investment Test

No Regulatory Investment Test for Transmission (RIT-T) analysis is required as the works are condition based.

5. Recommendation

From the above ALARP evaluation in accordance with the regulatory requirements, and the commercial and technical evaluation of the available options, it is recommended that detailed scoping for the refurbishment of Line 20 as outlined under Option A is undertaken.

³ The Network Safety Risk Reduction is calculated as 6 x Bushfire Risk Reduction + 6 x Safety Risk Reduction + 0.1 x Reliability Risk Reduction

⁴ Reasonably practicable is defined as whether the annualised CAPEX is less than the Network Safety Risk Reduction

Attachment 1 – Commercial evaluation report

Option A NPV calculation

Project_Option Name		Line 20 Refurbishment			
1. Financial Evaluation (excludes VCR benefits)					
NPV @ standard discount rate	10.00%	\$5.68m	NPV / Capital (Ratio)	16.71	
NPV @ upper bound rate	13.00%	\$4.39m	Pay Back Period (Yrs)	Not measurable	
NPV @ lower bound rate (WACC)	6.75%	\$7.74m	IRR%	220.61%	
2. Economic Evaluation (includes VCR benefits but excludes tax benefits from non-cash transactions, ENS penalty and overall tax cost)					
NPV @ standard discount rate	10.00%	\$5.68m	NPV / Capital (Ratio)	-2.84	
NPV @ upper bound rate	13.00%	\$4.40m	Pay Back Period (Yrs)	Not measurable	
NPV @ lower bound rate (WACC)	6.75%	\$7.74m	IRR%	220.66%	
Benefits					
Risk cost	As Is	To Be	Benefit	VCR Benefit	\$0.00m
Systems (reliability)	\$0.00m	\$0.00m	\$0.00m	ENS Penalty	\$0.00m
Financial	\$0.01m	\$0.00m	\$0.01m	All other risk benefits	\$0.85m
Operational/compliance	\$0.00m	\$0.00m	\$0.00m	Total Risk benefits	\$0.85m
People (safety)	\$0.21m	\$0.00m	\$0.21m	Benefits in the financial NPV*	\$0.85m
Environment	\$0.64m	\$0.01m	\$0.63m	*excludes VCR benefits	
Reputation	\$0.00m	\$0.00m	\$0.00m	Benefits in the economic NPV**	\$0.85m
Total Risk benefits	\$0.86m	\$0.01m	\$0.85m	**excludes ENS penalty	
Cost savings and other benefits			\$0.00m		
Total Benefits			\$0.85m		
Other Financial Drivers					
Incremental opex cost pa (no depreciation)			\$0.00m	Write-off cost	\$0.00m
Capital - initial \$m			-\$0.34m	Major Asset Life (Yrs)	20.00 Yrs
Residual Value - initial investment			\$0.02m	Re-investment capital	\$0.00m
Capitalisation period			2.00 Yrs	Start of the re-investment period	0.00 Yrs