

# OPTIONS EVALUATION REPORT (OER)

Line 90 330kV Transmission Line Renewal

OER 000000001347 revision 2.0



**Ellipse project description: P0007961**

**TRIM file: [TRIM No]**

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

**Project category:** Prescribed - Asset Renewal Strategies

## Approvals

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<b>Approved</b>	Lance Wee	Manager/Asset Strategy
<b>Date submitted for approval</b>	25 October 2016	

## Change History

Revision	Date	Amendment
0	17 June 2016	Initial Issue
1	15 September 2016	Revised for Updated Risk Cost
2	25 October 2016	Revised for New SFAIRP/ALARP Methodology

## 1. Need/opportunity

Line 90 is a steel tower 330kV transmission line between Eraring and Newcastle 330kV substations, with a route length of 21km. The transmission line is a key link between the Central Coast generators and the Newcastle region. The single circuit section of the transmission line between Structure 98 and Newcastle Substation, a route length of 11km, was constructed in 1959 and 1964, and consists of 28 structures. The transmission line mainly traverses through semi-urban and forested areas. Note this document refers to the single circuit section of the line only.

Condition assessment [NACA-000000001347](#) performed in March 2016 has identified a number of corrosion related issues with Line 90 which require rectification in the short – medium term (within the 2018-2023 Regulatory Control Period) to ensure that asset risk levels remain within an acceptable level in the longer term.

## 2. Related needs/opportunities

No related needs/opportunities have been identified.

## 3. Options

### Base Case — Run-To-Fail

Condition assessment [NACA-000000001347](#) has identified existing issues with the line which require rectification. A summary of these can be found in Needs Statement [NS-000000001347](#).

Under a base case 'run-to-fail' option, the associated risk cost from the issues identified in Table 1 is \$0.707 million 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**

Risk Category	Annual Risk Cost (\$m)
Reliability (System)	\$0.002
Financial	\$0.021
Operational/Compliance	\$0.000
People (Safety)	\$0.027
Environment	\$0.656
Reputation	\$0.001
<b>Total</b>	<b>\$0.707</b>

It can be seen from Table 1 that the category with the highest risk cost is 'environment', mainly due to the considerable consequences of a bushfire event resulting from conductor drop. Other considerable contributors to the overall risk cost are the 'people (safety)' and 'financial' categories, again mostly due to the consequences of conductor drop failure.

The risk cost per kilometre of line is \$0.064 million per annum.

### Option A — Line Refurbishment ([OFR-000000001347A](#), [OFS-000000001347A](#))

This option involves the refurbishment of Line 90 including treatment of corrosion to tower steelwork which could lead to asset failure and 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 90 Option A Scope of Works**

Issue	Qty	Remediation
Ground line corrosion of steel at footing	6 towers	Abrasive blast cleaning of steelwork to remove any corrosion product, application of Zinga paint and concrete encasement to prevent future corrosion
Buried concrete foundations	2 towers	Dig out tower legs, abrasive blast cleaning of steelwork to remove any corrosion product, application of Zinga paint and establishment of drainage channel
Corrosion of tower fasteners	6 towers	Replacement of fasteners Assume 3% of fasteners per tower
Insulator pin corrosion – suspension insulators	6 insulator strings	Replacement with composite longrod insulators
Insulator pin corrosion – tension insulators	96 insulators strings	Replacement with composite longrod insulators Replacement of tension hot and cold end fittings

It is estimated that the capital expenditure associated with the refurbishment outlined in this option is \$1.32 million  $\pm 25\%$  in 2016-2017 Australian dollars. Details can be found in Section 6 of [OFS-000000001347A](#).

Following the refurbishment under this option, the risk cost associated with the remediated line is \$0.107 million 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**

Risk Category	Annual Risk Cost (\$m)
Reliability (System)	\$0.001
Financial	\$0.009
Operational/Compliance	\$0.000
People (Safety)	\$0.018
Environment	\$0.078
Reputation	\$0.001
<b>Total</b>	<b>\$0.107</b>

The total projected risk reduction as a result of implementing Option A is \$0.600 million per annum. It can be seen from Table 3 that the largest component of the reduction is in the 'environment' category, due to the reduced likelihood of conductor drop failure. Reductions are also expected in the 'people (safety)' and 'financial' categories.

The total projected risk reduction per kilometre of line is \$0.055 million per annum.

## 4. Evaluation

### 4.1 Technical evaluation

Both the base case option and Option A outlined in Section 3 are considered to be technically feasible<sup>1</sup>.

### 4.2 Commercial evaluation

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

**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	-	-	\$0.707	-	-	-
A	Line Refurbishment	\$1.32	-	\$0.107	\$2.82	\$2.81	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 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	\$1.97	\$4.23

### 4.3 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:

<sup>1</sup> 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.

- > Structure failure
- > Conductor / earthwire 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:

- > Structure failure – 6 times the environment (bushfire) risk, 6 times the safety risk and 10% of the reliability risk (applicable to safety)
- > Conductor / earthwire 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 (\$ million)**

Option	Description	CAPEX	Expected Life	Annualised CAPEX
Base Case	Run-To-Fail	N/A	N/A	N/A
A	Line Refurbishment	\$1.32	20 years	\$0.066

**Table 7 Annual Risk Calculations (\$ million)**

Options	Annual Residual Risk			Annual Risk Reductions		
	Safety Risk	Reliability Risk	Environment Risk	Safety Risk	Reliability Risk	Environment Risk
Base Case	\$0.027	\$0.002	\$0.655	-	-	-
A	\$0.018	\$0.001	\$0.078	\$0.009	\$0.001	\$0.577

**Table 8: ALARP Evaluation (\$ million)**

Option	Network Safety Risk Reduction <sup>2</sup>	Annualised CAPEX	Reasonably Practicable (Y/N)
A	\$3.516	\$0.066	Yes

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

#### 4.4 Preferred option

From the SFAIRP/ALARP evaluation, Option A is considered to be reasonably practicable and is required to be undertaken in order to satisfy the organisation's SFAIRP/ALARP obligations.

Option A is also considered to be commercially viable (as per the commercial evaluation). For the aforementioned reasons, it is proposed that Option A be scoped in further detail.

#### Capital and Operating Expenditure

<sup>2</sup> The Network Safety Risk Reduction is calculated as 6 x Environment (Bushfire) Risk Reduction + 6 x Safety Risk Reduction + 0.1 x Reliability Risk Reduction.

The estimated capital expenditure associated with the refurbishment outlined in this option is \$1.32 million  $\pm 25\%$  in 2016-2017 Australian dollars. The vast majority of this expenditure is proposed to be carried out in 2022-2023.

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 RIT-T analysis is required as the works are condition based.

## **5. Recommendation**

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From the above SFAIRP/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 90 as outlined under Option A is undertaken.

## Attachment 1 – Commercial evaluation report

### Option A NPV Calculation

Project_Option Name			Line 90 (SC Only) Refurbishment	
1. Financial Evaluation (excludes VCR benefits)				
NPV @ standard discount rate	10.00%	\$2.81m	NPV / Capital (Ratio)	2.13
NPV @ upper bound rate	13.00%	\$1.97m	Pay Back Period (Yrs)	0.40 Yrs
NPV @ lower bound rate (WACC)	6.75%	\$4.22m	IRR%	39.77%
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%	\$2.82m	NPV / Capital (Ratio)	-0.94
NPV @ upper bound rate	13.00%	\$1.97m	Pay Back Period (Yrs)	2.20 Yrs
NPV @ lower bound rate (WACC)	6.75%	\$4.23m	IRR%	39.82%
Benefits				
Risk cost	As Is	To Be	Benefit	VCR Benefit
Systems (reliability)	\$0.00m	\$0.00m	\$0.00m	ENS Penalty
Financial	\$0.02m	\$0.01m	\$0.01m	All other risk benefits
Operational/compliance	\$0.00m	\$0.00m	\$0.00m	Total Risk benefits
People (safety)	\$0.03m	\$0.02m	\$0.01m	
Environment	\$0.66m	\$0.08m	\$0.58m	
Reputation	\$0.00m	\$0.00m	\$0.00m	
Total Risk benefits	\$0.71m	\$0.11m	\$0.60m	Benefits in the financial NPV*
Cost savings and other benefits			\$0.00m	*excludes VCR benefits
Total Benefits			\$0.60m	Benefits in the economic NPV**
				**excludes ENS penalty
Other Financial Drivers				
Incremental opex cost pa (no depreciation)		\$0.00m	Write-off cost	\$0.00m
Capital - initial \$m		-\$1.32m	Major Asset Life (Yrs)	20.00 Yrs
Residual Value - initial investment		\$0.07m	Re-investment capital	\$0.00m
Capitalisation period		3.00 Yrs	Start of the re-investment period	0.00 Yrs