

OPTIONS EVALUATION REPORT (OER)



Liverpool 415V AC Dist Replacement

OER 00000001519 revision 2.0

Ellipse project no.: P0008778

TRIM file: [TRIM No]

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

Project category: Prescribed - Replacement

Approvals

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Date submitted for approval	25 November 2016	

Change history

Revision	Date	Amendment
0	25 June 2016	Initial issue
1	28 October 2016	Update to 2016/17 dollars and SFAIRP/ALARP data
2	25 November 2016	Update to format

1. Need/opportunity

Liverpool Substation is an important point of interconnection for TransGrid's 330kV network and connects to Endeavour Energy at 132kV to supply the Sydney Metropolitan South West area. The 415V system at Liverpool has been identified as among those with a high proportion of defects and will be over 40 years old by 2023.

2. Related Needs/opportunities

Nil.

3. Options

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

Base Case

The Base Case for this Need is to continue with TransGrid's current management of defects through corrective maintenance and changes to work practices. This approach does not address the degrading condition of the 415V Alternating Current (AC) system or the structural deficiencies in the infrastructure. The risk cost of \$1.26m per annum will increase due to the probability of failure increasing as the assets further deteriorate with age.

The key driver for this risk cost is the poor condition of the aging 415V system. This increases the likelihood of a hazardous event occurring.

Increasing the corrective maintenance cannot reduce the probability of failure in order to reduce the risk cost. A holistic approach to bring the system up to current requirements as per AS3000 will likely achieve better safety outcomes.

Option A — 415V AC Distribution Replacement [[OFR 1519A](#), [OFS 1519A](#)]

Option A is to carry out the refurbishment of the 415V AC system in order to bring it to current AS3000 requirements. The scope of works includes the replacement of main 415V switchboards in the switchyard; Low Voltage Alternating Current (LVAC) distribution panels and light and power distribution boards in the Auxiliary Services Building; replacement and segregation of 415V cabling; and the segregation of LV AC cabling from Direct Current (DC) cabling.

The expected capital costs for the option total \$1.90m. This costing is estimated using TransGrid's "Success" estimating system.

The residual risk associated with this option upon completion of the project amounts to \$73.7k per annum (base case risk cost = \$1.26m). The risk reduction is realised through the reduction in the probability of failure for all assets.

4. Evaluation

Evaluation of the proposed options has been completed using both commercial considerations and the ALARP (as low as reasonably practical) regulatory requirements. The results of these evaluations are outlined below.

4.1 Commercial evaluation

The result of commercial evaluation for each of the options is summarised in Table 1.

Table 1 – 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	-	1.26	N/A	N/A	-
A	415V AC Distribution Replacement	1.90	-	0.074	5.53	(0.45)	1

The commercial evaluation is based on:

- > Economic life of the assets is assumed 40 years, hence this assessment period has been applied.
- > Capital cost is not escalated and it does not include capitalised interest.

Sensitivities on economic Net Present Value (NPV) for the option with changing discount rates are shown in Table 2.

Table 2 – Discount rate sensitivities (\$ million)

Option	Description	Economic NPV @13%	Economic NPV @6.75%
A	415V AC Distribution Replacement	3.68	8.91

4.2 SFAIRP/ALARP evaluation

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 below.

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:

- > Catastrophic failure of asset/uncontrolled discharge or contact with electricity/ unauthorised access to site - 3 times the safety risk and 10% of the reliability risk (applicable to safety)

The results of this evaluation are summarised in the tables below.

Table 3 – Feasible options (\$ thousand)

Option	Description	CAPEX	Expected Life	Annualised CAPEX
Base	Do nothing	N/A	N/A	N/A
A	415V AC Distribution Replacement	1,900	40 years	50

Table 4 – Annual risk calculations (\$ thousand)

Option	Annual Residual Risk			Annual Risk Savings		
	Safety Risk	Reliability Risk	Bushfire Risk	Safety Risk	Reliability Risk	Bushfire Risk
Base	0	1,259	0	N/A	N/A	N/A
A	0	66	0	0	1,193	0

Table 5 – Reasonably practicable test (\$ thousand)

Option	Network Safety Risk Reduction ¹	Annualised CAPEX	Reasonably practicable ² ?
A	119	50	Yes

Option A is reasonably practicable.

4.3 Preferred option

The outcome of the SFAIRP/ALARP evaluation is that Option A is the preferred option as it is reasonably practicable and provides the greatest network safety risk reduction, and is therefore required to satisfy the organisation’s SFAIRP/ALARP obligations.

The preferred option to address the condition of the secondary system is Option A – 415V AC Distribution Replacement.

This option has been selected due to its technical viability and reduction in reliability risk. This option provides significant technical benefits and provides a positive NPV.

Capital and operating expenditure

The capital expenditure required to deploy the preferred option is justified in the high reduction in reliability risk and beneficial safety outcomes it provides.

Regulatory Investment Test

A Regulatory Investment Test for Transmission (RIT-T) is not required as this is an asset replacement project with no augmentation component.

5. Recommendation

It is recommended that Option A – 415V AC Distribution Replacement be scoped in detail.

¹ The Network Safety Risk Reduction is calculated as 6 x Bushfire Risk Reduction + 3 x Safety Risk Reduction + 0.1 x Reliability Risk Reduction

² 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		Liverpool 415V AC Distribution Replacement - Option A			
1. Financial Evaluation (excludes VCR benefits)					
NPV @ standard discount rate	10.00%	-\$0.45m	NPV / Capital (Ratio)	-0.24	
NPV @ upper bound rate	13.00%	-\$0.53m	Pay Back Period (Yrs)	0.05 Yrs	
NPV @ lower bound rate (WACC)	6.75%	-\$0.20m	IRR%	5.30%	
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%	\$5.53m	NPV / Capital (Ratio)	2.91	
NPV @ upper bound rate	13.00%	\$3.68m	Pay Back Period (Yrs)	1.60 Yrs	
NPV @ lower bound rate (WACC)	6.75%	\$8.91m	IRR%	57.59%	
Benefits					
Risk cost	As Is	To Be	Benefit	VCR Benefit	\$1.06m
Systems (reliability)	\$1.14m	\$0.07m	\$1.07m	ENS Penalty	\$0.00m
Financial	\$0.12m	\$0.01m	\$0.12m	All other risk benefits	\$0.13m
Operational/compliance	\$0.00m	\$0.00m	\$0.00m	Total Risk benefits	\$1.19m
People (safety)	\$0.00m	\$0.00m	\$0.00m	Benefits in the financial NPV*	\$0.13m
Environment	\$0.00m	\$0.00m	\$0.00m	*excludes VCR benefits	
Reputation	\$0.00m	\$0.00m	\$0.00m	Benefits in the economic NPV**	\$1.19m
Total Risk benefits	\$1.26m	\$0.07m	\$1.19m	**excludes ENS penalty	
Cost savings and other benefits			\$0.00m		
Total Benefits			\$1.19m		
Other Financial Drivers					
Incremental opex cost pa (no depreciation)			\$0.00m	Write-off cost	\$0.00m
Capital - initial \$m			-\$1.90m	Major Asset Life (Yrs)	40.00 Yrs
Residual Value - initial investment			\$0.71m	Re-investment capital	\$0.00m
Capitalisation period			5.00 Yrs	Start of the re-investment period	0.00 Yrs