

OPTIONS EVALUATION REPORT (OER)

Armidale 415V AC Dist. Replacement

OER 000000001478 revision 4.0



Ellipse project no.: P0008603

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	6 January 2017	

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	24 November 2016	Update to format
3	05 January 2017	Correction to cost estimate
4	06 January 2017	Correction to number format

1. Need/opportunity

Armidale Substation is a critical point of interconnection for the supply to the NSW North East Region and connects to Essential Energy at 66kV. The 415V Alternating Current (AC) system at Armidale has been identified as among those with a high proportion of defects and will be over 50 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 AC system or the structural deficiencies in the infrastructure. The risk cost of \$609k per annum will increase due to the probability of failure increasing as the assets move further past their expected life.

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.

While continuing the corrective maintenance will 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 1478A](#), [OFS 1478A](#)]

Option A is to replace parts of the 415V AC Distribution system in order to bring the system to current AS3000 requirements. The scope includes the replacement of the existing 415V switchboard; the cable connections between the auxiliary transformers and the auxiliary services building; 415V AC Distribution Board and cabling to loads; and segregation of Low Voltage (LV) AC and Direct Current (DC) cables.

The expected capital costs for the upcoming regulatory period for the option total \$2.71m. This costing is estimated using TransGrid's "Success" estimating system.

The residual risk associated with this option upon completion of the project amounts to \$28.5k per annum (base case risk cost = \$609k). 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	-	0.609	N/A	N/A	2
A	415V AC Distribution Replacement	2.71	-	0.028	1.40	(0.07)	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 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	0.71	2.77

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	2,710	40 years	70

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	283	0	N/A	N/A	N/A
A	0	13	0	0	270	0

Table 5 – Reasonably practicable test (\$ thousand)

Option	Network Safety Risk Reduction ¹	Annualised CAPEX	Reasonably practicable ² ?
A	27	70	No

Option A is not reasonably practicable.

4.3 Preferred option

The outcome of the SFAIRP/ALARP evaluation is that none of the options presented above are reasonably practicable, and are therefore not 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 the greatest positive Net Present Value (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			Armidale 415V AC Distribution Replacement - Option A		
1. Financial Evaluation (excludes VCR benefits)					
NPV @ standard discount rate	10.00%	\$0.07m	NPV / Capital (Ratio)	0.02	
NPV @ upper bound rate	13.00%	-\$0.22m	Pay Back Period (Yrs)	0.11 Yrs	
NPV @ lower bound rate (WACC)	6.75%	\$0.71m	IRR%	10.53%	
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%	\$1.40m	NPV / Capital (Ratio)	0.52	
NPV @ upper bound rate	13.00%	\$0.71m	Pay Back Period (Yrs)	4.67 Yrs	
NPV @ lower bound rate (WACC)	6.75%	\$2.77m	IRR%	20.54%	
Benefits					
Risk cost	As Is	To Be	Benefit	VCR Benefit	\$0.27m
Systems (reliability)	\$0.28m	\$0.01m	\$0.27m	ENS Penalty	\$0.00m
Financial	\$0.33m	\$0.02m	\$0.31m	All other risk benefits	\$0.31m
Operational/compliance	\$0.00m	\$0.00m	\$0.00m	Total Risk benefits	\$0.58m
People (safety)	\$0.00m	\$0.00m	\$0.00m	Benefits in the financial NPV*	\$0.31m
Environment	\$0.00m	\$0.00m	\$0.00m	*excludes VCR benefits	
Reputation	\$0.00m	\$0.00m	\$0.00m	Benefits in the economic NPV**	\$0.58m
Total Risk benefits	\$0.61m	\$0.03m	\$0.58m	**excludes ENS penalty	
Cost savings and other benefits			\$0.00m		
Total Benefits			\$0.58m		
Other Financial Drivers					
Incremental opex cost pa (no depreciation)			\$0.00m	Write-off cost	\$0.00m
Capital - initial \$m			-\$2.71m	Major Asset Life (Yrs)	40.00 Yrs
Residual Value - initial investment			\$1.22m	Re-investment capital	\$0.00m
Capitalisation period			8.00 Yrs	Start of the re-investment period	0.00 Yrs