

# OPTIONS EVALUATION REPORT (OER)

Sydney East 415V AC Dist Replacement

OER 000000001516 revision 2.0



**Ellipse project no.:** P0008760

**TRIM file:** [TRIM No]

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

**Project category:** Prescribed - Replacement

## Approvals

Author	Adam Hoare	Senior Secondary Systems Analyst
Endorsed	Hazem Khamis	Secondary Systems Strategist
	Azil Khan	Investment Strategy Manager
Approved	Lance Wee	M/Asset Strategy
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

---

Sydney East Substation is a main point of interconnection for supply to the eastern region of Sydney and connected to Ausgrid's network at 132kV. The 415V Alternating Current (AC) system at Sydney East has been identified as among those with a high proportion of defects and will be over 45 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 \$23.7m 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 1516A](#), [OFS 1516A](#)]

Option A is to carry out a site wide 415V AC Distribution refurbishment in order to bring the system to current AS3000 requirements. The scope includes replacement of main switchboards and distribution panels in the Auxiliary Services Building; replacement and segregation of 415V mains; and segregation of Low Voltage (LV) AC cables from Direct Current (DC) cables.

The expected capital costs for the option total \$3.23m. This costing is estimated using TransGrid's "Success" estimating system.

The residual risk associated with this option upon completion of the project amounts to \$249k per annum (base case risk cost = \$23.7m). 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	-	23.7	N/A	N/A	2
A	415V AC Distribution Replacement	3.23	-	0.249	130	5.97	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	91.29	199.26

### 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	3,230	40 years	80

**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	22,243	0	N/A	N/A	N/A
A	0	234	0	0	22,009	0

**Table 5 – Reasonably practicable test (\$ thousand)**

Option	Network Safety Risk Reduction <sup>1</sup>	Annualised CAPEX	Reasonably practicable <sup>2</sup> ?
A	2,201	80	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.

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

<sup>2</sup> Reasonably practicable is defined as whether the annualised CAPEX is less than the Network Safety Risk Reduction

## 5. Recommendation

---

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

## Attachment 1 – Commercial evaluation report

### Option A NPV calculation

Project_Option Name			Sydney East 415V AC Distribution Replacement - Option A		
1. Financial Evaluation (excludes VCR benefits)					
NPV @ standard discount rate	10.00%	\$5.97m	NPV / Capital (Ratio)	1.86	
NPV @ upper bound rate	13.00%	\$3.77m	Pay Back Period (Yrs)	0.33 Yrs	
NPV @ lower bound rate (WACC)	6.75%	\$10.07m	IRR%	32.64%	
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%	\$129.97m	NPV / Capital (Ratio)	40.36	
NPV @ upper bound rate	13.00%	\$91.29m	Pay Back Period (Yrs)	Not measurable	
NPV @ lower bound rate (WACC)	6.75%	\$199.26m	IRR%	199.82%	
Benefits					
Risk cost	As Is	To Be	Benefit	VCR Benefit	\$22.00m
Systems (reliability)	\$22.24m	\$0.23m	\$22.01m	ENS Penalty	\$0.00m
Financial	\$1.45m	\$0.02m	\$1.43m	All other risk benefits	\$1.44m
Operational/compliance	\$0.00m	\$0.00m	\$0.00m	Total Risk benefits	\$23.44m
People (safety)	\$0.00m	\$0.00m	\$0.00m		
Environment	\$0.00m	\$0.00m	\$0.00m	Benefits in the financial NPV*	\$1.44m
Reputation	\$0.00m	\$0.00m	\$0.00m	*excludes VCR benefits	
Total Risk benefits	\$23.69m	\$0.25m	\$23.44m		
Cost savings and other benefits			\$0.00m	Benefits in the economic NPV**	\$23.44m
Total Benefits			\$23.44m	**excludes ENS penalty	
Other Financial Drivers					
Incremental opex cost pa (no depreciation)			\$0.00m	Write-off cost	\$0.00m
Capital - initial \$m			-\$3.22m	Major Asset Life (Yrs)	40.00 Yrs
Residual Value - initial investment			\$1.21m	Re-investment capital	\$0.00m
Capitalisation period			5.00 Yrs	Start of the re-investment period	0.00 Yrs