

OPTIONS EVALUATION REPORT (OER)



Molong Secondary Systems Renewal

OER 000000001267 revision 3.0

Ellipse project no.: P0005403

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	24 November 2016	

Change history

Revision	Date	Amendment
0	29 June 2016	Initial issue
1	31 October 2016	Update to 2016/17 dollars and SFAIRP/ALARP data
2	24 November 2016	Update to format
3	24 November 2016	Added OSR reference

1. Need/opportunity

Molong Substation is a necessary customer connection point supplying Essential Energy's 66kV network in the area inclusive of Wellington, Manildra, and Orange North. A significant portion of secondary systems assets at Molong Substation have been identified for replacement.

2. Related Needs/opportunities

The assets proposed to be replaced under this Secondary Systems Renewal were identified in the following Needs:

- > Need ID 1382 – Protection – GE FAC Condition
- > Need ID 610 – Replacement of EDMI MK3 Energy Meters
- > Need ID 629 – Replacement of Remote Terminal Units (RTUs)

3. Options

The options scoped for this need were identified as per the Options Screening Report – Secondary System Renewal.

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 operation and maintenance (O&M) for the site. This approach does not address the degrading condition of the secondary systems or the risk cost associated with the Need. The risk cost of \$3.11m per annum will increase due to:

- > The probability of failure increasing as the assets move further past their expected life; and
- > TransGrid's means of recovery from asset failure becoming exhausted, increasing the consequence of asset failure.

Key drivers for this risk cost are:

- > The majority of relays protecting assets are non self-checking and provide no feedback as to the health of the asset, therefore increasing the likelihood of a hazardous event occurring.
- > The majority of relays protecting assets at this site will reach their end of life by 2023, with limited spares and limited or no manufacturer support. This therefore increases the likelihood of a hazardous event occurring and decreases TransGrid's ability to react to mitigate or repair any failures.

Option A – Complete In-Situ Replacement [[OFR 1267A](#), [OFS 1267A](#)]

Option A is to replace all secondary systems assets at Molong Substation with current designs and architectures. This option also replaces Direct Current (DC) supplies to account for increase in power requirements and remediates the 415V Alternating Current (AC) distribution in the building and the yard.

The expected capital costs for the option total \$2.35m. This costing is estimated using TransGrid's "Success" estimating system. No further capital investment would be required over the 15 year life cycle of this option through to 2038.

Operating costs have been estimated at \$2k per annum based on current maintenance plan settings.

A benefit figure of \$26k per annum has been calculated for this option in accordance with TransGrid’s Renewal and Maintenance Strategy for Secondary Systems Site Installations¹.

The residual risk associated with this option upon completion amounts to \$66k per annum (base case risk cost = \$3.11m). The risk reduction is realised through the reduction in the probability of failure for all assets and remediation of the risk posed by the 415V AC distribution.

Option B – IEC-61850 Deployment [[OFR 1267B](#), [OFS 1267B](#)]

Option B is to replace and upgrade all secondary systems assets using IEC-61850 technology and methodologies. This option also includes the remediation of the 415V AC distribution in the building and the yard.

The expected capital costs for the option total \$3.59m. This costing is estimated using TransGrid’s “Success” estimating system. No further capital investment would be required over the 15 year life cycle of this option through to 2038.

Operating costs have been estimated at \$10k per annum based on a standard rate required for defect maintenance.

A benefit figure of \$26k per annum has been calculated for this option in accordance with TransGrid’s Renewal and Maintenance Strategy for Secondary Systems Site Installations. Additional benefit of \$300k in the 1st year, \$150k in the 2nd year and \$75k in the 3rd year is also included to account for gain due to standard development. This saving is a high level assumption and considers the benefits diminishing due to potential spend in IE61850 solution to allow for improvements.

The residual risk associated with this option upon completion amounts to \$176k per annum (base case risk cost = \$3.11m). The risk reduction is realised through the reduction in the probability of failure

Options A and B have both been assessed as technically feasible.

4. Evaluation

Evaluation of the proposed options has been completed using the ALARP (As Low as Reasonably Practicable) regulatory requirements and economic considerations. The results of this evaluation are outlined below.

4.1 Commercial evaluation

The result of commercial evaluation for each of the options is summarised in the 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	0.002	3.11	N/A	N/A	3
A	Complete In-Situ Replacement	2.35	0.002	0.066	11.25	3.20	1
B	IEC-61850 Deployment	3.59	0.010	0.176	11.15	2.40	2

¹ Refer SSA Strategy – Renewal and Maintenance - Secondary Systems Site Installations

The commercial evaluation is based on:

- > Economic life of the assets is assumed 15 years, hence this assessment period has been applied.
- > Write-offs have been estimated at \$138k for Option A and \$88k for Option B
- > Capital cost is not escalated and it does not include capitalised interest.

Sensitivities on economic NPV for all options 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	Complete In-Situ Replacement	8.23	16.02
B	IEC-61850 Deployment	8.32	15.52

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:

- > Conductor drop/structure failure - 6 times the bushfire risk , 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	Complete In-Situ Replacement	2,350	15 years	160
B	IEC-61850 Deployment	3,590	15 years	240

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	20	2,733	2	N/A	N/A	N/A
A	1	42	0	19	2,691	2
B	6	76	0	14	2,657	1

Table 5 – Reasonably practicable test (\$ thousand)

Option	Network Safety Risk Reduction ²	Annualised CAPEX	Reasonably practicable ³ ?
A	335	160	Yes
B	310	240	Yes

Both options A and B are reasonably practicable.

4.3 Preferred option

The outcome of the SFAIRP/ALARP evaluation is that both options are reasonably practicable.

The preferred option to address the condition of the secondary systems however, is Option B – IEC-61850 Deployment.

While the economic Net Present Value (NPV) on Option A is slightly better than Option B, the preferred option is Option B based on the following reasons;

This option has been selected because:

- > The safety risk reduction is almost comparable to option A (difference of \$5k only);
- > The option will provide real benefits to TransGrid in terms of lower capital expenditure and safety risk reduction;
- > The designs for IEC-61850 deployment have not been finalised and some uncertainty exists in the ultimate deployment costs, ongoing operational costs and ongoing risk cost for this solution. Conservative assumptions have been used as part of this evaluation, therefore there is potential for further savings;
- > There are only limited locations on the network appropriate for IEC-61850 deployment under the implementation plan⁴;
- > It is anticipated that further benefits and operating efficiencies will be identified once TransGrid becomes more familiar and comfortable with the IEC-61850 technology and its use becomes more widespread.

Capital and operating expenditure

There is negligible difference in predicted ongoing operational expenditure between the two options and the Base Case. Deploying the IEC-61850 option will provide benefits in terms of remote monitoring, control and interrogation, responding to faults more efficiently and phasing out of obsolete legacy systems. These have been captured as benefits for delivering the project.

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.

² The Network Safety Risk Reduction is calculated as 6 x Bushfire Risk Reduction + 3 x Safety Risk Reduction + 0.1 x Reliability Risk Reduction

³ Reasonably practicable is defined as whether the annualised CAPEX is less than the Network Safety Risk Reduction

⁴ Refer SSA Plan - Development and Deployment – IEC-61850

5. Recommendation

It is recommended that Option B – IEC-61850 Deployment be scoped in detail.

Attachment 1 – Commercial evaluation report

Option A NPV calculation

Project_Option Name		Molong Secondary Systems Renewal - Option A			
1. Financial Evaluation (excludes VCR benefits)					
NPV @ standard discount rate	10.00%	\$3.20m	NPV / Capital (Ratio)	1.36	
NPV @ upper bound rate	13.00%	\$2.09m	Pay Back Period (Yrs)	0.26 Yrs	
NPV @ lower bound rate (WACC)	6.75%	\$4.98m	IRR%	26.36%	
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%	\$11.25m	NPV / Capital (Ratio)	4.79	
NPV @ upper bound rate	13.00%	\$8.23m	Pay Back Period (Yrs)	Not measurable	
NPV @ lower bound rate (WACC)	6.75%	\$16.02m	IRR%	50.25%	
Benefits					
Risk cost	As Is	To Be	Benefit	VCR Benefit	\$2.10m
Systems (reliability)	\$2.73m	\$0.04m	\$2.69m	ENS Penalty	\$0.55m
Financial	\$0.27m	\$0.02m	\$0.25m	All other risk benefits	\$0.39m
Operational/compliance	\$0.00m	\$0.00m	\$0.00m	Total Risk benefits	\$3.04m
People (safety)	\$0.02m	\$0.00m	\$0.02m	Benefits in the financial NPV*	\$0.97m
Environment	\$0.00m	#REF!	#REF!	*excludes VCR benefits	
Reputation	\$0.09m	\$0.00m	\$0.08m	Benefits in the economic NPV**	\$2.52m
Total Risk benefits	\$3.11m	#REF!	#REF!	**excludes ENS penalty	
Cost savings and other benefits			#REF!		
Total Benefits			\$3.07m		
Other Financial Drivers					
Incremental opex cost pa (no depreciation)			-\$0.00m	Write-off cost	-\$0.14m
Capital - initial \$m			-\$2.35m	Major Asset Life (Yrs)	15.00 Yrs
Residual Value - initial investment			\$0.16m	Re-investment capital	\$0.00m
Capitalisation period			4.00 Yrs	Start of the re-investment period	0.00 Yrs

Option B NPV calculation

Project_Option Name

Molong Secondary Systems Renewal - Option B

1. Financial Evaluation (excludes VCR benefits)

NPV @ standard discount rate	10.00%	\$2.40m	NPV / Capital (Ratio)	0.67
NPV @ upper bound rate	13.00%	\$1.47m	Pay Back Period (Yrs)	0.22 Yrs
NPV @ lower bound rate (WACC)	6.75%	\$3.88m	IRR%	21.87%

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%	\$11.15m	NPV / Capital (Ratio)	3.10
NPV @ upper bound rate	13.00%	\$8.32m	Pay Back Period (Yrs)	1.35 Yrs
NPV @ lower bound rate (WACC)	6.75%	\$15.52m	IRR%	51.29%

Benefits

Risk cost	As Is	To Be	Benefit		
<i>Systems (reliability)</i>	\$2.73m	\$0.08m	\$2.66m	VCR Benefit	\$2.08m
<i>Financial</i>	\$0.27m	\$0.08m	\$0.19m	ENS Penalty	\$0.55m
<i>Operational/compliance</i>	\$0.00m	\$0.00m	\$0.00m	All other risk benefits	\$0.30m
<i>People (safety)</i>	\$0.02m	\$0.01m	\$0.01m	Total Risk benefits	\$2.93m
<i>Environment</i>	\$0.00m	\$0.00m	\$0.00m	Benefits in the financial NPV*	\$1.18m
<i>Reputation</i>	\$0.09m	\$0.01m	\$0.07m	*excludes VCR benefits	
Total Risk benefits	\$3.11m	\$0.18m	\$2.93m	Benefits in the economic NPV**	\$2.71m
Cost savings and other benefits			\$0.33m	**excludes ENS penalty	
Total Benefits			\$3.26m		

Other Financial Drivers

Incremental opex cost pa (no depreciation)	-\$0.01m	Write-off cost	-\$0.09m
Capital - initial \$m	-\$3.59m	Major Asset Life (Yrs)	15.00 Yrs
Residual Value - initial investment	\$0.00m	Re-investment capital	\$0.00m
Capitalisation period	3.00 Yrs	Start of the re-investment period	0.00 Yrs