

OPTIONS EVALUATION REPORT (OER)

SCADA-EMS NM4 Replacement

OER 000000001254 revision 2.0



Ellipse project no.: P0005327

TRIM file: [TRIM No]

Project reason: Capability - Obsolescence/Manufacturer support withdrawn

Project category: Prescribed - Replacement

Approvals

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Date submitted for approval	14 December 2016	

Change history

Revision	Date	Amendment
0	29 June 2016	Initial issue
1	28 October 2016	Update to 2016/17 dollars and SFAIRP/ALARP data
2	16 November 2016	Update to format
3	14 December 2016	Minor amendment – consistent option names

1. Need/opportunity

The Supervisory Control And Data Acquisition (SCADA) platform is a vital tool that allows TransGrid to efficiently operate and maintain its high voltage network, providing real-time visibility of the network status and indication when elements are defective. The platform also acts as a concentrator for network and generator data that is then passed onto AEMO for its use to dispatch and operate the Nation Electricity Market.

The need for remote monitoring and control facilities is a continuing requirement of the National Electricity Rules (NER) and the Australian Energy Market Operator (AEMO). It is foreseen that this requirement will continue into the future.

2. Related Needs/opportunities

The following Needs will significantly increase the substation data available for the SCADA system:

- > Need ID DCN216 – Avon Secondary Systems Replacement
- > Need ID DCN57 – Sydney North Secondary Systems Replacement
- > Need ID 1180 – Wagga 330kV Secondary Systems Renewal
- > Need ID 1186 – Murrumburrah Secondary Systems Renewal
- > Need ID 1191 – Deniliquin Secondary Systems Renewal
- > Need ID 1192 – Lower Tumut Secondary Systems Renewal
- > Need ID 1193 – Broken Hill Secondary Systems Renewal
- > Need ID 1194 – Tenterfield Secondary Systems Renewal
- > Need ID 1196 – Coleambally Secondary Systems Renewal
- > Need ID 1243 – Tamworth 330kV Secondary Systems Renewal
- > Need ID 1244 – Wallerawang 330kV Secondary Systems Renewal
- > Need ID 1246 – Panorama Secondary Systems Renewal
- > Need ID 1247 – Muswellbrook Secondary Systems Renewal
- > Need ID 1252 – Cowra Secondary Systems Renewal
- > Need ID 1253 – Darlington Point Secondary Systems Renewal
- > Need ID 1255 – Ingleburn Secondary Systems Renewal
- > Need ID 1258 – Regentville Secondary Systems Renewal
- > Need ID 1263 – Tuggerah Secondary Systems Renewal
- > Need ID 1266 – Marulan Secondary Systems Renewal
- > Need ID 1267 – Molong Secondary Systems Renewal
- > Need ID 1599 – Liverpool Secondary Systems Renewal

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 run these assets to failure. This approach does not address the lack of replacement components for the assets or the risk cost associated with the Need. At \$1.78m per annum, the risks are foreseen to increase as the probability of failure of the assets will also likely increase. Key drivers for this risk cost are:

- > The platform is native to Windows XP which is no longer available or supported by Microsoft.
- > The platform utilises point-to-point communications via RS-232 which is becoming obsolete and at risk of being incompatible with substation and communications systems being installed across the network.
- > The implementation of IEC61850 will create a step change in the quantity of digitised information available at the substation level. This likely will not be able to be supported by the SCADA platform in its current form and under the current licensing system.

Implementing maintenance routines cannot remediate the identified issues.

Option A – Replacement of individual Assets [[OFR 1254A](#), [OFS 1254A](#)]

This option covers the replacement of assets with a modern solution that is capable of handling additional data capabilities of modern control systems installed in the field.

There are no operating costs for this option based on current maintenance plan settings.

Due to the modernisation feature of this option, a benefit of approximately \$1.08m per annum has been calculated for this option based in a reduction of callouts and asset management effort due to an increase in data centrally available from sites. This value has been calculated in accordance with TransGrid's Renewal and Maintenance Strategy for Secondary Systems Site Installations¹ and applied to all sites due to the centralised nature of the SCADA system.

The expected total capital cost to replace the SCADA assets identified under this Need is \$15m. This costing is estimated using TransGrid's "Success" estimating system.

The residual risk associated with this option upon completion of the project amounts to \$0.09m per annum (base case risk cost = \$1.78m). The risk reduction is realised through the reduction in the probability of failure for all assets.

4. Evaluation

4.1 Commercial evaluation

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

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

Table 1 – Commercial evaluation (\$ million)

Option	Description	Total capex	Annual opex	Annual post project risk cost	Economic ² NPV @10%	Financial NPV @10%	Rank
Base Case	Run-to-fail	NA	0.0	1.78	NA	NA	2
A	Replace individual Assets	15.0	0.0	0.09	(2.23)	(7.75)	1

The commercial evaluation is based on:

- > Economic life of the assets is assumed 7 years, hence this assessment period has been applied
- > Write-offs have not been estimated
- > Capital cost is not escalated and it does not include capitalised interest

Sensitivities on with changing discount rate are shown in Table 2.

Table 2 – Discount rate sensitivities (\$ million)

Option	Description	Economic NPV @13%	Economic NPV @6.75%
A	Replace individual Assets	(3.30)	(0.58)

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 in Table 1.

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	Run-to-fail	N/A	N/A	N/A
A	Replace individual Assets	15,000	7 years	2,140

² Option A returns an IRR of 5.85%

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	1,752	0	N/A	N/A	N/A
A	0	88	0	0	1,664	0

Table 5 - Reasonably practicable test (\$ thousand)

Option	Network Safety Risk Reduction ³	Annualised CAPEX	Reasonably practicable ⁴ ?
A	166	2,140	No

4.3 Preferred option

The outcome of the SFAIRP/ALARP evaluation is that none of the options presented in Table 5 are reasonably practicable, and are therefore not required to satisfy the organisation's SFAIRP/ALARP obligations.

The option to address the condition of the identified assets, Option A - Replace All Assets, is the preferred option for this Need.

Although the Net Present Value (NPV) analysis is negative, this option is still preferred over the Base Case because this option will maintain TransGrid's compliance with the NER requirement of remote monitoring and control capabilities and to continue with the supply of status system points as determined by AEMO to maintain the security and reliability of the network. Some of the applicable NER clauses are;

Clause 4.3.4 (c) - Each Network Service Provider must arrange and maintain, in accordance with the standards described in clause 4.3.4(e), controls, monitoring and secure communication systems to facilitate a manually initiated, rotational load shedding and restoration process which may be necessary if there is, in AEMO's opinion, a prolonged major supply shortage or extreme power system disruption.

Clause 4.11.1 - Remote control and monitoring devices

(a) All remote control, operational metering and monitoring devices and local circuits as described in schedules 5.2, 5.3 and 5.3a, must be installed and maintained in accordance with the standards and protocols determined and advised by AEMO (for use in the control centres) for each:

(1) scheduled generating unit and semi-scheduled generating unit connected to the transmission or distribution network; and

(2) substation connected to the network.

(c) The control and monitoring devices must include provision for indication of active power and reactive power output, provision for signalling the status and any associated alarm condition relevant to achieving adequate control of the transmission network, and provision for indication of generating plant active and reactive output

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

⁴ Reasonably practicable is defined as whether the annualised CAPEX is less than the Network Safety Risk Reduction

Other factors that make this option preferred but were not included in the NPV analysis include:

- > The projected timeframe to deliver this option, as per OFS 1254A, is 50 months. This constitutes a significant portion of the current assets' lifecycle.
- > The commercial analysis and risk assessment are highly sensitive to the probability of failure of the equipment that makes up the SCADA platform. This probability of failure rate cannot be readily modelled with less than two years of in service performance data.
- > The SCADA platform is based on common devices, which leaves it susceptible to common failure modes at similar ages. This scenario could not be managed without a complete replacement solution being pursued in parallel with ongoing maintenance strategies.

This option provides additional benefits to the organisation by utilising the complete capabilities of modern control systems throughout the network.

Capital and operating expenditure

There is negligible difference in predicted ongoing operational expenditure between the option and Base Case. Implementing Option A will reduce callouts to address defects and this benefit has been captured in the risk assessment. 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.

5. Recommendation

It is recommended to proceed with the replacement of the identified SCADA system based on the NER compliance.

Attachment 1 – Commercial evaluation report

Option A NPV calculation

Project_Option Name

Option A - Replace SCADA system

1. Financial Evaluation (excludes VCR benefits)

NPV @ standard discount rate	10.00%	-\$7.75m	NPV / Capital (Ratio)	-0.52
NPV @ upper bound rate	13.00%	-\$7.81m	Pay Back Period (Yrs)	-0.08 Yrs
NPV @ lower bound rate (WACC)	6.75%	-\$7.53m	IRR%	-8.45%

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%	-\$2.23m	NPV / Capital (Ratio)	-0.15
NPV @ upper bound rate	13.00%	-\$3.30m	Pay Back Period (Yrs)	5.21 Yrs
NPV @ lower bound rate (WACC)	6.75%	-\$0.58m	IRR%	5.85%

Benefits

Risk cost	As Is	To Be	Benefit	VCR Benefit	\$1.66m
Systems (reliability)	\$1.75m	\$0.09m	\$1.66m	ENS Penalty	\$0.00m
Financial	\$0.03m	\$0.01m	\$0.02m	All other risk benefits	\$0.02m
Operational/compliance	\$0.00m	\$0.00m	\$0.00m	Total Risk benefits	\$1.68m
People (safety)	\$0.00m	\$0.00m	\$0.00m	Benefits in the financial NPV*	\$1.10m
Environment	\$0.00m	\$0.00m	\$0.00m	*excludes VCR benefits	
Reputation	\$0.00m	\$0.00m	\$0.00m	Benefits in the economic NPV**	\$2.76m
Total Risk benefits	\$1.78m	\$0.10m	\$1.68m	**excludes ENS penalty	
Cost savings and other benefits			\$1.08m		
Total Benefits			\$2.76m		

Other Financial Drivers

Incremental opex cost pa (no depreciation)	\$0.00m	Write-off cost	\$0.00m
Capital - initial \$m	-\$15.00m	Major Asset Life (Yrs)	7.00 Yrs
Residual Value - initial investment	\$0.00m	Re-investment capital	\$0.00m
Capitalisation period	4.00 Yrs	Start of the re-investment period	0.00 Yrs