

OPTIONS EVALUATION REPORT (OER)



Guthega Remote Relay Interrogation

OER 000000001402 revision 2.0

Ellipse project description:

TRIM file: [TRIM No]

Project reason: Capability - Improved Asset Management

Project category: Prescribed - NCIPAP

Approvals

Author	Bhavin Sanghavi	Operation Analysis Engineer
	Jay Esson	Network Modelling & Performance Engineer
Endorsed	Hoang Tong	Operations Analysis Manager
	Jahan Peiris	Network Modelling & Performance Manager
	Garrie Chubb	Investment Support Manager
Approved	Andrew Kingsmill	Manager/Power System Analysis
Date submitted for approval	2 November 2016	

1. Need/opportunity

This NCIPAP proposes to extend the rollout of the Fault Data Interrogation System (FDIS), using Tarigma GEM software, to all TransGrid sites that currently have protection relays capable of communicating information via TCP/IP or serial connection. There are 73 TransGrid sites (out of the total 94 sites) that currently do not have the FDIS Tarigma GEM software installed:

The FDIS is able to be remotely interrogated and provide a range of data about a fault such as fault type, faulted phase, flagging details, distance to fault, and fault waveforms. Currently, if a fault occurs on the network, the cause of the fault and subsequent return to service is not always apparent until a staff member has been called to site and the relay interrogated locally.

Different relay manufacturers use proprietary communications and software which make remote interrogation of the data difficult to accomplish with TransGrid's currently available systems. It should also be noted that modern protection systems only show flagging for the most recent fault and if subsequent faults occur only the latest flagging is available. The FDIS would download the protection flagging from the relays to be stored and keep a history in the Tarigma server.

Installing the Tarigma GEM software at the remaining TransGrid sites would resolve all the above issues, enabling faster diagnostics and restoration of outage equipment.

2. Related needs/opportunities

- > NS-0700 Rev 0 – IED Fault Data Interrogation System

3. Options

3.1 Base case

The Base Case is to continue to operate the network with the current practice. If a fault occurs on the network, the cause of the fault and subsequent return to service is not always apparent until a staff member has been called to site and the relay interrogated locally, with longer than acceptable restoration times.

The base case incurs an annual cost of \$0.41m to maintain a reliable and efficient transmission network as outlined in the NER.

Cost Calculation

The cost has been calculated using the following data¹:

- > There are approximately 560 Forced Emergency Outage Report (FEOR) per year. Each FEOR could have relays at multiple sites and because multiple relays can be collected at the same time this is assumed to be equivalent to 560 site visits. The average callout time for a site visit is 4.5 hours to travel to site including setup, connecting and retrieving flags, events and fault traces.
- > Annually there are on average 25 waveform downloads and 50 requests for information on system events from market participants or AEMO. The information retrieved from protection relays during system events will also contribute to the provision of more accurate information to improve the accuracy of voltage and transient stability constraints and potentially improve inter-regional transfer limits, together with fault recorder

¹ Based on TransGrid data January to December 2015

installations. The average time for a callout to collect the required information is 5 hours to travel to site including setup, connecting and retrieving flags, events and fault traces.

- > The prescribed burdening cost for a Protection staff member is \$175/hr.

The cost is calculated as:

- > Cost = (73 / 94) substations × ((560 flag readings × 4.5 hrs × \$175/hr) + (25 waveform downloads × 5 hrs × \$175/hr) + (50 enquiries × 5 hrs × \$175/hr))
- > Cost = \$0.41m per annum

3.2 Option A – Installing the Tarigma GEM software at the remaining TransGrid sites

The option involves the rollout of the Fault Data Interrogation System (FDIS), using Tarigma GEM software, to all remaining 73 TransGrid sites that currently have protection relays capable of communicating information via TCP/IP or serial connection.

The scope of works under this option can be found in [OFR-1402A](#).

The expected capital cost for this option is \$1.942 million ± 25% in un-escalated 2016-17 dollars, spread over 3 years. Refer to [OFS-1402A](#) for details.

There will be no callouts required for FEORs after this option is implemented.

Benefit Calculation

The benefit gained from avoiding the prescribed cost of collecting protection information from site is therefore:

- > Market Benefit = (73 / 94) substations × ((560 flag readings × 4.5 hrs × \$175/hr) + (25 waveform downloads × 5 hrs × \$175/hr) + (50 enquiries × 5 hrs × \$175/hr))
- > Market Benefit = \$410K per annum

4. Evaluation

The Base Case and Option A are technically feasible. In addition, Option A provides significant market benefits.

The commercial evaluation of the technically feasible option is set out in Table 1.

The full financial and economic evaluations are shown in Attachment 1.

Table 1: Commercial Evaluation of Technically Feasible Options

Option	Description	Total Capex (\$m)	Yearly Ongoing Opex (\$m)	Yearly Post Project Risk Cost/ Benefit (-ve) (\$m)	Economic NPV (\$m)	Rank
Base Case	'Do Nothing' – continue to incur site visit costs	-	-	n/a	-	2
A	Installing the Tarigma GEM software at the remaining TransGrid sites	1.942	0.04	-0.41	0.52	1

The commercial evaluation is based on:

- > a 10% discount rate, with sensitivities based on TransGrid’s current AER-determined pre-tax real regulatory WACC of 6.75% for the lower bound, and 13% for the upper bound provided in Attachment 1.

The applied sensitivities on the discount rate give the following economic NPVs:

Discount Rate (%)	Economic NPV (2018/19 \$m)
6.75	1.12
13.00	0.12

Preferred Option

The preferred option is therefore the Option A, as it provides significant benefits and has a positive NPV, as calculated using TransGrid’s NPV Calculation Tool (refer Attachment 1).

A summary of the preferred option can be found in Attachment 2.

Capital and operating expenditure

The yearly incremental operating expenditure is estimated to be 2% of the upfront capital cost of each option, which equates to \$0.04 million, escalated at a rate of 2.9% per annum.²

Payback period

Expected payback period for Option A is approximately about 5.29 years.

Regulatory Investment Test-Transmission

This Need is not subject to the RIT-T process as it does not exceed the \$6 million threshold requirement.

Recommendation

Based on the economic evaluation above, Option A is the preferred option to address the Need as it yields yearly benefits of \$ 0.41 million and has a positive NPV.

It is therefore recommended that a NCIPAP Project be initiated to implement Option A over the 2018-23 period.

² TransGrid Success Database as at May 2016.

Attachment 1 – Financial and Economic Evaluation Reports

Project_Option Name

Remote Relay Interrogation Installation at 73 TransGrid Sites

1. Financial Evaluation (excludes VCR benefits)

NPV @ standard discount rate	10.00%	\$0.52m	NPV / Capital (Ratio)	0.27
NPV @ upper bound rate	13.00%	\$0.12m	Pay Back Period (Yrs)	0.14 Yrs
NPV @ lower bound rate (WACC)	6.75%	\$1.12m	IRR%	14.15%

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%	\$0.52m	NPV / Capital (Ratio)	0.27
NPV @ upper bound rate	13.00%	\$0.12m	Pay Back Period (Yrs)	5.29 Yrs
NPV @ lower bound rate (WACC)	6.75%	\$1.12m	IRR%	14.15%

Benefits

Risk cost	As Is	To Be	Benefit		
<i>Systems (reliability)</i>	\$0.00m	\$0.00m	\$0.00m	<i>VCR Benefit</i>	\$0.00m
<i>Financial</i>	\$0.00m	\$0.00m	\$0.00m	<i>ENS Penalty</i>	\$0.00m
<i>Operational/compliance</i>	\$0.00m	\$0.00m	\$0.00m	<i>All other risk benefits</i>	\$0.00m
<i>People (safety)</i>	\$0.00m	\$0.00m	\$0.00m	Total Risk benefits	\$0.00m
<i>Environment</i>	\$0.00m	\$0.00m	\$0.00m	Benefits in the financial NPV*	\$0.41m
<i>Reputation</i>	\$0.00m	\$0.00m	\$0.00m	<i>*excludes VCR benefits</i>	
Total Risk benefits	\$0.00m	\$0.00m	\$0.00m	Benefits in the economic NPV**	\$0.41m
Cost savings and other benefits			\$0.41m	<i>**excludes ENS penalty</i>	
Total Benefits			\$0.41m		

Other Financial Drivers

Incremental opex cost pa (no depreciation)	-\$0.04m	Write-off cost	\$0.00m
Capital - initial \$m	-\$1.94m	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

Attachment 2 – Summary of Preferred Option

Remote Relay Interrogation	The Fault Data Interrogation System (FDIS) is able to be remotely interrogated and provide a range of data about a fault such as fault type, faulted phase, flagging details, distance to fault, and fault waveforms. Installing the FDIS all TransGrid sites would enabling faster diagnostics and restoration of outage equipment.
Transmission Circuit / Injection Point	At 73 TransGrid substation sites
Scope of works	Installation of FDIS software at 73 TransGrid sites out of a total of 94 substations.
Reasons to undertake the project	Protection relay flags, events and fault traces are stored locally, these should be retrieved as soon as available since if there is a quick succession of faults on the same equipment, flags, events and fault traces would not be lost. The information retrieved from protection relays during system events also contribute to the provision of more accurate information to improve the accuracy of voltage and transient stability constraints and potentially improve inter-regional transfer limits, together with fault recorder installations.
Current value of the limit	Protection relay fault information is presently stored at site, requiring a site visit to interrogate. Cost = \$0.41m per annum
Target limit	Remote interrogations of protection relay information from all of TransGrid's substations. The costs associated with collecting flags, events and fault traces would be eliminated. The information retrieved would contribute to improving the accuracy of voltage and transient stability constraints and potentially improve inter-regional transfer limits, potentially realising market benefits of greater than \$0.41m per annum.
Priority project improvement target	Improved operational flexibility by better scheduling of staff to read protection flags and download waveforms, and more efficient provision of remote support.
Capital Cost	The total capital cost is \$1.942m
Operating Cost	\$0.04m per annum
Market benefits	Benefit = (73 / 94) substations × ((560 flag readings × 4.5 hrs × \$175/hr) + (25 waveform downloads × 5 hrs × \$175/hr) + (50 enquiries × 5 hrs × \$175/hr)) Benefit = \$0.41m per annum
Pay-back period	Pay-back period = 5.29 Years
Completion date	Over the 2018-23 period