OPTIONS EVALUATION REPORT (OER)

Protection-Time Domain Development

OER- 000000001584 revision 1.0

Ellipse project no.: P0009384
TRIM file: [TRIM No]

Project reason: Reliability - To meet overall network reliability requirements
Project category: Prescribed - Replacement

Approvals

Author	Adam Hoare	Secondary Systems Senior Analyst
Endorsed	Mark Jones	Secondary Systems and Communications Asset Manager
	Azil Khan	Investment Strategy Manager
Approved	Lance Wee	M/Asset Strategy
Date submitted for approval	13 December 2016	

Change history

Revision	Date	Amendment
0	23 November 2016	Initial issue
1	13 December 2016	Update to format

1. Need/opportunity

Power system stability has driven the need for faster transmission line protection. The ability to reduce network fault clearance times have several advantages such as:

- Increased power transfer capabilities
- Increased personnel safety
- Decreased risk of high voltage asset damage caused by prolonged system faults
- Improved power quality

Schweitzer Engineering Laboratories (SEL) have recently released a time-based protection relay (SEL-T400L) utilising a combination of travelling-wave principals and traditional incremental-quantity principals to provide ultra-high-speed line protection. Such a relay could potentially replace existing communication aided distance relays and result in cost savings through no longer requiring inter-trip devices.

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 do nothing and continue with TransGrid's operation and maintenance (O&M) for secondary system assets.

Option A — Time Domain Protection Development [OFR 1584A, OFS 1584A]

This option covers the proof of concept, pilot deployment and in-service testing of a SEL time-domain based ultra-high-speed protection relay.

The expected total capital cost to implement this option is $479k. This costing is estimated using TransGrid's "Success" estimating system.

A benefit figure of $480k per annum has been calculated for this option and is based on expected savings from no longer requiring VF inter-trip units utilised in distance protection schemes. It is expected that 4 protection schemes on suitable feeders per annum can be replaced with SEL time-based relays, and therefore a total of 8 VF units can be saved per annum.

All options have been assessed as technically feasible.

4. Evaluation

4.1 Commercial evaluation

The commercial evaluation of the technically feasible options is set out in Table 1. Details appear in Attachment 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	Do nothing	N/A	-	0.40	N/A	N/A	2
A	Time Domain Protection Development	0.48	-	N/A	2.93	2.93	1

The commercial evaluation is based on:

- a 10% discount rate
- a life of the investment of 15 years and a corresponding residual/terminal value

Discount rate sensitivities based on TransGrid's current AER-determined pre-tax real regulatory Weighted Average Cost of Capital (WACC) of 6.7% and 13% appear in Table 2.

Table 2 – Discount rate sensitivities ($ million)

Option	Description	Economic NPV @13%	Economic NPV @6.75%
A	Time Domain Protection Development	6.24	15.0

4.2 SFAIRP/ALARP evaluation

As this Need is not addressing risk there is no requirement for an SFAIRP/ALARP analysis.

4.3 Preferred option

The preferred option to address the Need is Option A - Time Domain Protection Development based on the commercial evaluation.

This option has been selected due to its technical viability, significant technical benefits and provides a positive Net Present Value (NPV).

Capital and operating expenditure

There is negligible difference in predicted ongoing operational expenditure between the option and Base Case.

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 the recommendation that Option A - Time Domain Protection Development be scoped in detail.

Attachment 1 – Commercial evaluation report

Option A NPV calculation

Project_Option Name	Time-Domain Based Protection Development

1. Financial Evaluation (excludes VCR benefits)				
NPV @ standard discount rate	10.00%	$2.93m	*NPV / Capital (Ratio)*	*6.11*
NPV @ upper bound rate	13.00%	$2.12m	*Pay Back Period (Yrs)*	*Not measurable*
NPV @ lower bound rate (WACC)	6.75%	$4.24m	*IRR%*	*59.11%*

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%	$2.93m	*NPV / Capital (Ratio)*	*6.11*
NPV @ upper bound rate	13.00%	$2.12m	*Pay Back Period (Yrs)*	*Not measurable*
NPV @ lower bound rate (WACC)	6.75%	$4.24m	*IRR%*	*59.11%*

Benefits					
Risk cost	As Is	To Be	Benefit	*VCR Benefit*	*$0.00m*
Systems (reliability)	*$0.00m*	*$0.00m*	*$0.00m*	*ENS Penalty*	*$0.00m*
Financial	*$0.00m*	*$0.00m*	*$0.00m*	*All other risk benefits*	*$0.00m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits	$0.00m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*		
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*	$0.48m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*	
Total Risk benefits	$0.00m	$0.00m	$0.00m		
Cost savings and other benefits			$0.48m	Benefits in the economic NPV**	$0.48m
Total Benefits			$0.48m	***excludes ENS penalty*	

Other Financial Drivers			
Incremental opex cost pa (no depreciation)	$0.00m	Write-off cost	$0.00m
Capital - initial $m	-$0.48m	Major Asset Life (Yrs)	15.00 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