

OPTIONS EVALUATION REPORT (OER)



Making The Grid Smarter - Albury Area Under Voltage Load Shedding

OER 000000001535 revision 4.0

Ellipse project description:

TRIM file: [TRIM No]

Project reason: Network Capability Incentive Parameter Action Plan (NCIPAP)

Project category: Prescribed - NCIPAP

Approvals

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Date submitted for approval	7 June 2016	

1. Need/opportunity

As detailed in NOS-1535, this NCIPAP proposes the installation of Under-Voltage Load Shedding (UVLS) schemes at Albury and ANM 132 kV Substations. The UVLS will reduce the amount of load at risk in the Albury Supply Area while maintaining system security. During a recall phase, it will also allow the 132 kV network to be loaded to its maximum capability but remain secure for the next contingency.

2. Related needs/opportunities

Nil.

3. Options

3.1 Base Case

The base case under this Need is to “do nothing”.

The risk cost of the Base Case was assessed in NOS-1535 as approximately \$85,000 per year, and primarily consists of the VCR risk cost. The risk cost summary for the base case is included in Attachment 2.

The VCR risk cost = Cost of supply interruption to ANM and Albury loads
= Supply interruption due to forced outage of 99B during planned outage of 99H or Jindera transformers + supply interruption due to forced outage of 99H during planned outage of 99B or Jindera transformers

Supply interruption due to forced outage of 99B during planned outage of 99H or Jindera TXs = Average load x VCR x Outage rate 99B (line¹ + terminal²) x average planned outage hours³/8,760 x Average recall time
= 188 MW x 38,350 \$/MWh x [(0.117 x 12/100) + (2 x 0.073)] x 86/8,760 x 4 hours
= \$45,311

Supply interruption due to forced outage of 99H during planned outage of 99B or Jindera TXs = Average load x VCR x Outage rate 99H (line + terminal) x average planned outage hours/8760 x Average recall time
= 188 MW x 38,350 \$/MWh x [(0.117 x 17/100) + (2 x 0.073)] x 66/8,760 x 4 hours
= \$36,045

The total VCR risk cost = \$45,311 + \$36,045 = \$81,356/year

¹ Based on TransGrid historical 132 kV line outage statistics

² Based on TransGrid historical 132 kV terminal equipment statistics

³ Based on historical average outage times

3.2 Option A — Implementation of Albury Area UVLS

This option is to develop and implement UVLS schemes at both Albury and ANM 132 kV Substations.

- > Ensure that the UVLS schemes are time-graded and shed appropriate loads in order. Load feeders for UVLS scheme to be selected in consultation with Essential Energy.
- > Make any necessary changes to secondary systems, including metering and control systems, at Albury and ANM Substations.
- > Ensure that appropriate system data will be fed to the TransGrid SCADA system for the Control Room staff. Depending upon in the Albury Supply Area loading conditions, this information can also be used to restore partial or full load to ANM, as appropriate.

This option has been assessed for feasibility in [OFS-1535A](#). The estimated capital cost of the option is \$0.21M \pm 25% in \$2016-17.

The post-project risk cost of Option A is assessed to be about \$23,000 per year. The risk cost for this option is calculated using the same formula as in the base case in section 3.1, with load at risk reduced from 188 MW to 53 MW⁴. The risk cost summary for option A is included in Attachment 3.

3.3 Non-network Solutions

No feasible non-network solutions have been identified to address this Need.

⁴ Based on system studies, expected load that will be interrupted due to UVLS.

4. Evaluation

Commercial Evaluation

Both the Base Case and Option A are technically feasible. However, as seen above, the Base Case (i.e. do nothing) would generate a risk cost of \$81,000 per year, for every year that the Need is not addressed.

In contrast, implementation of Option A would reduce the risk to \$23,000 per year.

The commercial evaluation of the technically feasible options is summarised in Table 1.

The full financial and economic evaluations are shown in Attachment 1

Table 1 – Commercial Evaluation of Options

Option	Description	Total Capex (\$m)	Ongoing Opex/yr (\$m)	Yearly Post Project Risk Cost (\$m)	Financial NPV (\$m)	Economic NPV (\$m)	Yearly Benefits (\$m)	Rank
Base case	'Do nothing'	0	0	0.081	0	0	0	2
A	Implementation of UVLS schemes in Albury area	0.21	0.004	0.023	-0.24	0.22	0.06	1

The commercial evaluation is based on:

- > A 10% discount, 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. Full economic and financial evaluation of the preferred option is provided in Attachment 1.

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

Discount Rate (%)	Economic NPV (2018/2019 \$m)
6.75	0.32
13.00	0.16

Preferred Option

The preferred option is Option A, as it improves TransGrid's risk exposure, and yields the most benefits, as calculated using TransGrid's NPV Calculation Tool (refer Attachment 1) and Risk Tool. Risk cost summary for the base case and option A is included in Attachment 2 and 3 respectively.

A summary of the preferred option can be found in Attachment 4.

ALARP Evaluation

An ALARP assessment is triggered by the following hazard with the associated disproportionate factor:

- > Unplanned outage of high voltage equipment – 3 times the safety risk reduction and taking 10% of the reliability risk reduction as applicable to safety.

However, as this will only produce 30% of the benefit derived in the commercial evaluation, a full ALARP evaluation will not produce an alternative preferred solution.

Capital and operating expenditure

The estimated capital cost for option A is \$0.21 million. The yearly incremental operating expenditure is estimated to be 2% of the upfront capital cost, which equates to \$4,200, escalated at a rate of 2.9% per annum.⁵

Regulatory Investment Test – Transmission (RIT-T)

The preferred option is not subject to the RIT-T as it is below the \$6 million threshold required.

5. Recommendation

Based on the economic evaluation above, Option A is the preferred option to address the Need as it reduces TransGrid's risk exposure and yields benefits of \$ 0.06 million.

It is therefore recommended that an RPS be completed for the implementation of Albury area UVLS scheme within the 2019 – 2023 regulatory control period.

⁵ TransGrid Success Database as at May 2016.

Attachment 1 – Financial and Economic Evaluation Reports

Project_Option Name		Need 1535 - Option A - Albury Area UVLS Scheme			
1. Financial Evaluation (excludes VCR benefits)					
NPV @ standard discount rate	10.00%	-\$0.24m	NPV / Capital (Ratio)	-1.15	
NPV @ upper bound rate	13.00%	-\$0.24m	Pay Back Period (Yrs)	Not measurable	
NPV @ lower bound rate (WACC)	6.75%	-\$0.25m	IRR%	Not measurable	
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%	\$0.22m	NPV / Capital (Ratio)	1.06	
NPV @ upper bound rate	13.00%	\$0.16m	Pay Back Period (Yrs)	3.69 Yrs	
NPV @ lower bound rate (WACC)	6.75%	\$0.32m	IRR%	26.17%	
Benefits					
Risk cost	As Is	To Be	Benefit	VCR Benefit	\$0.06m
Systems (reliability)	\$0.08m	\$0.02m	\$0.06m	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	\$0.06m
People (safety)	\$0.00m	\$0.00m	\$0.00m	Benefits in the financial NPV*	\$0.00m
Environment	\$0.00m	\$0.00m	\$0.00m	*excludes VCR benefits	
Reputation	\$0.00m	\$0.00m	\$0.00m	Benefits in the economic NPV**	\$0.06m
Total Risk benefits	\$0.08m	\$0.02m	\$0.06m	**excludes ENS penalty	
Cost savings and other benefits			\$0.00m		
Total Benefits			\$0.06m		
Other Financial Drivers					
Incremental opex cost pa (no depreciation)			-\$0.00m	Write-off cost	\$0.00m
Capital - initial \$m			-\$0.21m	Major Asset Life (Yrs)	15.00 Yrs
Residual Value - initial investment			\$0.01m	Re-investment capital	\$0.00m
Capitalisation period			1.00 Yrs	Start of the re-investment period	0.00 Yrs

Attachment 2 – Risk Cost Summary – Base Case

Current Option Assessment - Risk Summary



Project Name: Albury Area UVLS scheme

Option Name: 1535 - Base Case

Option Assessment Name: 1535 - Base Case Option - Assessment 1

Rev Reset Period: Next (2018-23)

Major Component	No.	Minor Component	Sel. Hazardous Event	LoC x CoF (\$M)	Failure Mechanism	NoxLoC xCoF (\$M)	PoF (Yr 1)	Total Risk (\$M)	Risk (\$M) (Rel)	Risk (\$M) (Op)	Risk (\$M) (Fin)	Risk (\$M) (Peo)	Risk (\$M) (Env)	Risk (\$M) (Rep)
CB-99B	2	Electrical	Unplanned Outage - HV (CB-99B)	\$28.84	Failure	\$57.68	0.07%	\$0.04	\$0.04		\$0.00			\$0.00
CB-99H	2	Electrical	Unplanned Outage - HV (CB-99H)	\$28.84	Failure	\$57.68	0.05%	\$0.03	\$0.03		\$0.00			\$0.00
Structure	1	Wooden Poles	Unplanned Outage - HV (Structure)	\$28.84	Structural Failure	\$28.84	0.02%	\$0.01	\$0.01		\$0.00			\$0.00
Structure 99H	1	Wooden Poles	Unplanned Outage - HV (Structure 99H)	\$28.84	Structural Failure	\$28.84	0.02%	\$0.01	\$0.01		\$0.00			\$0.00
				\$115.36		\$173.04		\$0.08	\$0.08		\$0.00			\$0.00

Total VCR Risk: \$0.08

Total ENS Risk: \$0.00

Attachment 3 – Risk Cost Summary – Option A

Current Option Assessment - Risk Summary



Project Name: Albury Area UVLS scheme

Option Name: 1535 - Preferred Option

Option Assessment Name: Preferred Option - Assessment

Rev Reset Period: Next (2018-23)

Major Component	No.	Minor Component	Sel. Hazardous Event	LoC x CoF (\$M)	Failure Mechanism	NoxLoC xCoF (\$M)	PoF (Yr 1)	Total Risk (\$M)	Risk (\$M) (Rel)	Risk (\$M) (Op)	Risk (\$M) (Fin)	Risk (\$M) (Peo)	Risk (\$M) (Env)	Risk (\$M) (Rep)
CB-99B	2	Electrical	Unplanned Outage - HV (CB-99B)	\$8.13	Failure	\$16.26	0.07%	\$0.01	\$0.01		\$0.00			\$0.00
CB-99H	2	Electrical	Unplanned Outage - HV (CB-99H)	\$8.13	Failure	\$16.26	0.05%	\$0.01	\$0.01		\$0.00			\$0.00
Structure	1	Wooden Poles	Unplanned Outage - HV (Structure)	\$8.13	Structural Failure	\$8.13	0.02%	\$0.00	\$0.00		\$0.00			\$0.00
Structure 99H	1	Wooden Poles	Unplanned Outage - HV (Structure 99H)	\$8.13	Structural Failure	\$8.13	0.02%	\$0.00	\$0.00		\$0.00			\$0.00
				\$32.52		\$48.78		\$0.02	\$0.02		\$0.00			\$0.00

Total VCR Risk: \$0.02

Total ENS Risk: \$0.00



Attachment 4 – Project Summary

Albury Area UVLS Scheme	Implementation of Under Voltage Load Shedding (UVLS) scheme in Albury area
Transmission Circuit / Injection Point	Essential Energy's substations at Albury and Norske Skog's paper mill at ANM 132 kV substations
Scope of works	Develop and implement UVLS schemes at both Albury and ANM 132 kV Substations
Reasons to undertake the project	To reduce amount of loads at risk during outages of Jindera transformers and line 99B or 99H or 99Z or 996.
Current value of the limit	0 MW post-contingent limit at Albury and ANM with the prior outages of lines 99H or 99Z or 99B or 996 or 997.
Target limit	188 MW average load post-contingent limit at Albury and ANM with the prior outages of lines 99H or 99Z or 99B or 996 or 997.
Capital Cost	The total capital cost is \$0.21 millions
Operating Cost	\$4,200 per annum escalate at 2.9% per year
Market benefits	The Net Market Benefit = \$0.06 M per annum NPV = \$0.22 million, using 10% WACC and 15-year term
Pay-back period	Pay-back period = 3.69 years
Completion date	Over the 2018-23 period