OPTIONS EVALUATION REPORT

NCIPAP – Deniliquin 66 kV Full SCADA Capacity

OER-1499 Revision 1.0

Ellipse project no(s): P0008709
TRIM file: [TRIM No]

Project reason: Deniliquin 66 kV Full SCADA Capacity
Project category: Prescribed - NCIPAP

Approvals

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Date submitted for approval	28 October 2016	

1. NEED/OPPORTUNITY

Deniliquin substation is presently not equipped with full SCADA connectivity.

Enabling full SCADA at the site would provide full control of all aspects of the substation and represents the most efficient and practical way to manage high voltage plant and equipment.

For details, refer to the Need/Opportunity Statement (NOS-1499).

2. RELATED NEEDS/OPPORTUNITIES

NOS-1463 Finley full SCADA connectivity.

3. OPTIONS

3.1 Base Case

The base case is to maintain the present SCADA capacity at Deniliquin substation.

This will lead to an annual total risk cost of $0.72 million. The risk cost summary is included in Attachment 2. The risk cost is primarily made up on the value of unserved energy.

Unserved Energy Cost Calculation

The unserved energy is calculated in the NOS at $710k per annum. This is based on:

- Assumed 66 kV feeder failure rate of 3.9 / 100 km per decade (or 0.39 / 100 km per annum)[1]
- Average feeder length = Total feeder length[2]/No. of feeders = 225 km/4 = 56 km
- Assuming 66 kV terminal equipment failure rate of 0.5 unit per decade (or 0.05 / unit per annum)[3]
- Average Deniliquin load of 23 MW, therefore busbar load is half on each (i.e. 11.5 MW)[4]
- Assuming manual load restoration time is 3 hours[5]
- Value of customer reliability (VCR) of $38.35/kWh[6]

Risk Cost = [(66 kV feeder failure rate) x (no. of feeders) x (average feeder load) + (term equip failure rate) x (average bus section load) x (no. of busbars)] x (VCR) x (restoration time)

= [{(0.39 x (56/100)} x 4 x 5.75) + (0.05 x 11.5 x 2)] x 3 x 38.35 x 1000

= [0.2184 x 4 x 5.75 +0.05 x 2 x 11.5] x 3 x 38.35 x 1000

= (5.0232 + 1.15) x (115,050)

= $710,227

[1] Based on TransGrid historical outage statistics as at May 2016 – refer to the file “Reliability Analysis - Final Summary.xlsx” in PDGS Supporting Documents (132 kV feeder failure rate is assumed)

[2] TransGrid Electrical Database 2015

[3] Historical outage statistics – refer to the file “Reliability Analysis - Final Summary.xlsx” in PDGS Supporting Documents

[4] Based on historical Deniliquin load data for 2015-16 - refer to the file “Deniliquin Load 2015-16.xlsx” in PDGS Supporting Documents

[5] Based on travel times to the substation from Wagga and standard times for restoration

[6] AEMO, Value of Customer Reliability – Application Guide.

3.2 Option A – Install full SCADA capacity at Deniliquin substation 66 kV

This option is to install full SCADA capacity to the 66 kV at Deniliquin substation to provide full operating and monitoring capabilities.

This option has been assessed for feasibility in OFS-1499A. The estimated un-escalated capital cost of the option is $0.65 M ± 25% in 2016-17 AUD.

The post-project risk cost of Option A is assessed to be $0.13 million per year. The post project risk cost summary has been included in Attachment 2. The post project risk cost is primarily made up on the value of unserved energy.

Option Risk Cost

The post-option unserved energy is calculated to be $118k per annum. This is based on:

> Assuming remote load restoration time is 30 minutes

Risk Cost = [(66 kV feeder failure rate) x (no. of feeders) x (average feeder load) + (term equip failure rate) x (average substation load) x (no. of busbars)] x (VCR) x (restoration time)

= [(0.39 x (56/100) x 4 x 5.75) + (0.05 x 11.5 x 2)] x 0.5 x 38.35 x 1000

= (5.0232 + 1.15) x (19,175)

= $118,371

4. EVALUATION

Commercial Evaluation

A single option was identified and is evaluated below against the base case.

The economic evaluation of the technically feasible options is set out in Table 1.

Table 1 – Options Comparison

Option	Description	Capex ($m)^#	Opex ($m)	Yearly post project risk cost ($m)	NPV ($m)	Rank
Base case	'Do nothing'	Nil	-	0.72	-	2
A	Install full SCADA capacity at Deniliquin substation 66 kV	0.65*	0	0.13	3.85	1

^ In 2016-17 dollars
 # Expenditure in 2018-19 period
** Non-escalated cost*

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	4.83
13.00	3.17

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 to Attachment 1) and Risk Tool. Risk cost summaries are included in Attachment 2.

A summary of the preferred option can be found in Attachment 3.

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

There is no capital and operating expenditure trade-offs associated with this option.

Payback period

Expected payback period for Option A is 1.1 years.

Regulatory Investment Test

No RIT-T is required for this project as the total cost is less than $6 million.

5. Recommendation

It is recommended that Option A be implemented, to expand the SCADA system at Deniliquin to provide full operating and monitoring capabilities on the 66 kV. This will reduce TransGrid's risk exposure and yield a yearly benefit of $0.59 million.

Attachment 1 – Financial and Economic Evaluation Reports

Project_Option Name	Deniliquin 66 kV Full SCADA Capacity

1. Financial Evaluation (excludes VCR benefits)

NPV @ standard discount rate	10.00%	-$0.65m	*NPV / Capital (Ratio)*	*-1.00*
NPV @ upper bound rate	13.00%	-$0.65m	*Pay Back Period (Yrs)*	*Not measurable*
NPV @ lower bound rate (WACC)	6.75%	-$0.65m	*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%	$3.85m	*NPV / Capital (Ratio)*	*5.93*
NPV @ upper bound rate	13.00%	$3.17m	*Pay Back Period (Yrs)*	*1.10 Yrs*
NPV @ lower bound rate (WACC)	6.75%	$4.83m	*IRR%*	*91.05%*

Benefits

Risk cost	As Is	To Be	Benefit
Systems (reliability)	*$0.71m*	*$0.12m*	*$0.59m*
Financial	*$0.00m*	*$0.00m*	*$0.00m*
Operational/compliance	*$0.01m*	*$0.01m*	*$0.00m*
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*
Environment	*$0.00m*	*$0.00m*	*$0.00m*
Reputation	*$0.00m*	*$0.00m*	*$0.00m*
Total Risk benefits	$0.72m	$0.13m	$0.59m
Cost savings and other benefits			$0.00m
Total Benefits			$0.59m

VCR Benefit	*$0.59m*
ENS Penalty	*$0.00m*
All other risk benefits	*$0.00m*
Total Risk benefits	$0.59m
Benefits in the financial NPV*	$0.00m
**excludes VCR benefits*	
Benefits in the economic NPV**	$0.59m
***excludes ENS penalty*	

Other Financial Drivers

Incremental opex cost pa (no depreciation)	$0.00m	Write-off cost	$0.00m
Capital - initial $m	-$0.65m	Major Asset Life (Yrs)	15.00 Yrs
Residual Value - initial investment	$0.00m	Re-investment capital	$0.00m
Capitalisation period	1.00 Yrs	Start of the re-investment period	2031-32

Attachment 2 - Base Case Risk Cost Summary

Current Option Assessment - Risk Summary

Project Name: Deliniquin 66kV Full SCADA Capacity Augmentation

Option Name: 1499 - Base Case

Option Assessment Name: 1499 - Base Case - 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)
Busbar	2	Busbar	Unplanned Outage - HV (Busbar Failure)	$1.39	Structural Failure	$2.79	5.00%	$0.14	$0.13		$0.00			$0.00
Conductor	4	Conductor (inc Joints)	Unplanned Outage - HV (Feeder failure)	$0.66	Break	$2.65	21.80%	$0.58	$0.58					
				$2.06		$5.44		$0.72	$0.71		$0.00			$0.00

Total VCR Risk: $0.71

Total ENS Risk:

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Attachment 2 – Option A Risk Cost Summary

Current Option Assessment - Risk Summary

Project Name: Deliniquin 66kV Full SCADA Capacity Augmentation

Option Name: 1499 - Option A

Option Assessment Name: 1499 - Option A

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)
Busbar	2	Busbar	Unplanned Outage - HV (Busbar Failure)	$0.29	Structural Failure	$0.58	5.00%	$0.03	$0.02		$0.00			$0.00
Conductor	4	Conductor (inc Joints)	Unplanned Outage - HV (Feeder failure)	$0.11	Break	$0.44	21.80%	$0.10	$0.10					
				$0.40		$1.03		$0.13	$0.12		$0.00			$0.00

Total VCR Risk: $0.12

Total ENS Risk:

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Attachment 3 – Summary of the Project

Deniliquin 66 kV Full SCADA Capacity	
Transmission circuit / Injection point	Deniliquin 132/66 kV substation
Scope of works	Provide full SCADA capacity to the Deniliquin 66 kV
Reasons to undertake the project	Full SCADA control and monitoring improvements to significantly reduce the restoration time of the Deniliquin 66 kV supplies.
Current value of the limit	0 MW for feeders and bus faults with 3 hours restoration time.
Target limit	Full restoration of supply at the injection point (23 MW average loads) within 0.5 hours.
Capital cost	The total capital cost is $0.65 million
Operating cost	Nil
Market benefits	Benefit = ENS with 3 hours restoration – ENS with 0.5 hours restoration = $0.71 - $0.12 million / year **=** $0.59 million / year
Pay-back period	1.1 years
Completion date	Within the regulatory period 2018-2023