

OPTIONS EVALUATION REPORT (OER)



Making the Grid Smarter – Installation of transfer tripping scheme at Gadara, Tumut and Burrinjuck

OER 00000001401 revision 7.0

Ellipse project description: Gadara Transfer Tripping Scheme
TRIM file: [TRIM No]

Project reason: Imposed Standards - Control Systems to meet NER requirements

Project category: Prescribed - NCIPAP

Approvals

Author	Son Nguyen	Power System Analyst
Endorsed	Jahan Peiris	Network Modelling & Performance Manager
	Hoang Tong	Operation Analysis Manager
	Garrie Chubb	Investment Support Manager
Approved	Andrew Kingsmill	Manager/Power System Analysis
Date submitted for approval	7 December 2016	

1. Need/opportunity

As detailed in NOS-1401, a coincident outage of two lines in the 132 kV network connecting Gadara and Tumut (e.g. Line 970 and Line 993) could result in an island consisting of generation and load (e.g. in the case of outage of Lines 970 and 993, Tumut town and Visy paper mill loads and the Blowering, Burrinjuck and Visy generators will be in an island). The islanded system may operate in an unstable manner.

This NCIPAP project proposes to implement a transfer tripping scheme to avoid islanding operation of Burrinjuck and Blowering hydro generators and Gadara paper mill co-generation.

2. Related needs/opportunities

Nil.

3. Options

3.1 Base Case

The base case under this Need is to “do nothing” and continue to constrain the generation from Blowering, Burrinjuck power station to zero during the planned or forced outage of any one of the 132 kV lines in this interconnected network. Constraining cheap renewable generation in NSW will require thermal plant to meet the balance of generation. The higher cost of thermal generation increases the cost to the consumer and results in a negative market benefit.

3.2 Option A – Implementation of transfer tripping scheme at Gadara, Tumut and Burrinjuck

This option required implementation of a transfer tripping scheme with the following functionality:

- > The ability to arm/disarm the scheme using SCADA
- > Monitor the Circuit Breaker Status of Lines 993, 99P, 992 and 970
- > If two lines are off-loaded as given in the table below (i.e. at least one end CB is open on two lines), send transfer trip signals to trip the “Lines to be tripped”
- > This scheme needs to be implemented within Control/Protection Systems since the SCADA time frame is not adequate.

Table 1

Line outage combinations to be monitored	Lines to be tripped
970 & 993	Lines 99P, 992 and O97B
992 & 993	Lines 99P and O97B
970 & 99P	Lines 992 and O97B
992 & 99P	Line O97B

This option has been assessed for feasibility in [OFS-1401A Rev 1](#). The estimated un-escalated capital cost of the option is \$0.36 million ± 25% in 2016-17 AUD.

Market Benefit Calculation

The market benefit of implementing a transfer tripping scheme to allow the generation from Blowering, Burrinjuck power station to generate during the planned or forced outage of any one of the 132 kV lines in this interconnected network per year is assessed based on the following assumptions:

Average generation cost of thermal generation compared to renewable generation¹ = \$25/MWh

Blowering Benefit² = Average Blowering generation³ x generation cost x total outage hour (planned and unplanned outages of 970,992,993 and 99P lines⁴)
= 26.52 MW x \$25/MWh x (20+76+9+37) = \$94K / year

Burrinjuck Benefit⁵ = Average Burrinjuck generation⁷ x total outage hour (planned and unplanned outages of 970,992,993 and 99P lines²)
= 2.2 MW x \$25/MWh x (20+76+9+37) = \$7.8K / year

Using the above assumptions and calculation, the market benefits is assessed for Blowering and Burrinjuck to be \$101.8K per year

3.3 Non-Network Option

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

¹ Based on the NSW Black Coal variable costs of \$25 – refer page 61 of Jacobs report “Retail electricity price history and projections.pdf” filed in PDGS supporting documents. Typical bid price for renewable (wind/solar) generation is either \$0 or negative. Accordingly, Market impact = \$25 - \$0 = \$25.

² Typically, Blowering Bid Prices are less than the NSW Price. Refer file “Blowering Bid Price comparison example” in PDGS.

³ Based on historical Blowering & Burrinjuck generation – refer to file “1401 – Risk Assessment” in PDGS for details.

⁴ TransGrid historical asset performance assessment – as at May 2016.

⁵ Burrinjuck is a non-scheduled generator. Constraining Burrinjuck will cost the market at least NSW Dispatch Price or more per MW of Burrinjuck generation.

4. Evaluation

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

The commercial evaluation of the technically feasible options is summarised in Table 2.

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

Table 2 – Commercial Evaluation

Option	Description	Total Capex (\$m)	Ongoing Opex / yr (\$m)	Post project risk cost / Benefit (\$m)	Economic NPV (\$m)	Rank
Base case	'Do nothing'	0	0	0	0	2
A	Implementation of transfer tripping scheme at Gadara/Tumut	0.36	0.007	-0.10 (Benefit)	0.34	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	0.49
13.00	0.24

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 and Risk 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 \$7,200 escalated at a rate of 2.9% per annum.⁶

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.

⁶ TransGrid Success Database as at May 2016.

5. Recommendation

Based on the economic evaluation above, Option A is the preferred option to address the Need as it yields a net yearly benefit of \$0.10 million. This includes market benefit \$0.10 million and ongoing opex \$0.007 million.

It is therefore recommended that an RPS be completed for the implementation of transfer tripping scheme at Gadara, Tumut and Burrinjuck substations over the 2018-23 period.

Attachment 1 – Financial and Economic Evaluation Reports

Project_Option Name			Need 1401 - Option A - Gadara Transfer Tripping Scheme		
1. Financial Evaluation (excludes VCR benefits)					
NPV @ standard discount rate	10.00%	\$0.34m	NPV / Capital (Ratio)	0.94	
NPV @ upper bound rate	13.00%	\$0.24m	Pay Back Period (Yrs)	0.25 Yrs	
NPV @ lower bound rate (WACC)	6.75%	\$0.49m	IRR%	24.75%	
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%	\$0.34m	NPV / Capital (Ratio)	0.94	
NPV @ upper bound rate	13.00%	\$0.24m	Pay Back Period (Yrs)	3.87 Yrs	
NPV @ lower bound rate (WACC)	6.75%	\$0.49m	IRR%	24.75%	
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	Benefits in the financial NPV*	\$0.10m
Environment	\$0.00m	\$0.00m	\$0.00m	*excludes VCR benefits	
Reputation	\$0.00m	\$0.00m	\$0.00m	Benefits in the economic NPV**	\$0.10m
Total Risk benefits	\$0.00m	\$0.00m	\$0.00m	**excludes ENS penalty	
Cost savings and other benefits			\$0.10m		
Total Benefits			\$0.10m		
Other Financial Drivers					
Incremental opex cost pa (no depreciation)			-\$0.01m	Write-off cost	\$0.00m
Capital - initial \$m			-\$0.36m	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	0.00 Yrs

Attachment 2 – Summary of the Preferred Option

Gadara Transfer Tripping Scheme	Implementation of Transfer Tripping Scheme at Gadara, Tumut and Burrinjuck
Transmission Circuit / Injection Point	Tumut, Gadara, Burrinjuck
Scope of works	Implement a control system to trip: 99P, 992 and 097B during outage combinations of 970, 992, 993, 99P. The ability to arm/disarm the scheme using SCADA
Reasons to undertake the project	To avoid generation constraint during outages of line 970, 992, 993 or 99P.
Current value of the limit	These generators are constrained to 0 MW during outages of line 970, 992, 993 or 99P
Target limit	Increase the limit of the injections points on embedded generation in this area to 100 % generation availability (name plate rating = 140 MW)
Capital Cost	The total capital cost is \$0.34 millions The NPV cost = \$0.4 million, using 10% WACC and 15-year term
Operating Cost	\$7,200 escalate at 2.9% per year
Market benefits	Market Benefit = \$0.1 million/year The NPV benefit = \$0.34 million, using 10% WACC and 15-year term
Pay-back period	3.87 years
Completion date	Over the 2018-23 period