

OPTIONS EVALUATION REPORT (OER)



Macarthur 66 kV Line Switchbay for Endeavour Energy
Connection of New Menangle Park Zone Substation

OER 000000001437 revision 2.1

Ellipse project description: Macarthur 66 kV Line Switchbay for Endeavour Energy Connection of New Menangle Park Zone Substation

TRIM file: [TRIM No]

Project reason: Reliability - To meet connection point reliability requirements

Project category: Prescribed - Connection

Approvals

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Change history

Revision	Date	Amendment
0	22/06/2016	Initial Issue
1	27/10/2016	Updated costs and NPVs
2	28/10/2016	Formatting changes
3		Updated risk costs based on latest NOS

1. Need/opportunity

Through the joint planning (JP) process, Endeavour has informed TransGrid that it plans to establish two new zone substations (ZSs) to meet the supply needs of the NSW Department of Planning and Infrastructure's (DPI's) proposed new developments under its [Greater Macarthur Land Release](#). See [NOS-1437](#) for details.¹

The expected Need date for Menangle Park ZS to take supply from Macarthur Substation is summer 2019/20. The timing is to be confirmed with Endeavour through the JP process.

2. Related needs/opportunities

The following Needs at Macarthur BSP have similar Need dates and consideration should be given to packaging all emerging works into a single project, if possible:

- > Need 1444 – Macarthur 66 kV Line Switchbay (Mt Gilead ZS) – Need Date 2021.
This switchbay will be needed to supply the proposed Mt Gilead ZS, which has been identified as another distribution supply point for the Greater Macarthur Land Release.
- > Need 1438 – Constraints in Endeavour Energy's 132 kV Network between Macarthur and Nepean – Need Date 2020.

The nature of the constraint is an overloading of Endeavour's two 120 MVA 132/66 kV transformers following a forced outage of TransGrid's single existing 330/66 kV transformer at Macarthur Substation. Options are being developed and evaluated jointly by TransGrid and Endeavour to determine the most cost-effective option to address the constraint.

3. Options

Base Case

The base case under this Need is to "do nothing". In practice, this means refraining from any capital investment, i.e. not facilitating the connection of Endeavour Energy's Menangle Park ZS.

As outlined in [NOS-1437](#), the risk cost of not addressing this Need is therefore composed of the following components:

- > exposing customer load of 3.04 MW to risk of being unsupplied.
- > damage to TransGrid's reputation (negative media coverage).
- > litigation by customers/consumer groups.

The total cost of these risks has been calculated in TransGrid's Investment Risk Tool thus:

VCR Risk Cost (Unserviced Energy)

*VCR risk cost = load at risk * probability of Menangle Park going unsupplied for one day * VCR*

*∴ VCR risk cost = 3.04 MW * 24 hrs * \$38,350/MWh*

∴ VCR risk cost = \$2.8 million per annum

Reliability Risk Cost

Reliability risk cost = VCR risk cost + litigation costs

¹ Need/opportunity Statement 1437 - Macarthur 66 kV Line Switchbay for Endeavour Energy Connection of New Menangle Park Zone Substation, <<http://thewire/projects/prew/000000001437/Shared%20Documents/Milestone%20Documents/NS-000000001437.docx>>, accessed 7 December 2016.

$$\therefore \text{Reliability risk cost} = \$2.8\text{m} + \$0.01\text{m} = \$2.81 \text{ million per annum}$$

Financial Risk Cost

$$\text{Financial risk cost} = \text{internal investigation costs} = \$10,000$$

Reputational Risk Cost

$$\text{Reputational risk cost} = \text{external consultations \& communications costs} = \$33,000$$

Total Risk Cost

$$\text{Total risk cost} = \text{Reliability risk cost} + \text{Financial risk cost} + \text{Reputational risk cost}$$

$$\therefore \text{Total risk cost} = \$2.85 \text{ million per annum}$$

Option A — Macarthur 66 kV Line Switchbay for Endeavour Energy Connection of New Menangle Park Zone Substation <OFR-1437A, OFS-1437A>

The following works are required by TransGrid under this option:

- > Installation and commissioning of a new 66 kV feeder bay at Macarthur Substation;
- > Connect Endeavour's feeder from Menangle Park ZS to the new bay; and
- > Installation and commissioning of all necessary secondary systems in the switchbay.

This option has been assessed for feasibility in [OFS-1437A](#). The estimated un-escalated capital cost of the option is \$1.25 million \pm 25% in 2016-17 AUD.

The post-project risk cost of Option A is assessed to be zero. This is based on the extremely low probability of failure of the new connection point considering TransGrid historical outage rates and restoration times for switchbays. The post-option risk cost is therefore composed of the VCR risk cost, thus:

VCR Risk Cost (Unservd Energy)

$$\text{VCR risk cost} = \text{load at risk} * \text{probability of outage of Menangle Park connection at Macarthur}^2 * \text{VCR}$$

$$\text{VCR risk cost} = \text{load at risk} * \frac{[\text{connection point outage rate}] * [\text{connection point outage duration}]}{[\text{Total hours in a year}]} * \text{VCR}$$

$$\text{VCR risk cost} = 3.04 \text{ MW} * \frac{0.073 * 1}{8760} * \$38,350/\text{MWh}$$

$$\therefore \text{VCR risk cost} = 3.04 \text{ MW} * 0 * \$38,350/\text{MWh}$$

$$\therefore \text{VCR risk cost} = \$0 \text{ per annum}$$

Non-network Solutions

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

² Based on TransGrid historical outage rates for connection points (7.3%) and restoration time (1 hour).

4. Evaluation

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

Table 1: Commercial Evaluation of the Technically Feasible Options

Option	Description	Total Capex (\$m)	Yearly Opex (\$m)	Yearly Post Project Risk Cost (\$m)	Economic NPV (\$m)	Financial NPV (\$m)	Rank
Base case	'Do nothing' (Do not make new connection).	-	-	2.85	-	-	2
A	Construct a new Macarthur 66 kV Line Switchbay for Endeavour Energy Connection of New Menangle Park ZS	1.249	0.025	0.00	22.67	(1.02)	1

The commercial evaluation is based on:

- (a) a 10% discount rate
- (b) a life of the investment of 15 years and a corresponding residual/terminal value
- (c) Discount rate sensitivities based on TransGrid's current AER-determined pre-tax real regulatory WACC of 6.75 percent and 13% appear in Table 3 for the preferred option, A:

Table 3: Discount rate sensitivities (\$ million)

Option	Description	Economic NPV @ 13%	Economic NPV @ 6.75%
A	Construct a new Macarthur 66 kV Line Switchbay for Endeavour Energy Connection of New Menangle Park ZS	17.39	22.67

ALARP Evaluation

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

- > Unplanned outage of HV equipment → 3 times the safety risk reduction and taking 10% of the reliability risk reduction as being applicable to safety.

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

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 \$0.025 million, escalated at a rate of 2.9% per annum.³

Regulatory Investment Test – Transmission (RIT-T)

³ TransGrid Success Database as at May 2016.

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:

- > enables TransGrid to meet its supply obligations under the National Electricity Rules.
- > significantly reduces TransGrid's risk exposure and reduces the risk from \$2.85m to zero.

It is therefore recommended that an RPS be completed for the construction of a new 66 kV line switchbay at Macarthur BSP for the connection of Endeavour Energy's proposed Menangle Park ZS in 2019/20.

Appendix A - Financial and Economic Evaluation Reports

Project_Option Name

Need 1437 - Option A - Construct 66 kV Switchbay

1. Financial Evaluation (excludes VCR benefits)

NPV @ standard discount rate	10.00%	-\$1.02m	NPV / Capital (Ratio)	-0.81
NPV @ upper bound rate	13.00%	-\$1.04m	Pay Back Period (Yrs)	Not measurable
NPV @ lower bound rate (WACC)	6.75%	-\$0.96m	IRR%	-2.48%

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%	\$22.67m	NPV / Capital (Ratio)	18.15
NPV @ upper bound rate	13.00%	\$17.39m	Pay Back Period (Yrs)	Not measurable
NPV @ lower bound rate (WACC)	6.75%	\$31.66m	IRR%	129.73%

Benefits

Risk cost	As Is	To Be	Benefit	VCR Benefit	\$2.80m
Systems (reliability)	\$2.81m	\$0.00m	\$2.81m	ENS Penalty	\$0.00m
Financial	\$0.01m	\$0.00m	\$0.01m	All other risk benefits	\$0.05m
Operational/compliance	\$0.00m	\$0.00m	\$0.00m	Total Risk benefits	\$2.85m
People (safety)	\$0.00m	\$0.00m	\$0.00m	Benefits in the financial NPV*	\$0.05m
Environment	\$0.00m	\$0.00m	\$0.00m	*excludes VCR benefits	
Reputation	\$0.03m	\$0.00m	\$0.03m	Benefits in the economic NPV**	\$2.85m
Total Risk benefits	\$2.85m	\$0.00m	\$2.85m	**excludes ENS penalty	
Cost savings and other benefits			\$0.00m		
Total Benefits			\$2.85m		

Other Financial Drivers

Incremental opex cost pa (no depreciation)	-\$0.02m	Write-off cost	\$0.00m
Capital - initial \$m	-\$1.25m	Major Asset Life (Yrs)	40.00 Yrs
Residual Value - initial investment	\$0.37m	Re-investment capital	\$0.00m
Capitalisation period	2.00 Yrs	Start of the re-investment period	0.00 Yrs