OPTIONS EVALUATION REPORT (OER)

Molong Reinforcement

OER- 000000001696 revision 1.0

Ellipse project no(s): P0010128
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Project reason: Reliability - To meet connection point reliability requirements
Project category: Prescribed - Augmentation

Approvals

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Date submitted for approval	5/12/2016	

Change history

Revision	Date	Amendment
0	8/11/16	Initial Issue
1	27/11/2016	Updated risk costs and NPVs.
2		Clarified unserved energy calculations to align with NOS

1. Need/opportunity

The Independent Pricing and Regulatory Tribunal (IPART) was asked to recommend a reliability planning standard for electricity transmission in NSW, and in doing so have recommended a new reliability standard based on levels of reliability redundancy and an annual unserved energy allowance.

IPART's optimisation model makes recommendations on the optimal value of expected unserved energy at each Bulk Supply Point (BSP) which the TNSP is expected to comply.

The new reliability standard is to be applied from 1 July 2018 for each BSP, should the NSW Minister for Infrastructure approve the *Electricity transmission reliability standards - Draft Report May 2016*[a] and the *Electricity transmission reliability standards - Supplementary Draft Report September 2015*[b]. Molong needs to reduce its expected unserved energy minutes from the existing 108 minutes to 46 minutes (maximum value per year in minutes at average demand) [c].

2. Related needs/opportunities

These Needs are related in that they are also addressing an excess of unserved minutes per IPART's draft reliability standard:

- Need 1649 – Reliability of Supply to Broken Hill
- Need 1697 – Mudgee Reinforcement

3. Options

Base case

This option is to continue to operate the present Molong 66 kV supply arrangement and maintain the reliability level at the present 108 expected unserved energy (USE) minutes by using TransGrid's historical Molong transformer outage data. Essential Energy advised in their submission[d] to *IPART's Draft Reliability Standard Supplementary Report* that

"*Whilst informal back-up is available via Essential Energy's distribution network it cannot be permanently relied upon for an extended duration (catastrophic) single transformer outage."*

As such the Essential Energy network can not be relied on to provide a backup supply in the event of a catastrophic failure of the existing Molong 132/66 kV transformer.

The scope of the option is to maintain the present Molong assets through ongoing maintenance and will not involve any capital expenditure. However, this would also result in the Molong 66 kV connection point not compliant with the proposed network reliability standard which does not meet the need and is therefore not technically feasible.

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[a] *Electricity transmission reliability standards - An economic assessment Energy — Draft Report May 2016, https://www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/investigation-section-12-publications-electricity-transmission-reliability-standards/draft_report_-_electricity_transmission_reliability_standards_-_may_2016.pdf, retrieved on 2 December 2016.*

[b] *Electricity transmission reliability standards - Unserved energy allowances for Inner Sydney and Broken Hill, Molong, Mudgee, Munyang and Wellington Town Energy — Supplementary Draft Report September 2015 (sic), https://www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/investigation-section-12-publications-electricity-transmission-reliability-standards/supplementary-draft-report-electricity-transmission-reliability-standards-september-2016.pdf, retrieved on 2 December 2016.*

[c] See footnote a.

[d] *Essential Energy submission on Electricity Transmission Reliability Standards – Supplementary Draft Report https://www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/investigation-section-12-submissions-electricity-transmission-reliability-standards-supplementary-draft-report/online-submission-essential-energy-b.-supple-28-oct-2016-161618220.pdf, retrieved on 28 October 2016.*

The primary risk for TransGrid not addressing the identified need is non-compliance with the *Draft Electricity Transmission Reliability Standards.*

The risk cost of not addressing this Need is therefore composed of the following components:

- exposing customer connections to an excess of unserved energy of 62 minutes by TransGrid's historical Molong transformer outage data, or 199 minutes by using IPART's generic transformer outage data.
- application of a fine similar to the civil penalty as defined in the National Electricity Law (1996).
- damage to TransGrid's reputation (negative media coverage).
- litigation by customers/consumer groups.

VCR Risk Cost

$$VCR\ risk\ cost = Excess\ USE\ in\ MWh * VCR^{e}$$

$$Excess\ USE\ in\ MWh = \frac{excess\ USE\ in\ "minutes"}{60} * \{estimated\ average\ annual\ demand\ at\ Molong\ in\ MW\}$$

$$Excess\ USE\ in\ MWh = \frac{62}{60} hrs * 2.4\ MW^{f} = 2.48\ MWh$$

$$\therefore VCR\ risk\ cost\ = 2.48\ MWh/year * \$38{,}350/MWh = \$\mathbf{95{,}108\ per\ annum}$$

Note that the VCR risk cost is expected to be the same every year of the 2018 – 2023 regulatory period, as the Molong load is forecast to be constant during the period.[g]

Reliability Risk Cost

$$Reliability\ risk\ cost = VCR\ risk\ cost + litigation\ cost^{h}$$

$$\therefore\ Reliability\ risk\ cost = \$95{,}108 + \$110$$

$$\therefore\ \mathbf{Reliability\ risk\ cost} = \$\mathbf{95{,}218\ per\ annum}$$

Financial Risk Cost

$$Financial\ risk\ cost\ = civil\ penalty^{i} + investigation\ cost^{j}$$

$$\therefore\ \mathbf{Financial\ risk\ cost}\ = \$\mathbf{806\ per\ annum}$$

Reputation Risk Cost

$$Reputational\ risk\ cost\ = external\ consultations\ \&\ communications\ costs^{k}$$

$$\therefore\ \mathbf{Reputational\ risk\ cost}\ = \$\mathbf{37\ per\ annum}$$

Total Risk Cost

$$total\ risk\ cost = Reliability\ risk\ cost + financial\ risk\ cost$$

$$\therefore\ total\ risk\ cost = \$95{,}211 + \$793$$

$$\therefore\ \mathbf{total\ risk\ cost} = \$\mathbf{96{,}061\ per\ annum}$$

A risk-cost summary extract from the Investment Risk Tool appears in Attachment 1. A full risk cost breakdown report is available on PDGS.

[e] TransGrid's Investment Risk Tool bases the Value of Customer Reliability (VCR) on figures published by AEMO in its Value of Customer Reliability Review - Final Report, September 2014. In this case we use the mixed residential/industrial figure of $38,350/MWh.

[f] IPART's Supplementary Draft Report (September 2016) defines Average Demand as the total energy supplied during the year (MWh) divided by the number of hours in the year. TransGrid historical data in 2015 shows an average demand of 2.4 MW at Molong.

[g] TransGrid 2016, *Transmission Annual Planning Report*, 30 June 2016.

[h] This component is an assumed litigation risk cost.

[i] As per NEL clause 2AA. Assuming the Need goes unaddressed for the duration of the five-year regulatory period.

[j] This component is an assumed financial risk cost.

[k] This component is an assumed reputational risk cost.

Option A — Installation of a second 132/66 kV transformer at Molong

This option is to install a second 132/66 kV transformer at Molong to improve the reliability of the 66 kV connection point supply.

As discussed in NS-1696, Essential Energy advised that their backup supply to the area cannot be permanently relied upon for an extended duration (catastrophic) single transformer outage. The probability of both Molong 132/66 kV transformers tripping will be significantly lower than the probability of a single Molong 132/66 kV transformer outage.

The post-option risk cost is composed of the VCR risk cost as follows:

$$VCR\ risk\ cost = USE\ in\ MWh * VCR^{l} = \left(Total\ Energy\ at\ Risk * P_{double\ outages}\right) * VCR$$

Where:

$$P_{double\ outage} = P_{Tx1} * P_{Tx2} = \frac{Tx\ Outage\ Rate1 * Tx\ Outage\ Duration1}{365\ days * 24\frac{hours}{day}} * \frac{Tx\ Outage\ Rate2 * Tx\ Outage\ Duration2}{365\ days * 24\frac{hours}{day}}$$

$$P_{double\ outage} = \frac{0.286 * 6.3}{365 * 24} * \frac{0.286 * 6.3}{365 * 24} = 4.23 * 10^{-8}$$

$$USE\ in\ MWh = Total\ Energy\ at\ Risk * P_{double\ outages} = 21000\ MWh * 4.23 * 10^{-8} = 0.00089$$

$$\therefore\ VCR\ risk\ cost = 0.00089 * \$38{,}350/MWh = \$34/annum^{m}$$

$$USE\ in\ minutes = \frac{USE\ in\ MWh}{Estimated\ average\ annual\ demand\ in\ MW} * 60\ minutes/hr$$

$$\therefore\ USE\ in\ minutes = \frac{0.00089}{2.4} * 60 = 0.022\ minutes$$

This option is expected to reduce the calculated USE minutes from 108 minutes to around 0 minutes, and therefore the post-project risk cost of this option reduces to $34.

The expected capital cost for this option is $3.7 million ± 25% (in un-escalated 2016 - 17 dollars), spread over 2 years. The scope of works included in this option is outlined in OFS-1696A.

Option B — Demand Management

This option is to secure an amount of demand management equal to the value of the excess unserved energy as a result of not meeting the IPART recommended reliability standard. The excess unserved energy is 2.48 MWh / annum using TransGrid's Molong transformer historical outage data and this requires a demand management. The level of demand management is 1.5 MW[n].

It is anticipated that demand management is not technically feasible due to the remote geographic location with the aggregation of small loads[o].

[l] TransGrid's Investment Risk Tool bases the Value of Customer Reliability (VCR) on figures published by AEMO in its Value of Customer Reliability Review - Final Report, September 2014. In this case we use the mixed residential/industrial figure of $38,350/MWh.

[m] The energy at risk at Molong when the firm capacity is 0 MW during 2015 is 21000 MWh.

[n] Refer OSA-1696.

[o] Essential Energy Distribution Annual Planning Report, https://www.essentialenergy.com.au/asset/cms/pdf/electricitynetwork/DAPR-2015.pdf, Retrieved on 6/12/2016.

4. Evaluation

4.1 Technical evaluation

Only option A is technically feasible.

The Base Case is not technically feasible due to the existing Molong 66 kV connection point is not compliant with the proposed network reliability standard. Option B is not technically feasible due to the remote geographic location with aggregation of small loads.

4.2 Commercial evaluation

The commercial evaluations of the technically feasible options are set out in Table 1. The full financial and economic evaluations are shown in Appendix A.

Table 1 — Commercial Evaluation of Technically Feasible Options

Option	Description	Total Capex ($m)	Annual Opex/ yr ($m)	Annual Post project risk cost ($m)	Financial NPV @10% ($m)	Economic NPV @ 10% ($m)	Rank
Base case	'Do Nothing'	-	-	0.096	-	-	-
A	Installation of a second 132/66 kV transformer at Molong	3.70	0.074	0	(3.73)	(2.99)	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.
- The applied sensitivity on the discount rate given the following NPVs of the preferred option A:

Table 1 - Preferred Option

Option	Description	Economic NPV @ 6.75% ($m)	Economic NPV @ 13% ($m)
A	Installation of a second 132/66 kV transformer at Molong	(3.09)	(2.87)

4.3 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 option.

4.4 Compliance with Reliability Legislation

The objective of the IPART Electricity Transmission Reliability Standards is to:

- *Move away from a standard that is heavily based on network capability and towards one which better focuses on what customers value*
- *Introduce the concept of positive expected unserved energy into TransGrid's decision making processes*
- *Make explicit provision for the standards to be met using non-network solutions*
- *Not result in a significant change from the current level of reliability experienced by customers*

IPART has recommended that the standards be adopted as a planning standard, and not a performance standard. TransGrid is expected to undertake simulation modelling as part of the planning process, which IPART can review when assessing compliance. IPART has recommended that simulations be undertaken using life-cycle average failure rates rather than actual condition based failure rates.

Option A enables TransGrid to comply with the new reliability standard by reducing the USE level to within 46 minutes.

4.5 Preferred Option

The preferred option is to install a second 132/66 kV transformer at Molong (Option A).

Capital and operating expenditure

The yearly incremental operating expenditure of Option A is estimated to be 2% of the upfront capital cost of the option, which equates to $0.074 million, escalated at a rate of 2.9% per annum.

Regulatory Investment Test

No RIT-T is required for this project is valued at less than the $6 million threshold.

5. Recommendation

Based on the options evaluated, Option A – Installation of a second 132/66 kV transformer at Molong, is the preferred option with the least cost solution to comply with the new draft reliability standard. It is recommended that the preferred option be scoped in detail.

Appendix A – Financial and Economic Evaluation

Project_Option Name	Need 1696 - Option A - Second 132/66 kV transformer

1. Financial Evaluation (excludes VCR benefits)

NPV @ standard discount rate	10.00%	-$3.73m	*NPV / Capital (Ratio)*	*-1.01*
NPV @ upper bound rate	13.00%	-$3.43m	*Pay Back Period (Yrs)*	*Not measurable*
NPV @ lower bound rate (WACC)	6.75%	-$4.12m	*IRR%*	*-8.85%*

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%	-$2.99m	*NPV / Capital (Ratio)*	*-0.81*
NPV @ upper bound rate	13.00%	-$2.87m	*Pay Back Period (Yrs)*	*Not measurable*
NPV @ lower bound rate (WACC)	6.75%	-$3.09m	*IRR%*	*-3.92%*

Benefits

Risk cost	As Is	To Be	Benefit
Systems (reliability)	*$0.10m*	*$0.00m*	*$0.10m*
Financial	*$0.00m*	*$0.00m*	*$0.00m*
Operational/compliance	*$0.00m*	*$0.00m*	*$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	$0.10m	$0.00m	$0.10m
Cost savings and other benefits			$0.00m
Total Benefits			$0.10m

VCR Benefit	*$0.10m*
ENS Penalty	*$0.00m*
All other risk benefits	*$0.00m*
Total Risk benefits	$0.10m
Benefits in the financial NPV*	$0.00m
**excludes VCR benefits*	
Benefits in the economic NPV**	$0.10m
***excludes ENS penalty*	

Other Financial Drivers

Incremental opex cost pa (no depreciation)	-$0.07m	Write-off cost	$0.00m
Capital - initial $m	-$3.70m	Major Asset Life (Yrs)	50.00 Yrs
Residual Value - initial investment	$1.63m	Re-investment capital	$0.00m
Capitalisation period	2.00 Yrs	Start of the re-investment period	0.00 Yrs