

# OPTIONS EVALUATION REPORT (OER)

Liverpool 415V AC Dist Replacement

OER 000000001519 revision 2.0



**Ellipse project no.:** P0008778

**TRIM file:** [TRIM No]

**Project reason:** Capability - Asset Replacement for end of life condition

**Project category:** Prescribed - Replacement

## Approvals

|                                    |                  |                                  |
|------------------------------------|------------------|----------------------------------|
| <b>Author</b>                      | Adam Hoare       | Senior Secondary Systems Analyst |
| <b>Endorsed</b>                    | Hazem Khamis     | Secondary Systems Strategist     |
|                                    | Azil Khan        | Investment Strategy Manager      |
| <b>Approved</b>                    | Lance Wee        | M/Asset Strategy                 |
| <b>Date submitted for approval</b> | 25 November 2016 |                                  |

## Change history

| Revision | Date             | Amendment                                       |
|----------|------------------|-------------------------------------------------|
| 0        | 25 June 2016     | Initial issue                                   |
| 1        | 28 October 2016  | Update to 2016/17 dollars and SFAIRP/ALARP data |
| 2        | 25 November 2016 | Update to format                                |

## 1. Need/opportunity

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Liverpool Substation is an important point of interconnection for TransGrid's 330kV network and connects to Endeavour Energy at 132kV to supply the Sydney Metropolitan South West area. The 415V system at Liverpool has been identified as among those with a high proportion of defects and will be over 40 years old by 2023.

## 2. Related Needs/opportunities

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Nil.

## 3. Options

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All dollar values in this document are expressed in un-escalated 2016/17 dollars.

### Base Case

The Base Case for this Need is to continue with TransGrid's current management of defects through corrective maintenance and changes to work practices. This approach does not address the degrading condition of the 415V Alternating Current (AC) system or the structural deficiencies in the infrastructure. The risk cost of \$1.26m per annum will increase due to the probability of failure increasing as the assets further deteriorate with age.

The key driver for this risk cost is the poor condition of the aging 415V system. This increases the likelihood of a hazardous event occurring.

Increasing the corrective maintenance cannot reduce the probability of failure in order to reduce the risk cost. A holistic approach to bring the system up to current requirements as per AS3000 will likely achieve better safety outcomes.

### Option A — 415V AC Distribution Replacement [[OFR 1519A](#), [OFS 1519A](#)]

Option A is to carry out the refurbishment of the 415V AC system in order to bring it to current AS3000 requirements. The scope of works includes the replacement of main 415V switchboards in the switchyard; Low Voltage Alternating Current (LVAC) distribution panels and light and power distribution boards in the Auxiliary Services Building; replacement and segregation of 415V cabling; and the segregation of LV AC cabling from Direct Current (DC) cabling.

The expected capital costs for the option total \$1.90m. This costing is estimated using TransGrid's "Success" estimating system.

The residual risk associated with this option upon completion of the project amounts to \$73.7k per annum (base case risk cost = \$1.26m). The risk reduction is realised through the reduction in the probability of failure for all assets.

## 4. Evaluation

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Evaluation of the proposed options has been completed using both commercial considerations and the ALARP (as low as reasonably practical) regulatory requirements. The results of these evaluations are outlined below.

### 4.1 Commercial evaluation

The result of commercial evaluation for each of the options is summarised in Table 1.

**Table 1 – Commercial evaluation (\$ million)**

| Option           | Description                      | Total capex | Annual opex | Annual post project risk cost | Economic NPV @10% | Financial NPV @10% | Rank |
|------------------|----------------------------------|-------------|-------------|-------------------------------|-------------------|--------------------|------|
| <b>Base Case</b> | Run-to-fail                      | N/A         | -           | 1.26                          | N/A               | N/A                | -    |
| <b>A</b>         | 415V AC Distribution Replacement | 1.90        | -           | 0.074                         | 5.53              | (0.45)             | 1    |

The commercial evaluation is based on:

- > Economic life of the assets is assumed 40 years, hence this assessment period has been applied.
- > Capital cost is not escalated and it does not include capitalised interest.

Sensitivities on economic Net Present Value (NPV) for the option with changing discount rates are shown in Table 2.

**Table 2 – Discount rate sensitivities (\$ million)**

| Option   | Description                      | Economic NPV @13% | Economic NPV @6.75% |
|----------|----------------------------------|-------------------|---------------------|
| <b>A</b> | 415V AC Distribution Replacement | 3.68              | 8.91                |

## 4.2 SFAIRP/ALARP evaluation

Options to reduce the network safety risk as per the risk treatment hierarchy have been considered in other lifecycle stages of the asset, and it has been determined that no reasonably practicable options exist to reduce the risk further than those capital investment options listed below.

Evaluation of the proposed options has been completed against the SFAIRP (So Far As Is Reasonably Practicable)/ALARP (As Low As Reasonably Practical) obligation, as required by the Electricity Supply (Safety and Network Management) Regulation 2014 and the Work Health and Safety Act 2011. The Key Hazardous Events and the disproportionality multipliers considered in the evaluation are as follows:

- > Catastrophic failure of asset/uncontrolled discharge or contact with electricity/ unauthorised access to site - 3 times the safety risk and 10% of the reliability risk (applicable to safety)

The results of this evaluation are summarised in the tables below.

**Table 3 – Feasible options (\$ thousand)**

| Option      | Description                      | CAPEX | Expected Life | Annualised CAPEX |
|-------------|----------------------------------|-------|---------------|------------------|
| <b>Base</b> | Do nothing                       | N/A   | N/A           | N/A              |
| <b>A</b>    | 415V AC Distribution Replacement | 1,900 | 40 years      | 50               |

**Table 4 – Annual risk calculations (\$ thousand)**

| Option | Annual Residual Risk |                  |               | Annual Risk Savings |                  |               |
|--------|----------------------|------------------|---------------|---------------------|------------------|---------------|
|        | Safety Risk          | Reliability Risk | Bushfire Risk | Safety Risk         | Reliability Risk | Bushfire Risk |
| Base   | 0                    | 1,259            | 0             | N/A                 | N/A              | N/A           |
| A      | 0                    | 66               | 0             | 0                   | 1,193            | 0             |

**Table 5 – Reasonably practicable test (\$ thousand)**

| Option | Network Safety Risk Reduction <sup>1</sup> | Annualised CAPEX | Reasonably practicable <sup>2</sup> ? |
|--------|--------------------------------------------|------------------|---------------------------------------|
| A      | 119                                        | 50               | Yes                                   |

Option A is reasonably practicable.

### 4.3 Preferred option

The outcome of the SFAIRP/ALARP evaluation is that Option A is the preferred option as it is reasonably practicable and provides the greatest network safety risk reduction, and is therefore required to satisfy the organisation's SFAIRP/ALARP obligations.

The preferred option to address the condition of the secondary system is Option A – 415V AC Distribution Replacement.

This option has been selected due to its technical viability and reduction in reliability risk. This option provides significant technical benefits and provides a positive NPV.

#### Capital and operating expenditure

The capital expenditure required to deploy the preferred option is justified in the high reduction in reliability risk and beneficial safety outcomes it provides.

#### Regulatory Investment Test

A Regulatory Investment Test for Transmission (RIT-T) is not required as this is an asset replacement project with no augmentation component.

## 5. Recommendation

It is recommended that Option A – 415V AC Distribution Replacement be scoped in detail.

<sup>1</sup> The Network Safety Risk Reduction is calculated as 6 x Bushfire Risk Reduction + 3 x Safety Risk Reduction + 0.1 x Reliability Risk Reduction

<sup>2</sup> Reasonably practicable is defined as whether the annualised CAPEX is less than the Network Safety Risk Reduction

## Attachment 1 – Commercial evaluation report

### Option A NPV calculation

| Project_Option Name                                                                                                                   |         |          | Liverpool 415V AC Distribution Replacement - Option A |                                   |           |
|---------------------------------------------------------------------------------------------------------------------------------------|---------|----------|-------------------------------------------------------|-----------------------------------|-----------|
| 1. Financial Evaluation (excludes VCR benefits)                                                                                       |         |          |                                                       |                                   |           |
| NPV @ standard discount rate                                                                                                          | 10.00%  | -\$0.45m | NPV / Capital (Ratio)                                 | -0.24                             |           |
| NPV @ upper bound rate                                                                                                                | 13.00%  | -\$0.53m | Pay Back Period (Yrs)                                 | 0.05 Yrs                          |           |
| NPV @ lower bound rate (WACC)                                                                                                         | 6.75%   | -\$0.20m | IRR%                                                  | 5.30%                             |           |
| 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%  | \$5.53m  | NPV / Capital (Ratio)                                 | 2.91                              |           |
| NPV @ upper bound rate                                                                                                                | 13.00%  | \$3.68m  | Pay Back Period (Yrs)                                 | 1.60 Yrs                          |           |
| NPV @ lower bound rate (WACC)                                                                                                         | 6.75%   | \$8.91m  | IRR%                                                  | 57.59%                            |           |
| Benefits                                                                                                                              |         |          |                                                       |                                   |           |
| Risk cost                                                                                                                             | As Is   | To Be    | Benefit                                               | VCR Benefit                       | \$1.06m   |
| Systems (reliability)                                                                                                                 | \$1.14m | \$0.07m  | \$1.07m                                               | ENS Penalty                       | \$0.00m   |
| Financial                                                                                                                             | \$0.12m | \$0.01m  | \$0.12m                                               | All other risk benefits           | \$0.13m   |
| Operational/compliance                                                                                                                | \$0.00m | \$0.00m  | \$0.00m                                               | Total Risk benefits               | \$1.19m   |
| People (safety)                                                                                                                       | \$0.00m | \$0.00m  | \$0.00m                                               |                                   |           |
| Environment                                                                                                                           | \$0.00m | \$0.00m  | \$0.00m                                               | Benefits in the financial NPV*    | \$0.13m   |
| Reputation                                                                                                                            | \$0.00m | \$0.00m  | \$0.00m                                               | *excludes VCR benefits            |           |
| Total Risk benefits                                                                                                                   | \$1.26m | \$0.07m  | \$1.19m                                               |                                   |           |
| Cost savings and other benefits                                                                                                       |         |          | \$0.00m                                               | Benefits in the economic NPV**    | \$1.19m   |
| Total Benefits                                                                                                                        |         |          | \$1.19m                                               | **excludes ENS penalty            |           |
| Other Financial Drivers                                                                                                               |         |          |                                                       |                                   |           |
| Incremental opex cost pa (no depreciation)                                                                                            |         |          | \$0.00m                                               | Write-off cost                    | \$0.00m   |
| Capital - initial \$m                                                                                                                 |         |          | -\$1.90m                                              | Major Asset Life (Yrs)            | 40.00 Yrs |
| Residual Value - initial investment                                                                                                   |         |          | \$0.71m                                               | Re-investment capital             | \$0.00m   |
| Capitalisation period                                                                                                                 |         |          | 5.00 Yrs                                              | Start of the re-investment period | 0.00 Yrs  |