

# OPTIONS EVALUATION REPORT (OER)



Substation Based PC Condition

OER 000000001375 revision 2.0

**Ellipse project no.:** P0008016

**TRIM file:** [TRIM No]

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

**Project category:** Prescribed - Asset Renewal Strategies

## Approvals

|                                    |                  |  |
|------------------------------------|------------------|--|
| <b>Author</b>                      | Adam Hoare       | Secondary Systems Senior Analyst                   |
| <b>Endorsed</b>                    | Mark Jones       | Secondary Systems and Communications Asset Manager |
|                                    | Azil Khan        | Investment Analysis Manager                        |
| <b>Approved</b>                    | Lance Wee        | M/Asset Strategy                                   |
| <b>Date submitted for approval</b> | 14 December 2016 |  |

## Change history

| Revision | Date             | Amendment                                       |
|----------|------------------|---|
| 0        | 29 June 2016     | Initial issue                                   |
| 1        | 31 October 2016  | Update to 2016/17 dollars and SFAIRP/ALARP data |
| 2        | 14 December 2016 | Update to format                                |

## 1. Need/opportunity

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The assets raised within this Need have reached or exceeded their estimated technical life by 2023. Manufacturer support for the majority of models has ceased meaning no repair or replacement facilities exist and spares currently held by TransGrid for these models are projected to be exhausted. Additionally there are higher costs associated with managing and maintaining spares and the continuing maintenance capability required for obsolete models.

The use of substation based Personal Computers (PCs) provide core automation functions within a substation, including remote visibility capability, alarm monitoring and switchgear operability from the TransGrid Control Centre. As such these devices will be required into the foreseeable future.

## 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 run these assets to failure. This approach does not address the increasing failure rates or the risk cost associated with the Need. The risks are \$2.92m per annum and foreseen to increase as the probability of failure of the assets will also likely increase. Key drivers for this risk cost are:

- > Probability of asset failure is approximately 16.9% for substation PCs.
- > Increasing the maintenance for the assets cannot reduce the probability of failure in order to reduce the risk cost.

### Option A — Replacement of Individual Assets [[OFR 1375A](#), [OFS 1375A](#)]

This option covers the replacement of assets in a “like for like” manner. This involves removing the existing substation PCs and replacing it with them with new substation PCs utilising the same features currently in use. This option doesn’t include any upgrade of systems to maximise the utilisation of available technology.

No operating costs have been estimated for this option based on current maintenance plan settings.

Due to the “like for like” nature of this option, no benefit has been calculated in accordance with TransGrid’s Renewal and Maintenance Strategy for Secondary Systems Site Installations<sup>1</sup>.

The expected total capital cost to replace all 117 asset identified under this Need is \$2.42m. This costing is estimated using TransGrid’s “Success” estimating system.

The residual risk associated with this option upon completion of the project amounts to \$0.69m per annum (base case risk cost = \$2.92m). The risk reduction is realised through the reduction in the probability of failure for all assets.

The assets under investigation have been categorised into three broad categories:

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<sup>1</sup> Refer SSA Strategy - Renewal and Maintenance -Secondary Systems Site Installations

### Assets providing DCON (VmHost) services

This configuration covers only replacing the substation assets providing Data Concentrator (DCON) (VmHost) services.

The expected capital cost to replace this category of assets is \$0.50m. This costing was estimated using the unit costs provided under Option Feasibility Study (OFS) OFS 1375A and applying them to those assets that would be replaced. These costs are broken down in Table 1.

**Table 1 – Expected costs for replacing assets providing DCON (VmHost) services (\$ thousand)**

| Item                        | Unit Cost, Including Labour | Quantity | Total Cost |
|-----------------------------|-----------------------------|----------|------------|
| DCON (VmHost)               | 21                          | 24       | 500        |
| <b>Total estimated cost</b> |                             |          | <b>500</b> |

The residual risk associated with this portion of assets upon completion of the project amounts to \$0.64m per annum (base case risk cost component = \$2.70m). The risk reduction is realised through the reduction in the probability of failure for the affected assets.

### Assets providing HMI / Condition Monitoring / Other services

This configuration covers only replacing the substation assets providing HMI, condition monitoring and other miscellaneous services.

The expected capital cost to replace this category of assets is \$1.93m. This costing was estimated using the unit costs provided under OFS 1375A and applying them to those assets that would be replaced. These costs are broken down in Table 2.

**Table 2 – Expected costs for replacing assets providing HMI / Condition Monitoring / Other services (\$ thousand)**

| Item                        | Unit Cost, Including Labour | Quantity | Total Cost   |
|-----------------------------|-----------------------------|----------|--------------|
| HMI/CM/Other                | 21                          | 93       | 1,930        |
| <b>Total estimated cost</b> |                             |          | <b>1,930</b> |

The residual risk associated with this portion of assets upon completion of the project amounts to \$0.05m per annum (base case risk cost component = \$0.22m). The risk reduction is realised through the reduction in the probability of failure for the affected assets.

Option A has been identified as the only technically viable option as refurbishment of the systems is not possible.

## 4. Evaluation

Evaluation of the proposed options has been completed using the ALARP (As Low as Reasonably Practicable) regulatory requirements and economic considerations. The results of this evaluation are outlined below.

### 4.1 Commercial evaluation

The result of commercial evaluation for each of the technically feasible options is summarised in Table 3.

**Table 3 – 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         | 0           | 2.92                          | N/A               | N/A                | 4    |
| <b>A</b>         | Replace Individual Assets    | 2.42        | 0           | 0.69                          | 4.90              | (1.18)             | 2    |
| <b>i)</b>        | Replace DCON (VmHost) Assets | 0.50        | 0           | 0.64                          | 5.86              | (0.22)             | 1    |
| <b>ii)</b>       | Replace HMI/CM/Other Assets  | 1.93        | 0           | 0.05                          | (0.95)            | (0.95)             | 3    |

The commercial evaluation is based on:

- > Economic life of the PCs is assumed 7 years, hence this assessment period has been applied
- > Write-offs have not been estimated
- > Capital cost is not escalated and it does not include capitalised interest

Sensitivities on economic Net Present Value (NPV) for the options with changing discount rates are shown in Table 4.

**Table 4 – Discount rate sensitivities (\$ million)**

| Option     | Description                  | Economic NPV @13% | Economic NPV @6.75% |
|------------|------------------------------|-------------------|---------------------|
| <b>A</b>   | Replace Individual Assets    | 3.65              | 6.75                |
| <b>i)</b>  | Replace DCON (VmHost) Assets | 4.60              | 7.68                |
| <b>ii)</b> | Replace HMI/CM/Other Assets  | (0.95)            | (0.93)              |

## 4.2 SFAIRP/ALARP evaluation

There is no safety risk associated with these assets therefore an SFAIRP (So Far As Is Reasonably Practicable)/ALARP (As Low As Reasonably Practical) evaluation is not required.

## 4.3 Preferred option

The option to address the condition of the identified assets, Option A(i) – Replacement of DCON (VmHost) Assets, is the preferred option.

This option has been selected due to its technical viability and reduction in reliability risk. Although the replacement of DCON (VmHost) assets is below the ALARP value, TransGrid cannot reduce the safety risk of these assets further by spending more capital. Therefore this option reduces TransGrid's safety risk to as low as reasonably practicable.

### Capital and operating expenditure

There is negligible difference in predicted ongoing operational expenditure between the option and Base Case.

## 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

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It is recommended to proceed with the replacement of all 24 identified DCON (VmHost) assets in the categories identified above.

# Attachment 1 – Commercial evaluation report

## Option A NPV calculation

| Project_Option Name  |         | Need ID 1375 - Substation Based PC Condition - Option A Replacement |                       |                                   |          |
|--|---------|---|-----------------------|-----------------------------------|----------|
| <b>1. Financial Evaluation</b> (excludes VCR benefits)   |         |   |                       |                                   |          |
| NPV @ standard discount rate   | 10.00%  | -\$1.18m  | NPV / Capital (Ratio) | -0.48                             |          |
| NPV @ upper bound rate   | 13.00%  | -\$1.18m  | Pay Back Period (Yrs) | -0.07 Yrs                         |          |
| NPV @ lower bound rate (WACC)  | 6.75%   | -\$1.14m  | IRR%                  | -7.26%                            |          |
| <b>2. Economic Evaluation</b> (includes VCR benefits but excludes tax benefits from non-cash transactions, ENS penalty and overall tax cost) |         |   |                       |                                   |          |
| NPV @ standard discount rate   | 10.00%  | \$4.90m   | NPV / Capital (Ratio) | 2.02                              |          |
| NPV @ upper bound rate   | 13.00%  | \$3.65m   | Pay Back Period (Yrs) | 1.09 Yrs                          |          |
| NPV @ lower bound rate (WACC)  | 6.75%   | \$6.75m   | IRR%                  | 38.71%                            |          |
| <b>Benefits</b>  |         |   |                       |                                   |          |
| Risk cost  | As Is   | To Be   | Benefit               | VCR Benefit                       | \$2.01m  |
| Systems (reliability)  | \$2.64m | \$0.62m   | \$2.01m               | ENS Penalty                       | \$0.00m  |
| Financial  | \$0.29m | \$0.07m   | \$0.22m               | All other risk benefits           | \$0.22m  |
| Operational/compliance   | \$0.00m | \$0.00m   | \$0.00m               | Total Risk benefits               | \$2.23m  |
| People (safety)  | \$0.00m | \$0.00m   | \$0.00m               | Benefits in the financial NPV*    | \$0.22m  |
| Environment  | \$0.00m | \$0.00m   | \$0.00m               | *excludes VCR benefits            |          |
| Reputation   | \$0.00m | \$0.00m   | \$0.00m               | Benefits in the economic NPV**    | \$2.23m  |
| Total Risk benefits  | \$2.92m | \$0.69m   | \$2.23m               | **excludes ENS penalty            |          |
| Cost savings and other benefits  |         |   | \$0.00m               |                                   |          |
| Total Benefits   |         |   | \$2.23m               |                                   |          |
| <b>Other Financial Drivers</b>   |         |   |                       |                                   |          |
| Incremental opex cost pa (no depreciation)   |         |   | \$0.00m               | Write-off cost                    | \$0.00m  |
| Capital - initial \$m  |         |   | -\$2.42m              | Major Asset Life (Yrs)            | 7.00 Yrs |
| Residual Value - initial investment  |         |   | \$0.00m               | Re-investment capital             | \$0.00m  |
| Capitalisation period  |         |   | 5.00 Yrs              | Start of the re-investment period | 2028-29  |

## Option A(i) NPV calculation

Project\_Option Name

Need ID 1375 - Substation Based PC Condition - Option A Replac

### 1. Financial Evaluation (excludes VCR benefits)

|                               |        |          |                       |           |
|-------------------------------|--------|----------|-----------------------|-----------|
| NPV @ standard discount rate  | 10.00% | -\$0.22m | NPV / Capital (Ratio) | -0.45     |
| NPV @ upper bound rate        | 13.00% | -\$0.23m | Pay Back Period (Yrs) | -0.05 Yrs |
| NPV @ lower bound rate (WACC) | 6.75%  | -\$0.21m | IRR%                  | -5.26%    |

### 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% | \$5.86m | NPV / Capital (Ratio) | 11.78          |
| NPV @ upper bound rate        | 13.00% | \$4.60m | Pay Back Period (Yrs) | Not measurable |
| NPV @ lower bound rate (WACC) | 6.75%  | \$7.68m | IRR%                  | 84.65%         |

### Benefits

|                                 |         |         |         |                                |         |
|---------------------------------|---------|---------|---------|--------------------------------|---------|
| Risk cost                       | As Is   | To Be   | Benefit | VCR Benefit                    | \$2.01m |
| Systems (reliability)           | \$2.64m | \$0.62m | \$2.01m | ENS Penalty                    | \$0.00m |
| Financial                       | \$0.07m | \$0.02m | \$0.05m | All other risk benefits        | \$0.05m |
| Operational/compliance          | \$0.00m | \$0.00m | \$0.00m | Total Risk benefits            | \$2.06m |
| 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                      | \$0.00m | \$0.00m | \$0.00m | Benefits in the economic NPV** | \$2.06m |
| Total Risk benefits             | \$2.70m | \$0.64m | \$2.06m | **excludes ENS penalty         |         |
| Cost savings and other benefits |         |         | \$0.00m |                                |         |
| Total Benefits                  |         |         | \$2.06m |                                |         |

### Other Financial Drivers

|  |          |                                   |          |
|--|----------|-----------------------------------|----------|
| Incremental opex cost pa (no depreciation) | \$0.00m  | Write-off cost                    | \$0.00m  |
| Capital - initial \$m                      | -\$0.50m | Major Asset Life (Yrs)            | 7.00 Yrs |
| Residual Value - initial investment        | \$0.00m  | Re-investment capital             | \$0.00m  |
| Capitalisation period                      | 5.00 Yrs | Start of the re-investment period | 2028-29  |

## Option A(ii) NPV calculation

Project\_Option Name

Need ID 1375 - Substation Based PC Condition - Option A Replac

### 1. Financial Evaluation (excludes VCR benefits)

|                               |        |          |                       |           |
|-------------------------------|--------|----------|-----------------------|-----------|
| NPV @ standard discount rate  | 10.00% | -\$0.95m | NPV / Capital (Ratio) | -0.49     |
| NPV @ upper bound rate        | 13.00% | -\$0.95m | Pay Back Period (Yrs) | -0.08 Yrs |
| NPV @ lower bound rate (WACC) | 6.75%  | -\$0.93m | IRR%                  | -7.79%    |

### 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% | -\$0.95m | NPV / Capital (Ratio) | -0.49          |
| NPV @ upper bound rate        | 13.00% | -\$0.95m | Pay Back Period (Yrs) | Not measurable |
| NPV @ lower bound rate (WACC) | 6.75%  | -\$0.93m | IRR%                  | -7.79%         |

### Benefits

| Risk cost                              | As Is          | To Be          | Benefit        |                                       |                |
|--|----------------|----------------|----------------|---------------------------------------|----------------|
| <i>Systems (reliability)</i>           | \$0.00m        | \$0.00m        | \$0.00m        | <i>VCR Benefit</i>                    | \$0.00m        |
| <i>Financial</i>                       | \$0.22m        | \$0.05m        | \$0.17m        | <i>ENS Penalty</i>                    | \$0.00m        |
| <i>Operational/compliance</i>          | \$0.00m        | \$0.00m        | \$0.00m        | <i>All other risk benefits</i>        | \$0.17m        |
| <i>People (safety)</i>                 | \$0.00m        | \$0.00m        | \$0.00m        | <b>Total Risk benefits</b>            | <b>\$0.17m</b> |
| <i>Environment</i>                     | \$0.00m        | \$0.00m        | \$0.00m        | <b>Benefits in the financial NPV*</b> | <b>\$0.17m</b> |
| <i>Reputation</i>                      | \$0.00m        | \$0.00m        | \$0.00m        | <i>*excludes VCR benefits</i>         |                |
| <b>Total Risk benefits</b>             | <b>\$0.22m</b> | <b>\$0.05m</b> | <b>\$0.17m</b> | <b>Benefits in the economic NPV**</b> | <b>\$0.17m</b> |
| <b>Cost savings and other benefits</b> |                |                | <b>\$0.00m</b> | <i>**excludes ENS penalty</i>         |                |
| <b>Total Benefits</b>                  |                |                | <b>\$0.17m</b> |                                       |                |

### Other Financial Drivers

|  |          |                                   |          |
|--|----------|-----------------------------------|----------|
| Incremental opex cost pa (no depreciation) | \$0.00m  | Write-off cost                    | \$0.00m  |
| Capital - initial \$m                      | -\$1.93m | Major Asset Life (Yrs)            | 7.00 Yrs |
| Residual Value - initial investment        | \$0.00m  | Re-investment capital             | \$0.00m  |
| Capitalisation period                      | 5.00 Yrs | Start of the re-investment period | 2028-29  |