OPTIONS EVALUATION REPORT (OER)

Substation Capital Spares RP3

OER- N2617 revision 5.0

Ellipse project no(s):
TRIM file: [TRIM No]

Project reason: Capability - Improved Asset Management
Project category: Prescribed - Asset Renewal Strategies

Approvals

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Date submitted for approval	13 November 2021	

Change history

Revision	Date	Amendment
0	28/09/2021	Initial version
1,2	10/11/2021	Minor formatting updates
3,4,5	13/11/2021	Re-issue pdf version

Executive summary

Spare components and assets are required to enable the effective restoration of equipment following failure. Spares requirements are documented in TransGrid's Spares Policy (All Asset Streams) and substation spares requirements are in the Substation Spares Plan. Where the required spares meet TransGrid's capital expenditure policy the purchase of the spares is classified as replacement expenditure (repex). These items usually have significant lead-time to procure and are required to mitigate the impact of a failure of network equipment.

For substation assets, high voltage (HV) equipment such as circuit breakers, current transformers, voltage transformers or major components of HV equipment (e.g. bushings, tap changer, circuit breaker interrupters and poles) are classified as capital spares. Capital spares will be required in 2023-2028 regulatory period due to following reasons:

- Asset failures and consumption of existing spares based on historical consumption;
- Spares required based on identification of gaps in holdings based on ongoing spares analysis and data improvements; and
- New spares required to support new asset types installed into the network;

The option evaluation summary for the recommended 173 capital spare items as shown in Table 1. An NPV is not calculated for this investment because they are needed to comply with the spares plan. Additionally, the risk quantification for all HV assets is dependent on the availability of these spares in order to restore assets after failure in order to mitigate the impact of expected unserved energy.

Table 1 - Evaluated options ($ million)

Option	Description	Direct capital cost	Network and corporate overheads	Total capital cost[1]	Weighted NPV	Rank
Option A	Allowance for substation capital spares	$5.55	Nil	$5.55	N/A	1

It is recommended to proceed with allowance of $5.55 million for substation capital spares. The detailed breakdown of spares list is provided in Table 2.

The cost of spares include equipment supply cost only, therefore overhead cost component is nil.

[1] Total capital cost is the sum of the direct capital cost and network and corporate overheads. Total capital cost is used in this OER for all analysis.

1. Need/opportunity

The Substation Spares Plan determines spares holdings to minimise total cost whilst maintaining required levels of system reliability. Capital Spares are those spares that are required by the spares plan and that meet the criteria set down in the Expenditure Capitalisation procedure. They are recorded and capitalised with TransGrid's financial systems. HV Plant items such as circuit breakers, auxiliary transformers, current transformers, voltage transformers, or major components such as bushings, circuit breaker interrupters and poles may be classified as capital spares.

There is an ongoing need to purchase capital spare and the expected amount required in the 2023-2028 regulatory period is included under this need.

Capital spares are required to respond effectively to equipment failure or impending failure as indicated by condition monitoring results. Asset management programmes, refurbishment programmes for equipment such as circuit breakers and emergency plant replacement due to failure or breakdown depend on the availability of spare major assemblies and plant. Failure of equipment and delay in the restoration due to the non-availability of spares would lead to an increase in the expected unserved energy following an asset failure. Inability to respond appropriately to developing plant issues is certain to increase the failure rate dramatically over time.

To continue effective management of equipment, appropriate capital spares will need to be purchased over the 2023–2028 regulatory period in accordance with the Substation Spares Plan.

The capital spares program will also cater for spares required for new plant items being installed on TransGrid's high voltage network and replacement spares where these have been used on existing installations during maintenance refurbishment or emergency replacement.

2. Related needs/opportunities

There is no related need identified at this point in time.

3. Options

3.1 Base case

Operation of the transmission network relies on safe and effective high voltage plant within substations. Failure of equipment and delay in the restoration due to the non-availability of spares would lead to an increase in the expected unserved energy following an asset failure.

The 'do nothing' option – i.e. no future purchase of plant spares is not consistent with the operation of the electricity network and asset management practices.

3.2 Options evaluated

Option A — Purchase required capital spares [OFS N2617A]

This option allows for the purchase of appropriate capital spares to meet requirement of this need.

Spares requirements are documented in TransGrid's Spares Policy All Asset Streams and substation spares are in the Substation Spares Plan. Where the required spare meets TransGrid's capital expenditure policy the purchase of the spares is classified as replacement expenditure (repex). Based on the above criteria, it is estimated that the total cost of the program during the 2023-2028 regulatory period will be $5.55 million.

3.3 Options considered and not progressed

There are no other options considered.

4. Evaluation

The Substation Spares Plan provides guidelines in establishing appropriate minimum spares requirements for TransGrid to provide a High Voltage (HV) network that meets the required reliability standards. Option A is the only option that meets the requirements of the spares policy.

It is estimated that the procurement of substation capital spares for the 2023-2028 regulatory period will cost $5.55 million as per below Table 2.

Table 2 Capital spare item list

Item	Forecasted Quantities	OFS Unit Costing	Total Estimate
Aux Transformer 11kV, 500/1000kVA	1	$ 117,000	$ 117,000
Bushing 33kV and below	3	$ 12,950	$ 38,850
Bushing 66kV	2	$ 12,950	$ 25,900
Bushing 132kV	3	$ 45,000	$ 135,000
Bushing 220kV	2	$ 84,450	$ 168,900
Bushing 330kV	3	$ 101,249	$ 303,747
Bushing 500kV	2	$ 121,920	$ 243,840
CB 66kV Interrupter/Pole (LHCB)	11	$ 15,545	$ 170,995
CB 132kV Interrupter/Pole (LHCB)	18	$ 35,121	$ 632,178
CB 220kV Interrupter/Pole (LHCB)	3	$ 48,541	$ 145,623
CB 330kV Interrupter/Pole (LHCB)	15	$ 48,541	$ 728,115
CB 500kV Interrupter/Pole (LHCB)	2	$ 83,435	$ 166,870
CB 66kV Mechanism (LHCB)	5	$ 32,420	$ 162,100
CB 132kV Mechanism (LHCB)	8	$ 32,420	$ 259,360
CB 220kV Mechanism (LHCB)	1	$ 36,203	$ 36,203
CB 330kV Mechanism (LHCB)	8	$ 36,203	$ 289,624
CB 500kV Mechanism (LHCB)	1	$ 36,203	$ 36,203
CB 33kV Interrupter/Pole (DTCB)	3	$ 22,495	$ 67,485
CB 66kV Interrupter/Pole (DTCB)	7	$ 22,495	$ 157,465

Item	Forecasted Quantities	OFS Unit Costing	Total Estimate
CB 132kV Interrupter/Pole (DTCB)	11	$ 28,078	$ 308,858
CB 220kV Interrupter/Pole (DTCB)	1	$ 40,150	$ 40,150
CB 330kV Interrupter/Pole (DTCB)	2	$ 40,150	$ 80,300
CB 33kV Mechanism (DTCB)	1	$ 12,375	$ 12,375
CB 66kV Mechanism (DTCB)	3	$ 12,375	$ 37,125
CB 132kV Mechanism (DTCB)	4	$ 21,698	$ 86,792
CB 220kV Mechanism (DTCB)	1	$ 28,050	$ 28,050
CB 330kV Mechanism (DTCB)	1	$ 28,050	$ 28,050
Condition Monitoring Devices (Bushing Monitors)	2	$ 25,000	$ 50,000
Current Transformer 66kV	6	$ 10,900	$ 65,400
Current Transformer 132kV	6	$ 15,800	$ 94,800
Current Transformer 330kV	9	$ 25,800	$ 232,200
Current Transformer 500kV	3	$ 66,100	$ 198,300
CVT 132kV	6	$ 10,500	$ 63,000
CVT 330kV	9	$ 16,000	$ 144,000
CVT 500kV	5	$ 28,300	$ 141,500
MVT 66 kV and below	4	$ 10,000	$ 40,000
Magnetic Voltage Transformer (MVT) 132kV	1	$ 10,000	$ 10,000
Total	**173**		**$ 5,546,358**

Note: * Usually auxiliary transformer is not required as spare in substation spares plan, however due to ageing population and limited planned replacements it is estimated that failure rate could increase and budget is allowed to procure one auxiliary transformer as spare in 2023-2028 regulatory period .

4.1 ALARP evaluation

ALARP evaluation is not applicable for this need as the need relates the restoration of assets after failure or deteriorated condition and which does not have a quantified safety risk cost.

4.2 Preferred option

Option A is the preferred option and the only option which meets the requirements of the Substation Spares Plan. The Substation Spares Plan has been developed to provide a minimum level of substation spares to allow response to equipment failure over the expected life of the equipment. The levels chosen balance factors including:

- Substation component criticality

- Population of a particular plant item
- The likelihood of failure of particular equipment components
- Minimising stores inventory and upfront costs
- The possibility/feasibility of component part repair
- The need to support the equipment over the design life period usually around 40 years for many substation assets, recognising that parts are cheaper when plant is originally purchased and may not even be available near end of life.

Capital and Operating Expenditure

There are no capex to opex trade-offs considered in this evaluation.

Regulatory Investment Test

It is not currently anticipated that a Regulatory Investment Test for Transmission (RIT-T) will be applied.

5. Recommendation

It is recommended to proceed with allowance of $5.55 million for substation capital spares as stipulated under this need N2617 for 2023-2028 regulatory period.