

Management System Document

Substation Security Asset Renewal and Maintenance Strategy

Substation Security Asset Renewal and Maintenance Strategy

Summary

This strategy guides the management of TransGrid's existing security assets.

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1. Purpose

This document defines the renewal and maintenance strategies for TransGrid's substation security asset fleet. In doing this it applies the overarching asset management strategy and objectives, and relevant Lifecycle Strategies.

The document identifies the emerging issues with TransGrid's substation security assets, and details the renewal and maintenance initiatives to be implemented in response to these issues. The output of the strategy is the asset management program of works, which is derived via distinct paths as follows:

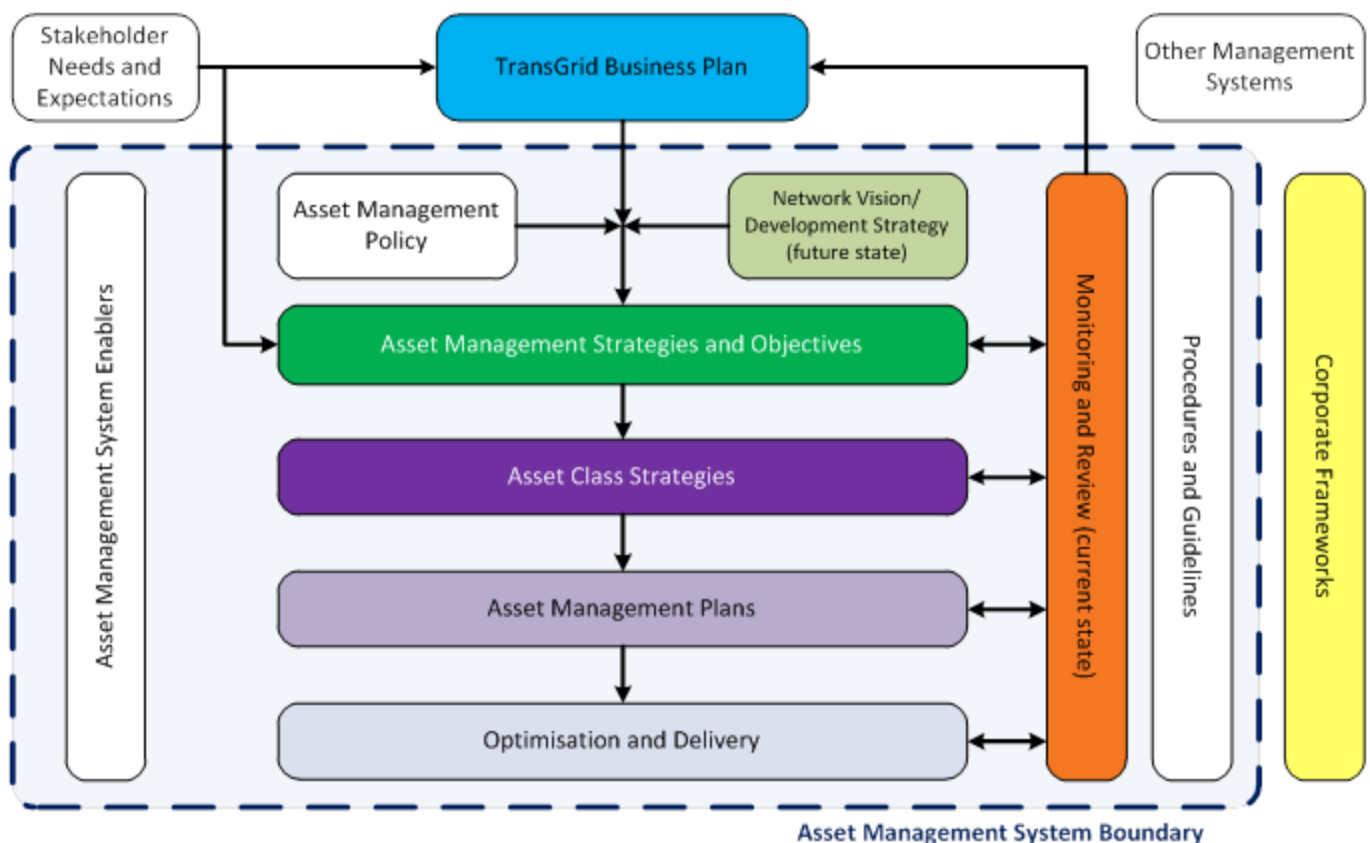
- The renewal and disposal initiatives are considered through the prescribed capital investment process and managed through the Portfolio Management group, which then leads to the resource-optimised capital works program.
- The maintenance initiatives directly drive the maintenance regimes which are detailed within the Substation Security Asset Maintenance Plan. The maintenance plans are then resource-optimised through TransGrid's Enterprise Resource Planning (ERP) system, *Ellipse*.

The strategies contained in this document cover the period to June 2023.

2. Positioning within the Asset Management Framework

The *Substation Security Asset Renewal and Maintenance Strategy* document is one of several that comprise the Asset Management Strategies within TransGrid's Asset Management System. This document sits below the Asset Management Strategy and Objectives document as shown in *Figure 1*.

Figure 1: Asset Management System Document Hierarchy (to be updated)



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3. Definitions

Table 1: Definitions

Term	Definition
Asset Management Objectives	<ul style="list-style-type: none">• Specific and measurable outcomes required of the assets in order to achieve the Corporate Plan and objectives; and/or• Specific and measurable level of performance required of the assets; and/or• Specific and measurable level of the health or condition required of the assets; and/or• Specific and measurable outcomes or achievement required of the asset management system.
Key Hazardous Events	The events of most concern associated with the assets that prevent the achievement of the corporate and asset management objectives.
Emerging Issues	Newly identified issues with an asset that pose a risk to the achievement of the corporate and asset management objectives.

4. Asset Management Strategy ‘Line of Sight’

The renewal and maintenance strategic initiatives set out in this document support the achievement of the strategies set out in the Asset Management Strategy and Objectives document. The strategic alignment of the initiatives in this document to the Asset Management Strategy and Objectives document is shown in Table 2 and Table 3.

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Table 2: Substation Asset Outcomes

Asset Management Objectives	Asset Management Performance Indicators
<ul style="list-style-type: none">Manage substation related public and staff safety risks to As Low As Reasonably Practicable (ALARP)/So Far As Is Reasonably Practicable (SFAIRP)	<ol style="list-style-type: none">Maintain zero security related LTIsMaintain Unauthorised Entry at 5 year average levelMaintain average age of asset class population to a sustainable level.
<ul style="list-style-type: none">Maintain network reliability	<ol style="list-style-type: none">Maintain 5 year average level of loss of supply events due to unauthorised entry

Table 3: Substation Asset Contribution to Financial Outcomes

Asset Management Objectives	Asset Management Performance Indicators
<ul style="list-style-type: none">Improve CAPEX Performance	<ol style="list-style-type: none">Improve Capital project performance
<ul style="list-style-type: none">Improve OPEX Performance	<ol style="list-style-type: none">Perform within -5/+10% of Asset Management Program of Works

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5. Review of Previous Renewal, Disposal and Maintenance Strategies

This section discusses the progress of the previous renewal and maintenance initiatives, and their effectiveness at meeting the asset management objectives.

5.1 Review of Renewal and Maintenance Initiatives

The tables below outline the ongoing renewal and maintenance initiatives from the previous iteration of this strategy.

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Table 4: Previous Renewal and Maintenance Initiatives

Asset	Asset Management Objective	Strategic Initiative	Progress (completion and expenditure)	Reference Documents
System	<ul style="list-style-type: none"> Manage substation related public and staff safety risks to As Low As Reasonably Practicable (ALARP)/So Far As Is Reasonably Practicable (SFAIRP) Maintain network reliability 	Asset Manager to undertake further analysis: <ul style="list-style-type: none"> Continue to monitor the identified issues through defect maintenance. Review the performance and condition of the over the next 12 months and assess the need for further action. 	<ul style="list-style-type: none"> Condition assessment of is completed. A need to replace has been raised to be completed by 2022-23. OER approved. 	Need 1452 OER 1452
System		Renewal initiative: <ul style="list-style-type: none"> Install at the sites that are currently with the Network Security Standard. 	<ul style="list-style-type: none"> RPS657 approved 	Need 657 OER 657
Security		Asset Manager to undertake further analysis: <ul style="list-style-type: none"> An investigation is to be carried out to assess . The outcome of the investigation should make recommendations concerning the continued use of the and whether any design modifications etc. are necessary. The current renewal initiative to replace to be placed on hold pending the outcome of the review. An investigation is to be carried out to assess the of . The outcome of the investigation should make recommendations concerning the vulnerability. 	<ul style="list-style-type: none"> Investigations are in progress. Liddell replacement project has been completed. 	
Security		Renewal initiative: <ul style="list-style-type: none"> Replace at the sites where are currently installed. 	<ul style="list-style-type: none"> of sites has been replaced with Replacement of the remaining sites has been proposed as part of revenue reset period 2018/19 – 2022/23. 	Need 1451 OER 1451

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Asset	Asset Management Objective	Strategic Initiative	Progress (completion and expenditure)	Reference Documents
			<ul style="list-style-type: none"> OER1451 approved 	
		Renewal initiative: <ul style="list-style-type: none"> Replace all substation [REDACTED] with [REDACTED]. 	<ul style="list-style-type: none"> Project delivery is underway. 	Need 656 PAD 656
		Asset Manager to undertake further analysis: <ul style="list-style-type: none"> Continue to monitor the identified issues through defect management and defect maintenance. Review the performance and condition of the [REDACTED] after 12 months and assess the need for further action. Risk assessment on [REDACTED] is to be carried out and recommendation is to be made on its mitigation. 	<ul style="list-style-type: none"> Risk assessment and defect analysis have been performed. Several needs have been raised to address issues as part of Operational Refurbishment Projects. Projects to be delivered by 2022-23. 	Need 1712 Need 1720 Need 1722
		Renewal initiative: <ul style="list-style-type: none"> Upgrade [REDACTED]g systems to provide [REDACTED] capability at the [REDACTED] sites where condition based renewals are currently required. Asset Manager to undertake further analysis: <ul style="list-style-type: none"> Continue to carry out periodic condition assessments of [REDACTED] systems. Initiate Prescribed Capital Investment Process to [REDACTED] based on [REDACTED] system condition. Maintenance initiative: <ul style="list-style-type: none"> Establish a maintenance regime for [REDACTED] systems based on manufacturer recommendations. 	<ul style="list-style-type: none"> Network Investment process has been initiated. OER1455 approved Maintenance regime for [REDACTED] systems will be prepared once the assets are installed. 	Need 1455 OER 1455

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5.2 Review of Maintenance Program

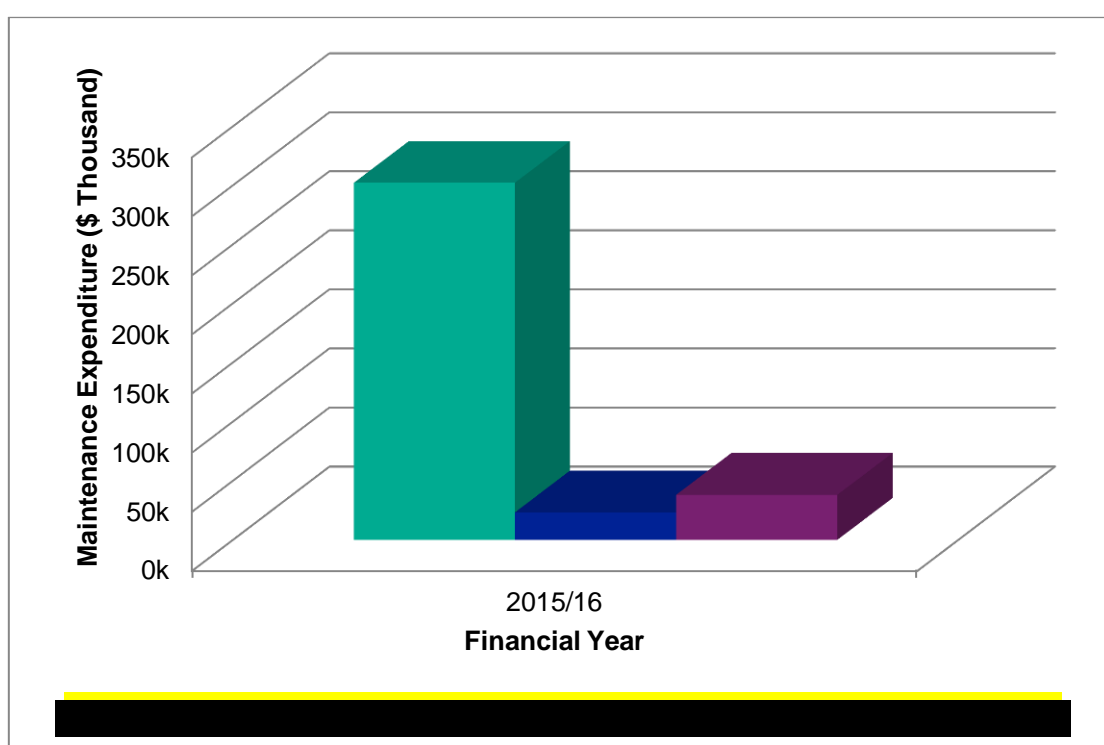
TransGrid's security assets are predominantly low value assets and have few mechanical components. As such preventative maintenance has historically been comprised of routine inspections followed by either condition based or corrective maintenance. Corrective maintenance could also take place in response to identification of a security breach as raised during an ad hoc site visit.

All substation security asset maintenance under the previous plan was successfully completed.

As part of asset management capability in Section 10, required level of asset breakdown has been developed in Ellipse to accommodate security asset data. Consequently, historical expenditure information on substation security assets is available at a useful level of granularity. However, historical budget information for security asset is not available at the similar level because security assets were categorised under the head of property.

Figure 2 shows the historical maintenance expenditure for routine, condition based and corrective maintenance for FY2015/16.

Figure 2: Security Asset Maintenance Expenditure



5.3 Past Performance – Asset Management Performance Indicators

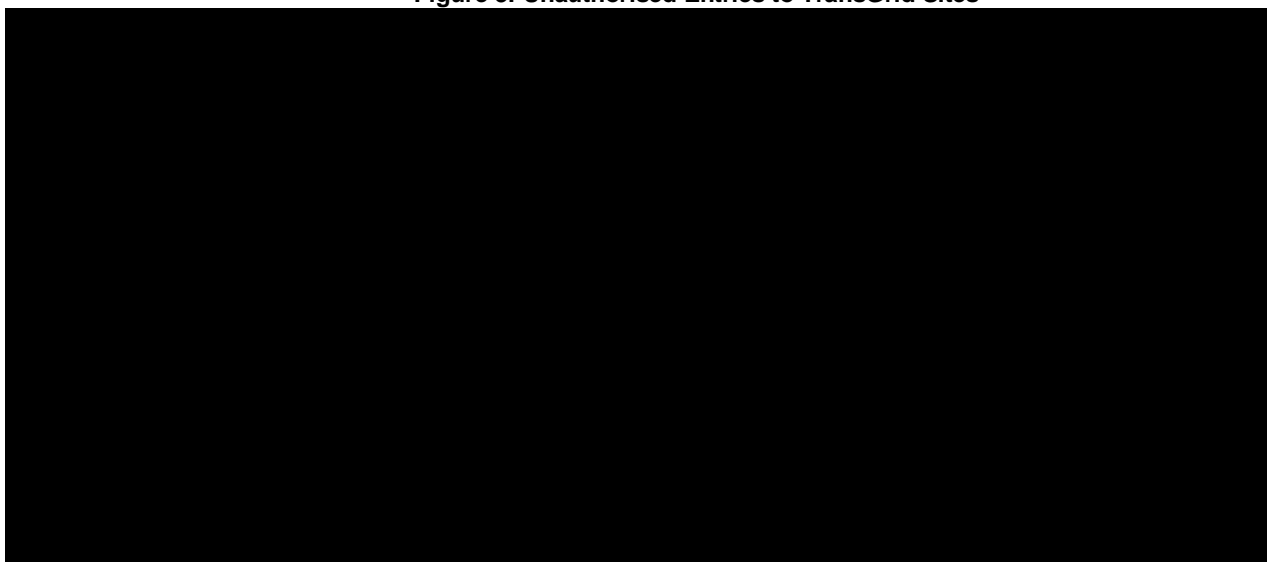
The KPIs that demonstrate the effectiveness of this Renewal and Maintenance strategy to mitigate the network related safety and reliability risks in support of the achievement of the asset management strategy and objectives are the number of unauthorised entries (HV Break-in, Non-HV Break-in) as shown in Figure 3. This measure has been maintained below the last 5 year average level over the past five years, indicating that the Renewal and Maintenance Strategy – Substation Security Assets has been effective at mitigating the associated risks and achieving the asset management objectives as identified in Table 5.

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Table 5: Performance against Asset management Performance Indicators

Asset Management Performance Indicator	Past Performance
<ol style="list-style-type: none">1. Maintain zero security related LTIs2. Maintain Unauthorised Entry at 5 year average level	<ul style="list-style-type: none">• Zero LTI due to security asset failure• The rate for unauthorised entry during 2010 - 2015 is below the 5 year average level.• Key hazardous event trending as below in Figure 2
<ol style="list-style-type: none">3. Maintain 5 year average level of loss of supply events due to unauthorised entry	<ul style="list-style-type: none">• No loss of supply events have occurred due to unauthorised entry.

Figure 3: Unauthorised Entries to TransGrid Sites



A significant reduction in unauthorised entries to substation sites following the substantial efforts that were made to upgrade substation security assets and systems during 2008 and 2009 is evident in Figure 2.

TransGrid's target for 'number of unauthorised entries' is zero. To maintain the performance at the target level, a significant departure from the historical expenditure profile is not expected.

6. Substation Security Asset Overview

6.1 Scope of Assets

The following substation security assets are considered within the scope of this strategy:

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[REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]

6.2 Asset Base

A snapshot of the substation security asset base is provided in Table 3.

Table 5: Substation Security Asset Base

1. *Journal of the American Medical Association*, 1997; 277: 1231-1236.

The substation security asset base can change either due to:

- Introduction/removal of security systems (treatments) in order to optimise security – the anticipated changes to security treatments are the outcomes of this document.

* The elements of TransGrid's security systems are referred to as security "treatments". This is a reference to the risk treatments identified in the Corporate Risk Management Framework, where security assets fall under the "reduction" treatment in the mitigation of security risks.

- Substation commissioning and other works requiring changes to existing security systems – it is expected that there will be less than 5 new substations commissioned within the 2016-21 period.
- There are no significant changes expected to TransGrid's substation security asset base that will affect renewal and maintenance strategies moving forward.

7. Substation Security Asset Review

This section details the emerging issues with the Substation Security assets, and the renewal and maintenance initiatives to be implemented to address the issues. These are derived through the renewal and maintenance decision process outlined in the *Asset Management Strategy and Objectives* document.

All strategic initiatives with respect to TransGrid's Security assets are outlined in this section, including the renewal and maintenance initiatives that contribute to the asset management program of works. Further details can be found in the relevant Security Maintenance Plan, and the referenced governance documents.

7.1 Implementation of the Renewal and Maintenance Decision Process

TransGrid undertakes a variety of performance, cost, risk and compliance analyses to capture the range of current and emerging issues that are apparent with respect to individual assets and asset groups. The analysis takes into consideration:

- Population age profiling against nominal asset lifespan.
- Asset inspection and condition assessments.
- Diagnostic testing – such as electrical, structural and oil testing.
- Failure mode.
- Failure and defect rates.
- Failure investigations.
- Maintenance program outcomes.
- Communication from maintenance staff.

Once the entire scope of issues are captured and the appropriate analysis undertaken, the asset manager will consider a number of options and determine the most appropriate course of action to address the issue and associated risks. The course of action is generally to observe the asset, undertake maintenance, renew, or dispose of the asset. The decision making process is described further in *the Asset Management Strategy and Objectives* document.

Renewal initiatives are developed through TransGrid's *Prescribed Capital Investment Process**. Two security related projects are committed and five security projects are proposed for next revenue reset period (2018/19-2022/23).

Disposal initiatives are also developed through TransGrid's *Network Investment Process*. Disposal of goods and materials are managed in accordance with TransGrid's:

- Grid Policy Disposal of Goods and Materials.
- Disposal Strategy as defined in the parent Asset Management Strategies and Objectives document.

TransGrid's maintenance regimes for assets have been refined over a number of years, and with each re-evaluation further opportunities to refine the processes are considered. They are based on consideration of the specific asset failure modes, condition, criticality, performance, and risk, and seek to strike an optimised balance between preventative and corrective maintenance. The maintenance initiatives directly drive the routine maintenance regimes which are detailed within the *Maintenance Plan - Substation Security Assets*.

* details of the relevant project planning documents for these renewal initiatives can be obtained at <http://thewire/dc/planning/ProjectPlanningDocuments/Pages/default.aspx>

7.2 Substation Security Assets Population Review

Under the current Work Health and Safety Regulation and Electricity Network Safety Management System, TransGrid has an obligation to ensure that the risk to the health and safety of its workers and members of the public is managed 'So Far As Is Reasonably Practicable' (SFAIRP) and 'As Low As Reasonably Practicable' (ALARP). This implies that TransGrid:

- > Identify all reasonably foreseeable risks to the health and safety of its workers and members of the public
- > Identify all control measures which eliminate or minimise the risks
- > Then decide which of the controls are 'reasonably practicable' to be implemented.
- > This 'reasonableness of acting' infers that cost by itself is unlikely to be a sufficient justification in the court of law for not implementing or lowering a control measure unless the cost is grossly disproportionate to the risk.

Although there are no regulations or standards that identify specific security measures to be implemented at substation sites, guidelines produced by critical infrastructure and power industry bodies are available. National Guidelines for Prevention of Unauthorised Access to Electricity Infrastructure (ENA DOC 015-2006) is a guideline produced by the Energy Network Association to be used as a tool that promotes an understanding of safety and security issues and outlines a number of control measures in order to achieve protection against security threats and public safety risks around electricity infrastructure. TransGrid heavily bases its security measures on this guideline, as relevant, in order to meet its obligations.

TransGrid's overall substation security strategy is to secure premises so that there is no unauthorised entry, and to optimise the balance between performance, costs and risk in achieving this. TransGrid's *Compliance Requirements* strategy establishes appropriate levels of security to achieve this by way of a tiered security system; this tiered security system is defined by TransGrid's *Network Security Standard* document.

The *Network Security Standard* assigns each TransGrid substation a Criticality Ranking, and then categorises substations into Risk Groupings. Levels (tiers) of security are then applied depending on the Risk Grouping of that site. The Criticality Ranking and Risk Groupings are also used as indicators with which to prioritise renewal and maintenance works. TransGrid's Substation Risk Groupings are provided in Attachment 1 and the Criticality Rankings provided in Attachment 2 of this document.

To ensure that this tiered system provides an appropriate level of security at each substation, TransGrid has established the substation Risk Groupings and Criticality Rankings based on its experience of securing these sites, setting the:

- Minimum requirements in consideration of the safety risks represented by substation security breaches.
- Increasing the requirements in consideration of the operational risks that the site presents to the network, considering both the attractiveness of the substation as a target, and the potential load at risk.

There have not been any regulatory changes that have resulted in modification of these security levels.

In addition, the Asset Manager carries out reviews of the following:

- The security systems installed at each site against the requirements of their Risk Grouping.
- The Risk Grouping requirements in consideration of existing asset performance, emerging technologies, and the continually evolving regulations.
- The Criticality Ranking of each substation to ensure that they are assigned to the correct Substation Risk Grouping.

Based on the outcome of these reviews, the security initiatives are listed below:

- Install [redacted] systems at [redacted] sites.
- Install [redacted] at [redacted] sites in conjunction with condition based replacements.
- Replace [redacted] at [redacted] sites.

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- Replace [redacted] sites.
- Replace existing [redacted] systems with [redacted] sites.
- Replace [redacted] system with a modern equivalent.

These initiatives are required to ensure that TransGrid's substation security assets meet their objectives and consequently that TransGrid meet its obligations. These initiatives are discussed further in Section 7.2.2 with respect to the individual asset classes.

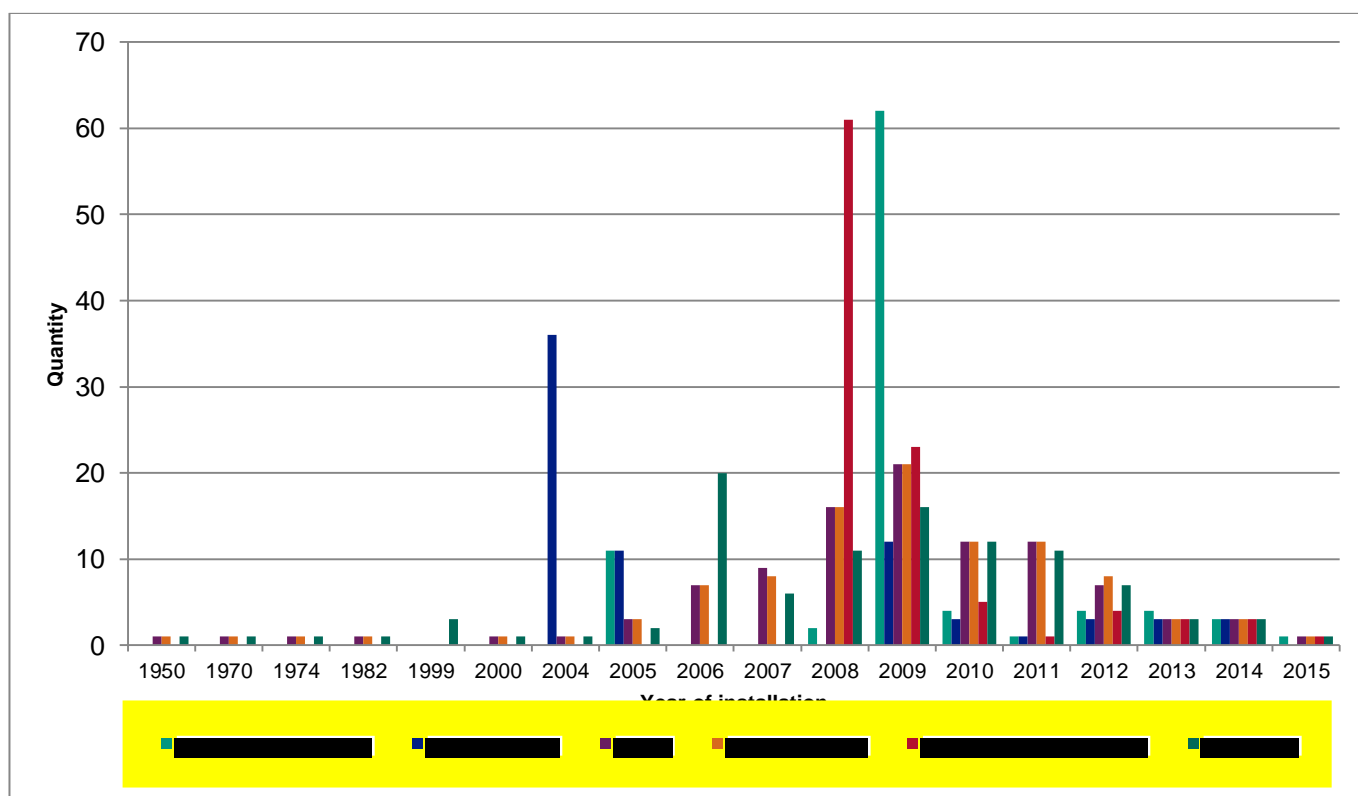
TransGrid's security controls and systems have gradually been upgraded to meet the Risk Grouping requirements during the past few years. These upgrades have contributed significantly in reducing the number of site break-ins and site compromises as shown in Figure 3. It should be noted that the "Non-HV Break-ins" statistics also includes other sites in addition to substations, such as depots, offices and stores.

7.2.1 Population Review

Unlike other assets, a health indexing has not been developed for security assets. A good indication of asset health and obsolescence at a total population level can generally be provided by the age profile of the asset population; where assets have increased probability of deteriorating in health or becoming obsolete as they advance in age, and particularly as they approach the end of their nominal lifespan.

The age profile of TransGrid's security assets is illustrated in Figure 4. It shows that the bulk of TransGrid's substation security assets are less than 10 years old and seems to suggest that a significant portion of the substation security asset population will not be subject to emerging health and obsolescence issues.

Figure4: Age profile - Substation Security Assets



However, security assets typically have a combination of both electronic and mechanical components, which means that the nominal lives of the incongruent asset types can vary from 10 to 45 years. Notwithstanding any intervening actions, by the end of the next 5 year period this will result in the outcome as shown in Figure 5; which shows the average age for each asset class against the nominal lifespan for that asset class.

Figure 5: Age Forecast - Substation Security Assets

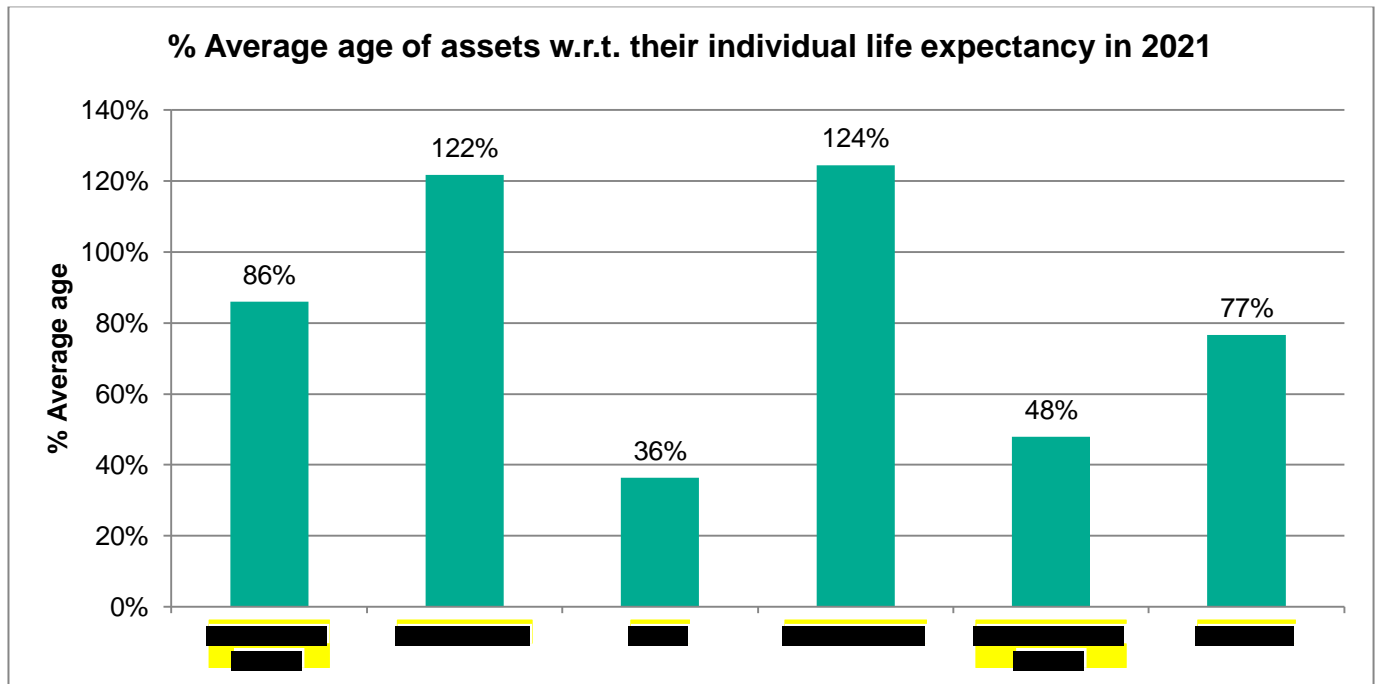


Figure 4 depicts a clearer picture of the condition of security assets by outlining a proxy “health” view of the assets (based on their natural ages). This indicates that on average [redacted] and [blue] systems will be exceeding their nominal lifespan by the end of the 5 year period. This suggests that renewal strategies may be required for these asset types, depending on their actual health and obsolescence situation. In essence, by June 2021:

- [redacted] systems will have an average age of 11.6 years against a nominal lifespan of 10 years.
- [redacted] [blue] (electric) will have an average age of 17.6 years against a nominal lifespan of 15.5 years.
- [redacted] system will have an average age of 11.2 years against a nominal lifespan of 15 years.

This age profile analysis assumes that no intervening action will be taken with respect to these assets within the period. It should be noted that [redacted], [redacted] system and [redacted] system have been identified for strategic initiatives in Section 7.2.2 to meet compliance requirements. These initiatives are discussed in Section 7.2.2 with respect to the assets in question.

7.2.2 Emerging Issues, and Renewal and Maintenance Initiatives

This section reviews the status of TransGrid’s different classes of substation security asset populations to identify any current or emerging issues. The strategic initiatives that have been established in response to the identified issues are also noted.

7.2.2.1 [redacted] System Review

The **Access Card** System is reliant on several system-wide elements that will affect a large proportion of, if not all, substations in the event of a failure. The system-wide elements fall into two main categories:

- Substation security head unit and software: Failure of the server component, database or software application may have a system wide impact. To mitigate the risk of such a failure, the system has been established with full redundancy, and a disaster recovery plan is prepared and ready to implement as required. Communications network: The system also relies on the communications network. The communications network is not included in the scope of this document – refer to *Renewal and Maintenance Strategy - Telecommunications Terminal Equipment* and *Renewal and Maintenance Strategy – Telecommunications Infrastructure*.

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The [REDACTED] System at each site is also comprised of distributed asset components installed at strategic locations within that site. The impact on system availability due to a distributed asset failure is usually localised. The distributed [REDACTED] System asset components fall into two main categories:

- Indoor components: [REDACTED]. Little deterioration of these system components is expected due to environmental effects. However, [REDACTED] the manufacturer of the current [REDACTED], anticipates that the current [REDACTED] and its key components will [REDACTED] as it will be difficult to obtain replacements and spare parts, and retain hardware/software support.
- Outdoor components: The external [REDACTED] are located outdoors and exposed to the harsh environment. These are exhibiting signs of accelerated aging and premature failure as a result.

The emerging issues, and renewal and maintenance initiatives will be discussed in the table below:

Table 6: Emerging Issues, Renewal and Maintenance Initiative

Asset	Asset Management Objective	Current and Emerging Issue	Strategic Initiative	Progress (completion and expenditure)	References
<ul style="list-style-type: none"> • [REDACTED] System 	<ul style="list-style-type: none"> • Manage substation related public and staff safety risks to As Low As Reasonably Practicable (ALARP)/So Far As Is Reasonably Practicable (SFAIRP) • Maintain network reliability 	<p>External [REDACTED] are exposed to harsh environment and thus exhibit signs of accelerated aging and occasional early failure.</p>	<p>Renewal initiative:</p> <ul style="list-style-type: none"> • Replace 350 [REDACTED] at [REDACTED] substation sites over the next revenue reset period 2018/19 – 2022/23. <p>Maintenance Initiative</p> <ul style="list-style-type: none"> • Continue to monitor the identified issues through defect maintenance. • Review the performance and condition of the [REDACTED] over the next 12 months and assess the need for further action. 	<p>Renewal initiative:</p> <ul style="list-style-type: none"> • OER approved <p>Maintenance initiative:</p> <ul style="list-style-type: none"> • Condition assessment of [REDACTED] yet to be done. 	<ul style="list-style-type: none"> • Need No: 1452 • OER 1452
		<p>The useful life of the current system will be shortened due to an end of manufacturer's support and spares availability by 2023.</p> <p>A number of sites are currently outside of coverage of the system, which makes them non-complaint with the Network Security Standard.</p>	<p>Renewal initiative:</p> <ul style="list-style-type: none"> • Replace the entire system across all existing sites. • Expand the coverage of the system to the sites in question 	<p>Renewal initiative:</p> <ul style="list-style-type: none"> • OER approved 	<ul style="list-style-type: none"> • Need No: 1595 • OER 1595

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Apart from disposals associated with renewal works, there is no known need to dispose of any Security Fence assets within the 2016-21 period.

7.2.2.2 System Review

The CCTV systems will be approaching the end of their nominal lifespan by the end of the 2016-21 period. The CCTV systems have begun to show age/wear related failures and the failure rate are observed to be increasing with time. CCTV systems are comprised of distributed assets located on site.

The impacts on system availability due to a distributed asset failure are usually localised. The distributed system components fall into two main categories:

- Indoor components: [REDACTED]. Beyond [REDACTED], due to aging, the failure rates of these [REDACTED]s will be [REDACTED] necessitating [REDACTED] maintenance cost. A number of these [REDACTED] are subject to conditional failure due to [REDACTED] as per the Network Security Standard.
- Outdoor components: Outdoor [REDACTED]s and the relevant communication infrastructure are exposed to the harsh environment. These are [REDACTED] as a result.

TransGrid's review of substation Risk Groupings and Criticality Rankings has identified compliance issues affecting TransGrid's [REDACTED]. The review found that the public safety and environmental risks associated with not having [REDACTED] systems in operation at the [REDACTED] are significant. The review found that amending the Network Security Standard to now require [REDACTED] systems to be in operation at [REDACTED] provides an effective risk mitigation strategy, which is consistent with the overall asset strategy. This amendment to the Network Security Standard affects 28 substations.

"Asset Monitoring Centre – Asset Monitoring Functional Description" identifies the [REDACTED] system as a key enabler to perform the AMC's core function. For asset monitoring and [REDACTED] of the high value assets will be of great benefit.

In addition, [REDACTED] will enable regular and on-demand [REDACTED] of the energised assets and hot joints, and will assist in classifying outages due to transient causes such as direct lightning strikes or flying debris. This will also enable Asset Monitoring Centre and System Operators in verifying certain SCADA/condition monitoring alarms.

The emerging issues and renewal initiatives will be discussed in the table below:

Table 5: Emerging Issues and Renewal Initiative

Asset	Asset Management Objective	Current and Emerging Issue	Strategic Initiative	Progress (completion and expenditure)	References
<ul style="list-style-type: none"> System 	<ul style="list-style-type: none"> Manage substation related public and staff safety risks to As Low As Reasonably Practicable (ALARP)/So Far As Is Reasonably Practicable (SFAIRP) Maintain network reliability 	Significant Public safety risks associated with not having systems in operation at the medium criticality ranking sites.	Renewal initiative: Install at the sites that are currently with the Network Security Standard.	<ul style="list-style-type: none"> RPS 657 approved 	<ul style="list-style-type: none"> Need No: 657 RPS 657
		Due to aging, the failure rates of existing analogue cameras are high and incur high corrective maintenance cost.	Renewal initiative: <ul style="list-style-type: none"> Replace sites. Install sites. 	<ul style="list-style-type: none"> OER 1398 approved 	<ul style="list-style-type: none"> Need No: 1398 OER 1398

Apart from disposals associated with renewal works, there is no known need to dispose of any system assets within the 2016-21 period.

7.2.2.3 Security Review

TransGrid standard e for new installations is a Palisade . The majority of are of this type and were installed no earlier than 2005. These are considered to be in a good condition overall. However, a concern has been raised where if upgrading to W-pale Palisade system without upgrading footings the may be vulnerable to collapse during extreme wind events.

TransGrid has a small proportion of that are of different types to the standard; however, it is TransGrid's strategy that these will only be considered for renewal if there are issues identified with them that warrant such

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The emerging issues and maintenance initiatives will be discussed in the table below:

Table 6: Emerging Issues and Maintenance Initiative

Asset	Asset Management Objective	Current and Emerging Issue	Strategic Initiative	Progress (completion and expenditure)	References
<ul style="list-style-type: none"> Security 	<ul style="list-style-type: none"> Manage substation related public and staff safety risks to As Low As Reasonably Practicable (ALARP)/So Far As Is Reasonably Practicable (SFAIRP) Maintain network reliability 	<ul style="list-style-type: none"> Retrofit of on existing may increase wind loading and subject these to collapse during high wind events. New defeat mechanism of palisade is identified via spreading any two adjacent pales longitudinally with the help of a car jack 	<p>Asset manager to undertake further analysis:</p> <ul style="list-style-type: none"> An investigation is to be carried out to assess vulnerability of retrofitting at Armidale and Newcastle substations following recommendations (If any design modifications are necessary). The current renewal initiative to replace with to be placed on hold pending the outcome of the review. An investigation is to be carried out to assess the new defeat mechanism of palisade. The outcome of the investigation should make recommendations concerning the vulnerability. 	<ul style="list-style-type: none"> Investigation into the vulnerability of to be completed by July 2017. Recommendations from the above review to be captured and a program for implementation developed by July 2017. An investigation on the new defeat mechanism of palisade to be completed by July 2017. Recommendations from the above review to be captured and a program for implementation developed by July 2017. 	

Apart from disposals associated with renewal works, there is no known need to dispose of any Security assets within the 2016-21 period.

7.2.2.4 Security Review

Thirty-nine of TransGrid sites currently have razor wire installed. These are considered to be in a good condition overall. There are no current or emerging issues that have been identified with respect to the razor-wire s.

Sixty-two of TransGrid's sites had electric installed between 2005 and 2012. Although this security treatment is relatively new, these systems have exhibited a number of failures in the following areas:

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The above issues have led to a review of the continued use of electric [REDACTED]. The review has found that compared to other types of [REDACTED] available the electric [REDACTED] have:

- Increased maintenance, defect and renewal costs.
- Decreased performance: system being non-operational due to defects and failures, providing less of a visual deterrent than razor wire against attempted security breaches.
- Increased risk of unauthorised substation entry as a result of the poor performance.

Following the review of the use of electric [REDACTED], they were found to pose significant risk to the organisation and potentially put TransGrid in breach of its regulatory obligations. As a result, they are no longer considered as an appropriate security treatment, and the design standard has reverted to the installation of razor wire [REDACTED] instead. There are [REDACTED] sites where electric [REDACTED] are installed and these sites are considered to no longer meet their [REDACTED] security requirements.

The emerging issues, and renewal initiatives will be discussed in the table below:

Table 7: Emerging Issues and Renewal Initiative

Asset	Asset Management Objective	Current and Emerging Issue	Strategic Initiative	Progress (completion and expenditure)	References
<ul style="list-style-type: none"> • Security [REDACTED] 	<ul style="list-style-type: none"> • Manage substation related public and staff safety risks to As Low As Reasonably Practicable (ALARP)/So Far As Is Reasonably Practicable (SFAIRP) • Maintain network reliability 	There are 57 sites where electric [REDACTED] are installed and these sites are considered to no longer meet their [REDACTED] security requirements.	Renewal initiative: Replace electric [REDACTED] with [REDACTED] at the [REDACTED] sites where electric [REDACTED] are currently installed	<ul style="list-style-type: none"> • OER 1451 approved 	<ul style="list-style-type: none"> • Need No: 1451 • OER 1451

Apart from disposals associated with renewal works, there is no known need to dispose of any Security [REDACTED] assets within the 2016-21 period.

7.2.2.5 [REDACTED] Review

The overall condition of the TransGrid's [REDACTED] are considered to be satisfactory. There have not been any reports of any successful compromise or attempts to compromise substation security through a breach or attempted breach of the lock and key security treatment.

No current or emerging issues have been identified concerning asset health or obsolescence.

Apart from disposals associated with renewal works, there is no known need to dispose of any [REDACTED] assets within the 2016-21 period.

7.2.2.6 [REDACTED] Review

[REDACTED] of TransGrid's sites have [REDACTED] installed. These [REDACTED] are installed during the [REDACTED] installations for a given site and therefore are relatively new i.e. they were installed no earlier than 2005. The overall performance of the [REDACTED] is considered to be satisfactory. Although, a few failures have occurred in the [REDACTED]

In general, due to having large wind surface area, manual [REDACTED] may accelerate uncontrollably during opening or closing at a moderate to high wind condition. This has been identified as a potential safety hazard for TransGrid staff and its contractors.

Both [REDACTED] are built from [REDACTED] to provide a similar level of security as the [REDACTED]. As an unintentional consequence, these [REDACTED] are heavy and cause additional wear and tear to the mechanisms resulting in shortening of their useful lives.

The emerging issues, renewal and maintenance initiatives will be discussed in the table below:

Table 8: Emerging Issues and Maintenance Initiative

Asset	Asset Management Objective	Current and Emerging Issue	Strategic Initiative	Progress (completion and expenditure)	References
<ul style="list-style-type: none"> [REDACTED] 	<ul style="list-style-type: none"> Manage substation related public and staff safety risks to As Low As Reasonably Practicable (ALARP)/So Far As Is Reasonably Practicable (SFAIRP) Maintain network reliability 	<ul style="list-style-type: none"> Defective [REDACTED] causing [REDACTED] unable to close. [REDACTED] controller module and motor drives failure. Breakage of rack teeth hindering [REDACTED] movement. Wind loading causing [REDACTED] sliding [REDACTED] to misalign and to bump while closing and resulting in motor trip on thermal overload. Wind loading causing manual [REDACTED] to accelerate uncontrollably to become a safety hazard 	<p>Renewal Initiative:</p> <ul style="list-style-type: none"> Install and upgrade safety [REDACTED] on [REDACTED] Modify [REDACTED] Modify manual [REDACTED] <p>Maintenance Initiative:</p> <ul style="list-style-type: none"> Continue to monitor the identified issues through defect management and defect maintenance. 	<p>Renewal initiative:</p> <ul style="list-style-type: none"> Need 1720 Need 1722 Need 1712 <p>Maintenance Initiative:</p> <ul style="list-style-type: none"> To be monitored through defect management. 	<ul style="list-style-type: none"> Need 1720 Need 1722 Need 1712

Apart from disposals associated with renewal works, there is no known need to dispose of any Security [REDACTED] assets within the 2016-21 period.

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7.2.2.7 [REDACTED] Review

The Network Security Standard requires the use of [REDACTED] at all substation perimeters; however, at present there are none that have [REDACTED] systems in operation. The primary purpose of the [REDACTED] is to provide a signal to potential intruders that their presence has been detected without the need to use audible alarms, which has caused complaints by neighbours due to false alarming. The [REDACTED] is to be activated by dedicated movement detectors or by the intrusion detection systems installed at the site.

[REDACTED] requires the immediate switching of lights near the perimeter on receipt of a signal. The standard [REDACTED] existing at TransGrid sites [REDACTED] does not provide the fast start capability required for security [REDACTED]

A risk-based cost versus benefits analysis has been undertaken which has concluded that upgrading all of the substation [REDACTED] systems to provide [REDACTED] is not warranted. Instead, it is preferred to upgrade to [REDACTED] as the condition of current [REDACTED] g systems deteriorates to a stage where asset renewal is required.

A condition assessment of the existing [REDACTED] g systems (which fulfils both an operational and security need) has indicated that [REDACTED] sites require a condition based replacement of the [REDACTED] systems.

The emerging issues, and renewal and maintenance initiatives will be discussed in the table below:

Table 9: Emerging Issues, Renewal and Maintenance Initiative

Asset	Asset Management Objective	Current and Emerging Issue	Strategic Initiative	Progress (completion and expenditure)	References
[REDACTED]	<ul style="list-style-type: none"> Manage substation related public and staff safety risks to As Low As Reasonably Practicable (ALARP)/So Far As Is Reasonably Practicable (SFAIRP) Maintain network reliability 	<ul style="list-style-type: none"> [REDACTED] systems are required for compliance with the Network Security Standard. Existing [REDACTED] systems are not compatible with [REDACTED] would need to be replaced to introduce [REDACTED]. <p>Condition assessments have identified 10 substations where renewal of existing [REDACTED] systems is currently recommended.</p>	<p>Renewal initiative:</p> <p>Upgrade [REDACTED] systems to provide [REDACTED] capability at the [REDACTED] sites where condition based renewals are currently required.</p>	<ul style="list-style-type: none"> OER approved. 	<ul style="list-style-type: none"> Need No: 1455 OER 1455

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Asset	Asset Management Objective	Current and Emerging Issue	Strategic Initiative	Progress (completion and expenditure)	References
			Asset Manager to undertake further analysis: Continue to carry out periodic condition assessments of [REDACTED] systems. Maintenance initiative: Establish a maintenance regime for [REDACTED] [REDACTED] systems based on manufacturer recommendations.	Maintenance Initiative: <ul style="list-style-type: none"> To be monitored through defect management after [REDACTED] [REDACTED] installation 	

No disposal initiative is required.

7.2.3 Maintenance Program

There is a modification in renewal and maintenance strategy for security assets in order to deliver the 2016/17 Business Plan and further enhance the strategy as shown in Table 10. It has been identified from the analysis that elimination of routine maintenance has positive impact on operating cost reduction. Also the increase in risk is minimal compared to the cost reduction of routine maintenance. So it has been proposed to eliminate half yearly security asset related site inspection and yearly security system maintenance for greater efficiencies in costs and processes by reducing operating costs and will be managed on defect basis. It is also suggested to combine quarterly substation perimeter [REDACTED] inspection with substation inspection. This will be followed by modification in Maintenance Plan – Substation Security Asset

Table 10 Security Asset Maintenance Strategy Modification

Maintenance Task	Current Frequency	Proposed Frequency	Reason for change
Site Inspections	[REDACTED]	[REDACTED]	[REDACTED]
Security System maintenance	[REDACTED]	[REDACTED]	[REDACTED]
Substation Perimeter [REDACTED] Inspection	[REDACTED]	[REDACTED] [REDACTED]	[REDACTED] [REDACTED] [REDACTED]

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8. Future Outlook

8.1 Forecast Expenditure

The table below outlines the expenditure forecast related to renewal, disposal and maintenance initiatives as described in this document. This excludes expenditure related to routine inspection and maintenance tasks or as indicated.

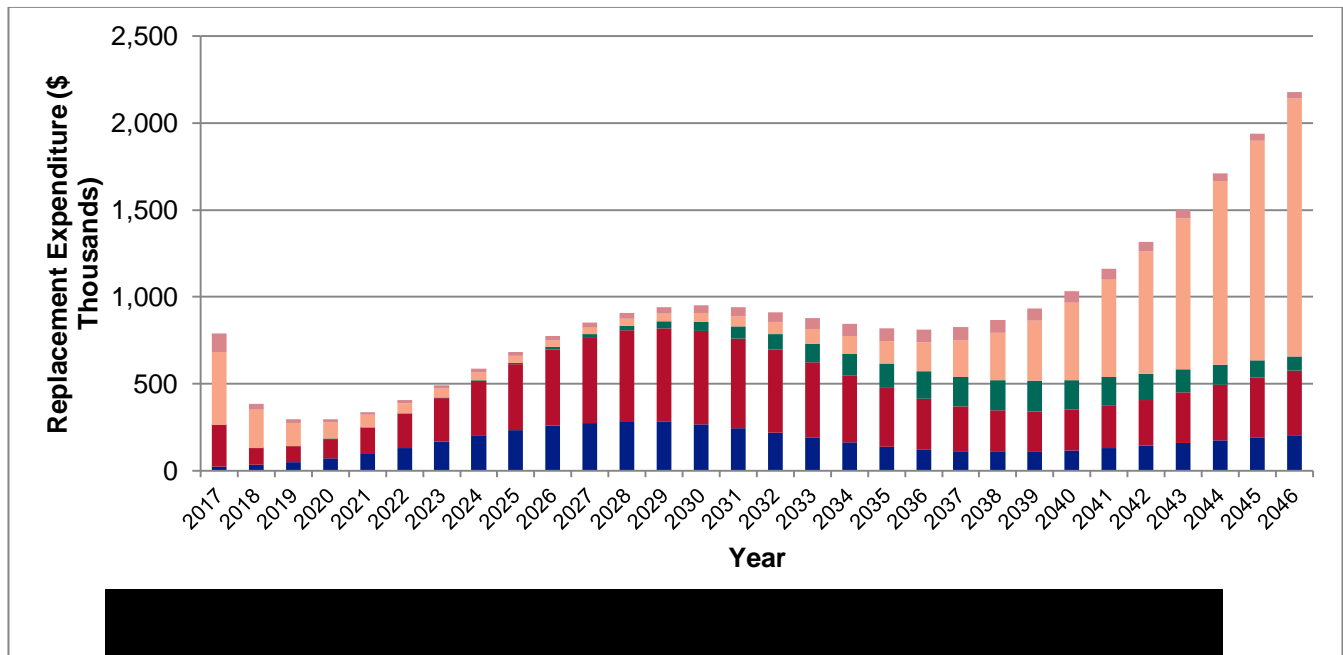
Table 11: Security Assets Expenditure Forecast

Asset	Renewal Initiative Forecast 2016-21	Maintenance Initiative Forecast 2016-21
[REDACTED]	\$13.94M	\$0.2M
[REDACTED]	\$14.3M	-
[REDACTED]	\$2.1M	-
[REDACTED]	-	\$0.4M
[REDACTED]	\$3.87M	-
[REDACTED]	\$1.66M	\$0.2M
[REDACTED]	\$7.70M	\$0.1M

The baseline inspection and corrective maintenance budget per year is approximately \$0.3M (2016-17 dollars) up to June 2021.

Figure 6 below depicts a 30-year replacement expenditure look ahead based on asset age and are expressed in 2016/17 dollars.

Figure 6: Security Assets Replacement Expenditure Forecast based on age



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8.2 Anticipated Changes to the Asset Base

The substation security asset base can change either due to:

- Introduction/removal of security systems (treatments¹) in order to optimise security – the anticipated changes to security treatments are the outcomes of this document.
- Substation commissioning and other works requiring changes to existing security systems – it is expected that there will be less than 5 new substations commissioned within the 2016-21 period.

There are no significant changes expected to TransGrid's substation security asset base that will affect renewal and maintenance strategies moving forward.

9. Spares

Spares are items of serviceable equipment that are booked into and stored in TransGrid's storage facilities for maintenance and project purposes. This document does not cover the spares required for project purposes.

TransGrid has purchased a range of strategic spare equipment to improve the organisations ability to restore supply and system security in a timely manner, following the major failure of an in-service unit. The below key asset components are to be kept in hand as strategic spares:

Table 12: Security Strategic Spares

Asset	Component	Quantity	Location	Responsibility
System		6	Metropolitan Regional Centre, Newcastle Regional Centre, Wagga Wagga Area Centre	Property manager, Field Services
		6	Metropolitan Regional Centre, Newcastle Regional Centre, Wagga Wagga Area Centre	Property manager, Field Services
System		6	Metropolitan Regional Centre, Newcastle Regional Centre, Wagga Wagga Area Centre	Property manager, Field Services

* The elements of TransGrid's security systems are referred to as security "treatments". This is a reference to the risk treatments identified in the Corporate Risk Management Framework, where security assets fall under the "reduction" treatment in the mitigation of security risks.

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10. Asset management capability and continual improvement

Table 13 outlines the continual improvement initiatives for the security asset:

Table 13: Continual Improvement Initiatives

Asset Management Objectives	Asset Management Actions	Reference
Deliver a successful revenue determination	1. Documentation required for RP2 submitted	All documentation completed by deadline.
<ul style="list-style-type: none"> ISO 55001 Compliant Continually improve the Asset Management System 	2. Asset information improvements (governance, data, reporting and systems) implemented 3. Asset maintenance scope and frequency optimised 4. Plant and design standards optimised	<ul style="list-style-type: none"> Overhaul of the Ellipse Data rules for security asset has been completed and implemented. Changes the maintenance strategy to be reviewed next year. Annual refresh of Network Security Standard
<ul style="list-style-type: none"> AS 5577 compliant Continually improve the Electricity Network Management System 	5. Formal Safety Assessments complete and externally audited	<ul style="list-style-type: none"> Public Electricity Safety Awareness (PESA) Plan reviewed on an annual basis.
Improve CAPEX performance	6. REPEX and risk scenarios understood 7. Investment governance/prioritisation/optimisation process enhanced	<ul style="list-style-type: none"> Utilisation of the risk tool to provide a more granular view of the pre and post-investment risks associated with building new or replacing assets. ALARP analysis completed for proposed RP2 renewals. NPV analysis completed on all solutions to ensure value for money.

Asset management capabilities are those elements that facilitate best practice asset management decision making. These include:

- Risk management practices.
- Asset information.
- Staff skills and competency.
- Continual improvement initiatives for the system.

No other asset management capability initiative is deemed necessary.

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11. Implementing the Strategies

To implement the strategic renewal and maintenance initiatives stemming from this document, actions are to be established via the:

- Substation Security Asset - Maintenance Plan: The maintenance plan outlines the routine maintenance tasks and frequencies for each asset type.
- Capital Works Program: The capital works program outlines the approved asset renewal and disposal projects.
- Other enabler plans detailing how the asset management capability improvements are being implemented

The Security Asset Manager is responsible for preparation of the maintenance plans and referring the renewal and disposal initiative to the network investment process. Field Services is responsible for delivering the maintenance plans as per the Service Level Agreements, and Portfolio Management group/Project Services are responsible for delivering the renewal and disposal initiatives detailed in the approved capital works program.

12. Monitoring and review

Implementation of the Substation Security Asset Renewal and Maintenance Strategy is monitored and reviewed by the Security Asset Manager, Group Manager/Asset Strategy and Executive Asset Strategy Committee annually.

13. Roles and Responsibilities to Develop this Asset Strategy

The roles and responsibilities of those charged with the development of this asset strategy are as follows:

- The Group Manager/Asset Strategy is responsible for the approval of this strategy.
- Security Asset Manager is responsible for the development and regular review of this strategy. The document will be reviewed biannually or as significant changes to investment needs become apparent.

14. Change history

Revision no	Approved by	Amendment
3	L. Wee GM/Asset Strategy	Review and update to deliver the 2016/17 Business Plan and further enhance the strategy in the new template.
2	L. Wee GM/Asset Strategy	Review and update to deliver the 2015/16 Corporate Plan and further enhance the strategy.
1	G. Chubb, M/Asset Performance	Updated to reflect the continual improvement in the “top down” approach for the line of sight to the Asset Management Strategy and the Corporate Plan and an enhanced description of the asset management decision process and the strategic initiatives to be undertaken.

15. References

Asset Management Strategy and Objectives

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Asset Management System Description

Substation Security Assets Maintenance Plan

Network Security Standard

Energy Networks Australia (ENA) – National Guidelines for Prevention of Unauthorised Access to Electricity Infrastructure, Doc 015-2006.

National Guidelines for Protecting Critical Infrastructure from Terrorism, ISBN: 978-1-921725-57-9.

Network Asset Risk Assessment Methodology

Network Asset Criticality Framework

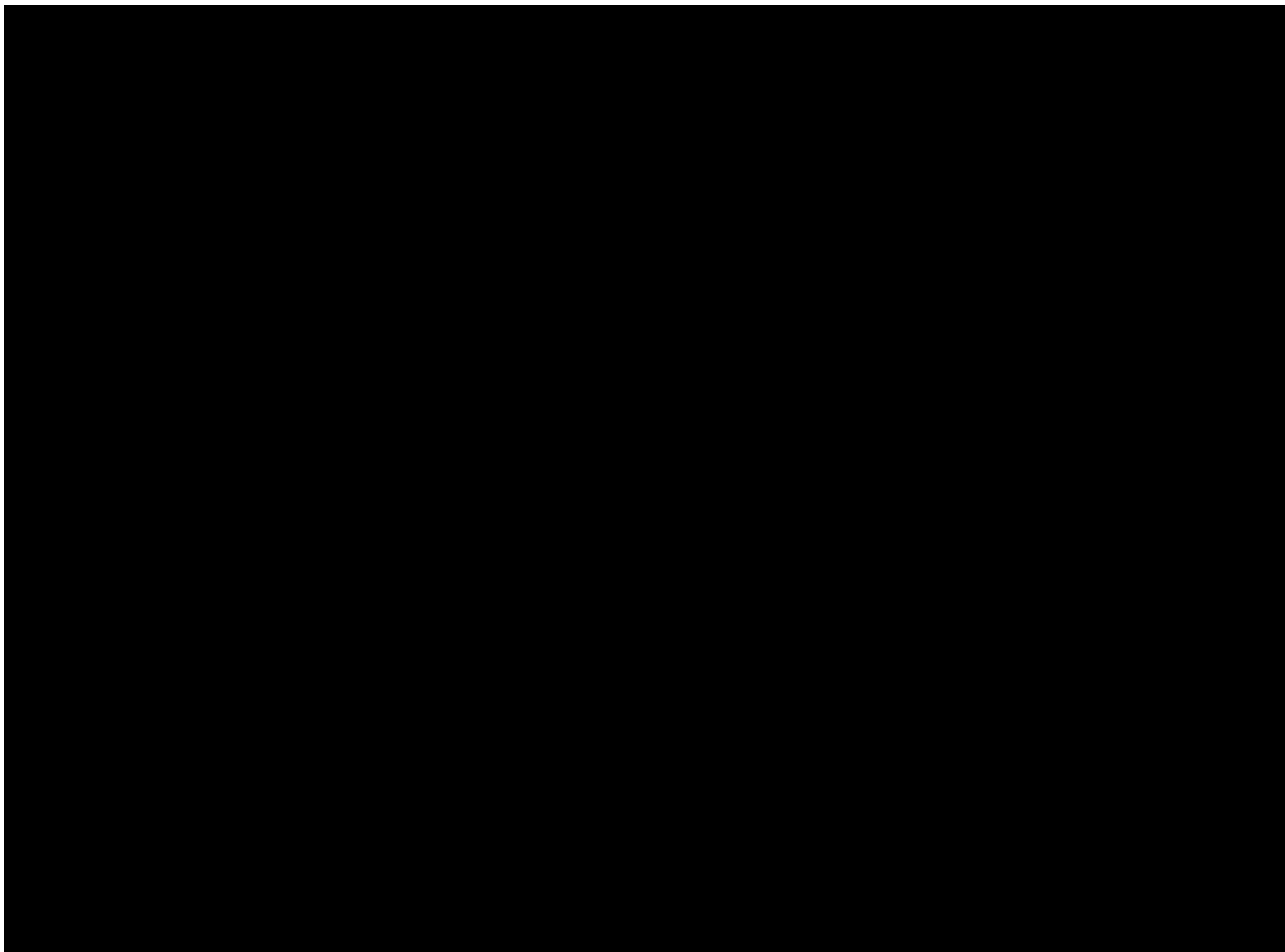
Network Asset Health Framework

16. Attachments

Attachment 1 - "Substation Risk Groups and Requirements"

Attachment 2 – "Substation Criticality Ranking"

A.1 Attachment 1 - Substation Risk Groups and Requirements



Note 1:

TransGrid's review of substation Risk Groupings and Criticality Rankings has identified a range of public safety and environmental risks at a number of sites and will result in a change to the Network Security Standard. Under the revised Network Security Standard both "Medium" and "Low" risk sites will now require Closed Circuit Television [REDACTED]

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A.2 Attachment 2 – Substation Criticality Ranking

Table 16: Substation Criticality Ranking

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