TRANSPOWER

2026 Asset Management Plan

Managing and maintaining our grid, ICT and business support assets

SEPTEMBER 2026

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Introduction

Introduction

For over 100 years Transpower has been powering and connecting New Zealand. Our mahi delivers comfort, connection and economic prosperity for New Zealanders through delivering the clean energy that fuels Aotearoa New Zealand. As the owner and operator of Aotearoa New Zealand's national electricity transmission system, we hold a unique position in the energy sector. We do not generate or sell electricity but provide the infrastructure and market system that connects electricity generators to major electricity users and the distribution networks that deliver electricity to homes and businesses.

Electrification is central to enabling New Zealand's long-term economic growth. The substantial expansion of the electricity system to support growth will require coordinated, systemwide planning to deliver the least-cost electricity system for New Zealanders. Our role is critical in enabling Aotearoa New Zealand's electrification and a net zero carbon future. We are committed to enabling the significant increase in electricity required for Aotearoa New Zealand to meet its decarbonisation goals while ensuring the resilient, reliable, and safe operation of the grid at least cost. People and relationships are core to our business as we work alongside landowners, iwi, hapū, and the communities that host our assets.

Our services are regulated to help ensure we efficiently deliver the right services, with the right level of funding. We operate in 5-year regulatory control periods (RCPs). From 1 July 2025 we embarked on our fourth Regulatory Control Period (RCP), which will operate through to 30 June 2030. Throughout RCP4, we are scaling our capability across capital delivery and system operations to maintain a safe and reliable network for kiwis, and to enable New Zealand's growth.

In addition to our RCP proposal process, we can submit proposals to the Commerce Commission to seek approval, for major capital projects (MCPs) that have expected costs greater than $30m. Although falling outside our RCP proposal approval process, our MCP proposals are developed with the same sound asset management principles that are applied to an RCP proposal. Our **Transmission Planning Reports** provide more detail on our MCPs.

This Asset Management Plan (AMP) is a valuable resource to communicate our asset management approach and plans with our customers. It is one of three supporting documents within our Integrated Transmission Plan (ITP). It is a regulatory requirement for us to produce an ITP. The ITP is a suite of documents describing our plans for our regulated transmission business.

It consists of:

- **ITP Narrative**: provides a concise, accessible overview of our plans
- **AMP:** documents our asset management approach, processes and investment requirements by asset class, covering our grid, Information and Communications Technology (ICT) and business support assets
- **Transmission Planning Report**: describes grid security and capacity issues that could arise over the coming 15 years due to changes in demand and generation. It includes detail on committed and potential grid enhancements.
- **Service Measures Report**: summarises the performance of our regulated transmission business, including service performance and asset health measures, quality standards, and targets and revenue incentives for RCP4.

Our assets

We invest in, operate, and maintain approximately $5 billion of regulated electricity transmission infrastructure and associated support systems and facilities that together enable a functional, reliable, and safe grid. We have classified our assets into three portfolio categories based on their role within the business. These are grid assets, ICT assets, and business support assets.

Grid assets

We classify our grid assets as primary and secondary assets. Together, these assets operate as a system. Our primary assets consist of assets such as towers, conductors, and power transformers’; our secondary assets include protection and control equipment. We group our grid assets into the following six portfolios that reflect their different characteristics:

- Alternating Current (AC) Substations
- Transmission Lines (TL)
- Buildings and Grounds
- High Voltage Direct Current (HVDC)
- Reactive assets
- Secondary assets.

ICT assets

Our ICT assets include all our operational technology, information technology, systems, and telecommunications assets. We categorise our ICT assets into the following five ICT asset portfolios.

- Asset Management Systems
- Transmission Systems
- Shared Services
- Corporate Services
- Telecommunications, Network and Security Services.

Business support assets

Our business support assets are the essential infrastructure we need to support our operations and activities. These include corporate buildings, vehicles and other equipment including laptops and mobile phones used for day-to-day operations that are not directly related to the grid or ICT.

Structure of this document

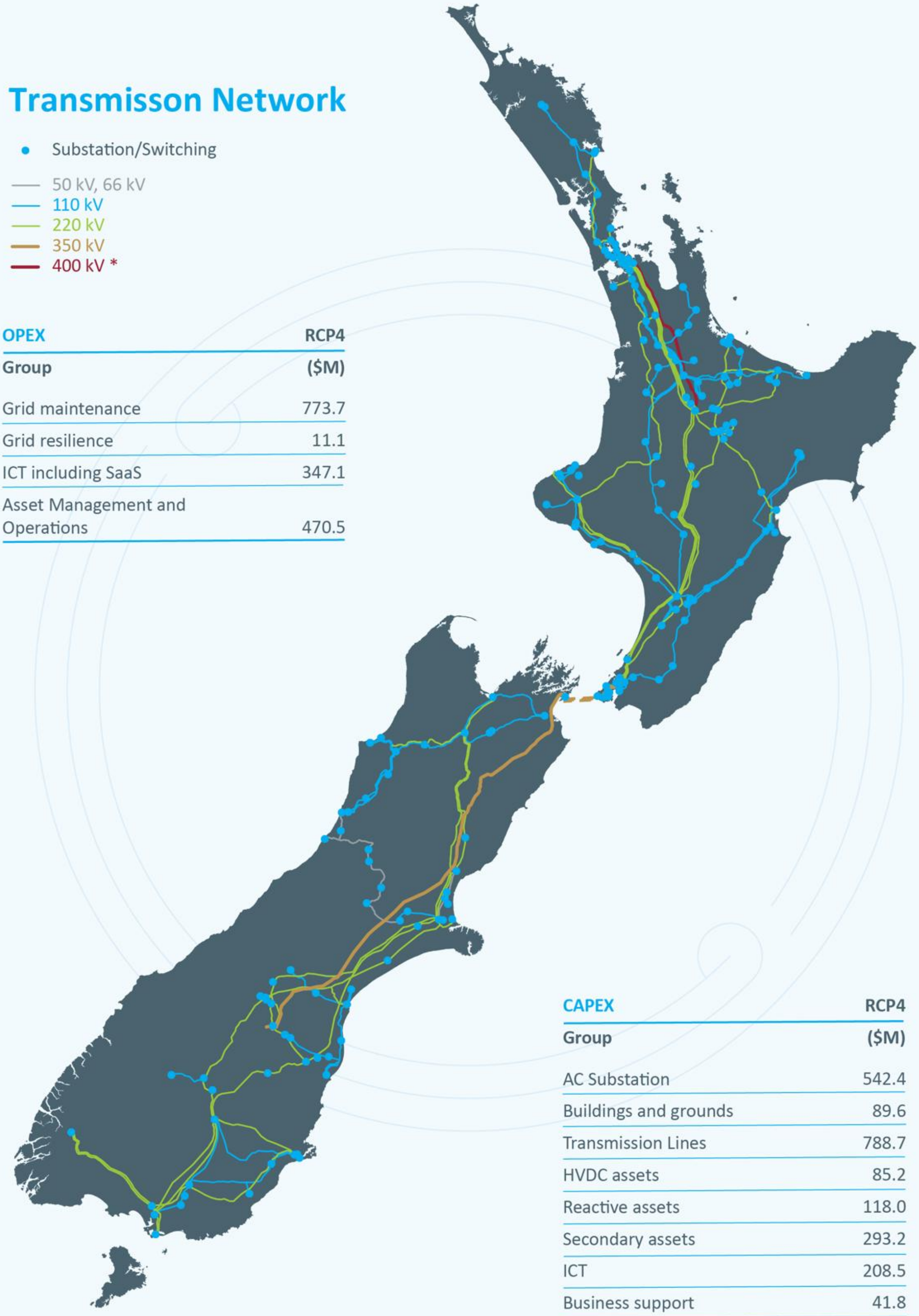
This AMP is structured into six sections as shown in Table 1.

Table 1: AMP structure

Section	Section name
1.	Introduction
2.	Plan Summary
3.	Our Approach to Asset Management
4.	Grid Asset Class Plans
5.	ICT Asset Class Plans
6.	Business Support Asset Class Plan

Plan Summary

Transmisson Network



OPEX Group	RCP4 ($M)
Grid maintenance	773.7
Grid resilience	11.1
ICT including SaaS	347.1
Asset Management and Operations	470.5

CAPEX Group	RCP4 ($M)
AC Substation	542.4
Buildings and grounds	89.6
Transmission Lines	788.7
HVDC assets	85.2
Reactive assets	118.0
Secondary assets	293.2
ICT	208.5
Business support	41.8
Grid resilience	143.7

*Designed to 400kV, operated at 220kV

Plan Summary

Empowering New Zealand's energy future depends on us making the right choices at the right time. This includes ensuring timely least cost investment to enable kiwi homes and businesses to access affordable energy. Ultimately, it is about ensuring the transmission network supports Aotearoa New Zealand to thrive and grow as it electrifies. Electrification is central to enabling New Zealand's long-term economic growth. Te Kanapu, our strategic initiative to develop a long-term Grid Blueprint for 2050, is focused on ensuring our long-term transmission planning is robust, transparent, and aligned with New Zealand's economic aspirations. It focuses on a 2050 vision of Aotearoa and customer outcomes by asking the question "what is the electricity grid that delivers the lowest cost, reliable, electricity", then working back to the system and grid that can best enable that.

Delivering electrification to lower New Zealand's overall energy costs requires infrastructure investment not seen in generations. We are experiencing a substantial increase in new customer connections along with major projects needed to enable economic growth and electrification.[1] At the same time, a significant proportion of our existing grid assets were built between the 1950s and 1980s and are now reaching end of life, requiring refurbishment or replacement to maintain reliability. This investment is essential to New Zealand's energy future and to avoid higher cost and more reactive expenditure later. Investment is also required to ensure the resilience of the grid. We are committed to ensuring that our critical infrastructure is reliable and resilient, enables growth, and meets New Zealanders' needs at the least cost for generations to come.

The investment we are making during RCP4, seeks to deliver on the following outcomes:

- **A reliable and safe network.** We will deliver a transmission service that minimises interruptions at least whole of life cost, where assets are monitored, controlled, operated, maintained and replaced in line with good electricity industry practices, and where risks to our staff, contractors and general public are minimised.
- **A resilient network.** A resilient network avoids extended power outages and quickly restores power when major events occur.
- **Enhancing the network.** We aim to ensure capacity is in the right place at the right time and customers continue to receive a reliable and secure transmission service that meets their needs[2].
- **A sustainable network.** We will reduce our carbon footprint over RCP4 to ensure we can achieve a 60% reduction in emissions by 2030 in our aim to reach a net zero target by 2050.

We are working within the context of Aotearoa New Zealand pursuing a goal to be net zero carbon by 2050. Electrification of most of the energy used in Aotearoa's economy is happening, and the pace is only going to continue. We are experiencing a dramatic increase in enquiries for connections to the grid from both new generation developers and our existing load customers. In addition, peak demand - the amount of electricity used at the busiest times on the grid – continues to trend up. Our purpose, *Whakamana i te mauri hiko tu mai Aotearoa – empowering the energy future for Aotearoa New Zealand* reflects our commitment to the enabling role we play in the transition to a more electrified, renewable economy and ensuring a resilient, reliable and affordable power supply for all New Zealanders.

To enable this increase in electrification, ensure resilience, and to face the challenge of climate change we need to have the foundation of a well-functioning grid. Consistent with our peer companies around the world, expenditure will need to increase over the coming years to maintain the reliability and resilience of the grid to support electrification.

Aotearoa is not alone in electrifying its economy. Large scale electrification globally, with subsequent grid maintenance and expansion around the globe has created pressure within international supply chains and industry resourcing. We have also seen a substantial and sustained increase in ICT hardware costs due to unprecedented demand for AI-enabled computing infrastructure and global shortage of critical technology components. These factors have resulted in significant and sustained price increases for electrical infrastructure equipment, driving price increases in our industry higher than CPI. Our RCP4 allowances accounted for real price effects (input prices including CPI); the price increases we are experiencing have far surpassed our allowances.

[1] Transpower's **Transmission Planning Reports** provides more detail on this
[2] For more details on grid enhancements, please refer to our **Transmission Planning Reports**

We're putting the right tools and processes in place to ensure we meet our service targets, while balancing the significant increases in equipment prices. Where prices have increased significantly, we are actively both reprioritising work and exploring opportunities for increasing efficiency in how we deliver our work. Our focus is to apply a disciplined, systematic asset management approach to our workplan. Reprioritisation is undertaken based on updated asset condition, health and criticality information, the identification of cost-effective packaging of work for efficiencies and aligning the delivery timing of our workplan with known customer work in the area. This will ensure we are able to concurrently deliver our opex and base capex program alongside increasing demand for customer connections and a large pipeline of major capital projects. Delivery of all three will ensure we are able to continue to provide a safe and reliable service and enable electrification.

We are in the process of optimising ongoing refurbishment and life extension programmes for key assets such as power transformers, towers, conductors, and the HVDC link. In addition, we are refreshing our TransGO network. This work will ensure our national grid remains safe, reliable, and cost-effective into the future. This investment is essential to enable us to support continued electrification and to help us avoid more costly and pressured expenditure in the future.

Competition for skilled resources has intensified as electrification accelerates both domestically and internationally, alongside an ageing workforce across the energy and infrastructure sectors. Our workforce planning is accounting for this, to ensure we have the required workforce capacity and skills for the delivery demands of RCP4 and beyond. By actively seeking efficiencies and ensuring a highly skilled workforce, we are setting the stage for a sustainable future and building a foundation for growth and resilience.

We are focused on strengthening the resilience of our infrastructure. Our grid assets consist of long-lived assets that were built to the standards of the day. These assets are subject to a diverse range of natural hazards, and climate change is increasing both the frequency and magnitude of many of these. Our asset planning accounts for this changing dynamic to ensure we appropriately invest ahead of these impacts by incorporating resilience to major hazards and climate change projections. Our first Climate Adaptation Plan sets out a journey recognising the need to adapt to climate change over times as we replace aging assets, build and operate new assets for the grid and for customers, and through our proactive resilience programme.

Our ICT investments are further focused on using data and digital technology to accelerate our organisational effectiveness. Our aim is to assist our workforce with enhanced data driven decision making, while maintaining secure and reliable services. We are continuing to review and monitor emerging trends and actively adopt technology as it matures. We have completed the changes to the Transmission Pricing Methodology (TPM). Our focus remains on ensuring that ICT system capabilities are robust and compliant, enabling the accurate determination of regulated transmission charges for customers following the implementation of the new TPM. A key investment for us is the refresh of our nationwide area network, TransGO. Several key components are reaching the end of their effective life; this is driving a major investment to modernise the network during RCP4. We have also completed the procurement and blueprint phase of our Enterprise Resource Planning (ERP) capability modernisation and progressing to delivery and transition over the next 12-18 months.

Expenditure overview

We forecast an increase in our base capex requirements over the next 15 years, driven by an increased work programme, an ageing asset base, and escalating material and services prices.

Our total base capex is forecast to be $2,445.8 million for RCP4. Base capex is capex incurred in relation to asset replacement and refurbishment (R&R), business support, and ICT. It includes enhancement and development (E&D) base capex that supports increasing capacity and capability of the grid. The base capex within this AMP does not include capex associated with R&R listed projects. The capex is provided separately, as shown in **Figure 1**. Commentary on listed projects is provided within the applicable asset class plan within this AMP.

Please refer to the Transmission Planning Report for commentary on all our E&D expenditure, including major capital projects.

Figure 1 shows the forecast base capex, resilience, and listed projects expenditure profile for RCPs 4 to 6.

Figure 1: Base capex, resilience, and listed projects for RCP4 to RCP6

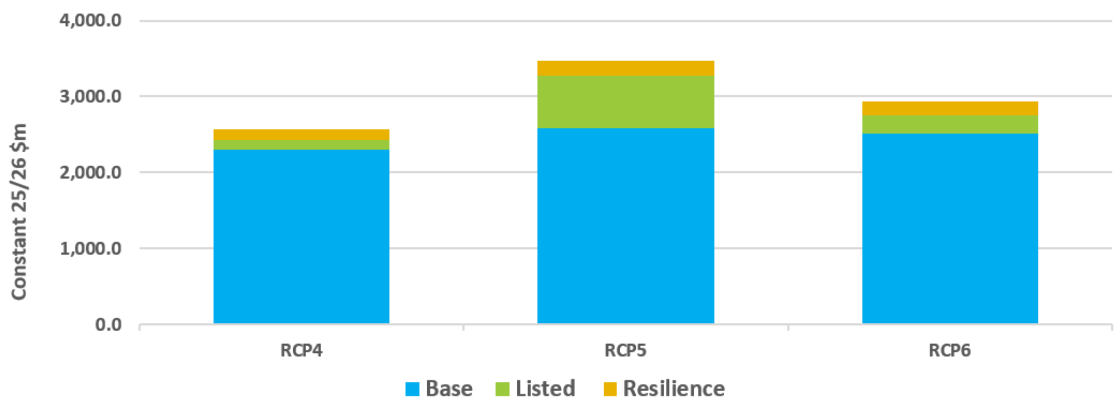
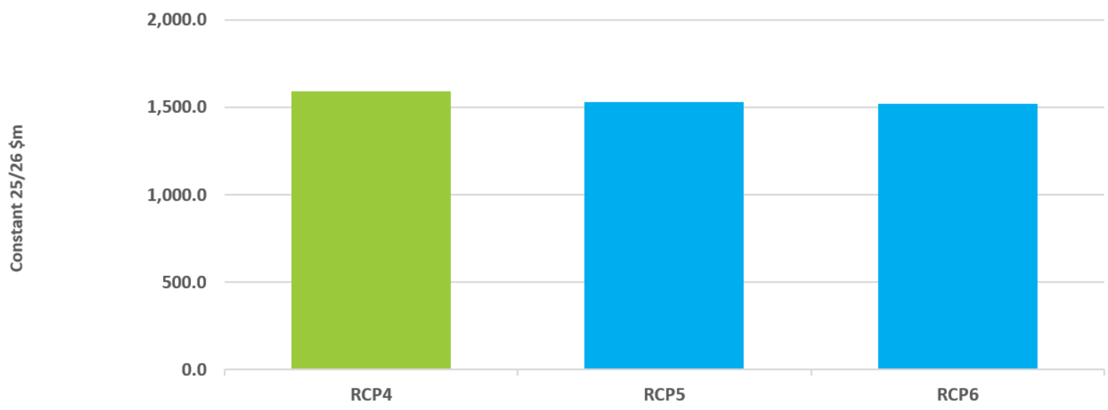


Figure 2 shows the forecast opex profile over RCP4 to RCP6 for all grid, ICT, and asset management & operations.

Figure 2: Grid, ICT, and asset management & operations, including sustainability and resilience opex RCP4 to RCP6



More detail on the grid, ICT, asset management & operations and resilience opex forecasts is provided in the sections below. The opex costs associated with business support and other corporate opex costs are reported in the ITP Narrative document.

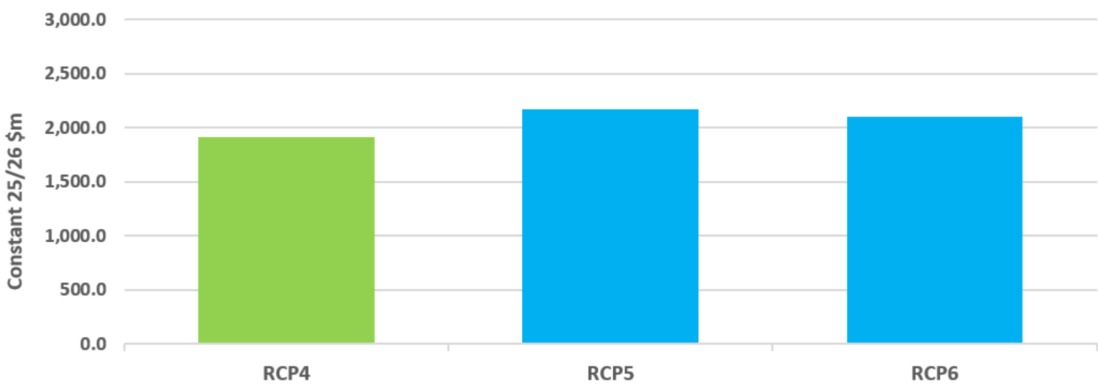
Grid expenditure

Grid expenditure detailed in this AMP covers-grid R&R capex and grid opex.

Grid R&R capex

Our grid R&R capex, excluding listed projects, is shown in **Figure 3**. The primary investment drivers in each RCP are discussed further below.

Figure 3: Grid R&R capex forecast RCP4 to RCP6 (excluding resilience and listed projects)



To support the outcomes sought, there is an expenditure increase over the next 15 years, as a higher portion of our long-life higher-value assets reach their end of life. These outcomes include maintaining a safe and reliable network and realising improvements in resilience by replacement to current standards, improving environmental and sustainability outcomes, leveraging technology and innovation (such as our digital engineering strategic programme), and enabling the electrification of industry.

The grid base capex increase is primarily associated with:

- conductor replacements;
- an increase in substation asset replacements;
- the continuation of the life extension refurbishment work for HVDC and reactive support assets; and
- managing corrosion and degradation of our steel lattice towers.

Our largest programmes of R&R work include the following:

Reconductoring

Our current modelling estimates that between 8%-10% of our network's conductors will require replacement in the next 15-20 years based on conductor condition i.e reaching end of life.

Given the scale of forecasted reconductoring work, we have adopted an innovative approach to safely and sustainably reduce future reconductoring requirements. By utilising drones and high-definition photography to assess conductor condition — particularly corrosion—we can gather detailed data. Drone inspection works particularly well for Aluminium Conductor Steel Reinforced (ASCR) conductors, where visible corrosion between the dissimilar materials can be seen as white powder or conductor bulges. Combined with conductor sample testing in laboratories, defect modelling and targeted repairs, our drone inspection strategy allows us to re-evaluate and validate our forward reconductoring programme, enabling us to focus on areas where conductor life can be extended through repair rather than full replacement.

The specific projects proposed in RCP4 along with the longer-term volume forecasts of reconductoring has been validated using the drone condition assessment and conductor sample testing methodology, which is now our standard approach to assessing conductor condition. This has confirmed that the volume of reconductoring is significantly less than initial RCP3 estimates. We initially forecasted over 800 cct kms of reconductoring needed in RCP4. Through our innovative condition assessment methodology, we have refined this to 278 cct km for the RCP4 period and had forecast similar reductions in our forecast for RCP5 and RCP6. Our current RCP5 and RCP6 forecasts indicate an increase from our initial modelling, attributable to a greater number of our aging copper conductor lines nearing the end of their service life. As we obtain more condition information on our lines through drone inspections, we will further refine our RCP5 and RCP6 forecasts.

Tower painting

Over recent years, we have assessed different options for managing our ageing towers. Traditionally, tower painting has been the lowest-cost lifecycle option to manage these assets. More recently, improvements in technology have helped enable reductions in the cost of alternatives such as replacing suitable towers with pole structures. Following investigation, we have now adopted a tower-to-pole strategy to address tower corrosion on a subset of our aging towers. We have identified that approximately onequarter of our towers could be better managed through replacement with a pole structure or similar, compared with continued tower painting. These towers are generally the smaller, more lightly loaded towers on the network.

This work has also highlighted deferred tower painting, including painting within the Minimum Approach Distance (MAD), the area close to the conductor where an outage is required to carry out the work safely. The painting work we are forecasting for RCP4 and beyond now focuses on larger, more expensive towers than our original submission. Over the next 15 years we have included specific focus on MAD painting, aiming to address all MADs on towers that we paint. We expect the pole replacement programme, instead of painting, to start ramping up towards the latter end of RCP4, with larger volumes expected in RCP5 and 6. We will not see a corresponding reduction in the volume of tower painting for the immediate future, as we will start picking up the backlog of 'now-due' towers to be painted.

We have undertaken an innovation sprint to further understand our intervention points for tower painting, and to better understand the economic optimum point to undertake painting work on our towers across various environmental conditions. We are now ascertaining the opportunities from this.

Power transformers

As our power transformer asset class ages, the need for renewal continues to grow. We undertake comprehensive analyses to prioritise projects, assets, and their critical components during the planning and scoping phases. This approach enables us to target specific component replacements rather than pursuing full asset replacements. An example of life extension solution is midlife refurbishment which includes replacing bushings and other smaller components such as tap changer motor drive units, instrumentation, and corrosion control. Often a midlife refurbishment project costs less than 10% of the transformer replacement while significantly reducing the key risks, enhancing the reliability, and extending the useful life of the asset for an additional 15-20 years.

Compared with a pure asset-health driven programme, our risk-based life-extension programme has resulted in an overall reduction in the number of total asset replacements planned and therefore a substantial reduction in costs. The transformer replacement programme in has already demonstrated the benefits of this approach. While the age profile of the power transformer fleet suggests that for the next 15 years we will need more transformer replacements, we will continue identifying and prioritizing opportunities where a midlife refurbishment could provide better overall economic value for Transpower.

Cost escalations continue to have a major influence on our power transformer programme. Procurement costs and lead times of power transformers have increased significantly in recent years. Other components, such as civil work, are also seeing significant inflation pressure. This has caused an increase in average unit rates across the programme.

HVDC

The majority of our HVDC assets can be divided into two categories based on their age: Pole 2 and Pole 2 era associated AC and HVDC assets (commissioned in 1992), and Pole 3 and Pole 3 era associated AC and HVDC assets (commissioned in 2013). At 13 years into their operational life, most Pole 3 assets are still in relatively good condition. The Pole 2 control, protection system and some primary assets were also replaced as part of Pole 3 project.

Our investment planning is based on achieving a 50-year operational life from each HVDC pole by undertaking necessary interventions at the correct times. As such, a significant portion of the Pole 2 life extension programme was delivered in RCP3. The replacement of the remainder of Pole 2 era primary AC assets, such as interventions to reactive support plant, refurbishment of remaining auxiliary systems, are planned across RCP4.

We have undertaken asset health modelling of our submarine cables to predict the (increasing) risk of failure and to determine when the cables require replacement.

The asset health model design is informed by a failure mode and effects analysis (FMEA) of the HVDC submarine cables. The model calculates and forecasts asset health using an expected life of 50 years combined with location factors, duty factors and observed and measured condition.

The planned intervention on the existing in service cables (Cables 4, 5 and 6) is scheduled for 2031. This involves replacing the three exiting cables with four new cables, increasing the available North Island transfer capability to 1,400 MW. The broader delivery programme is already under way, with the cable replacement intervention representing a critical milestone in the programme's completion.

The intervention criteria reflects an increasing likelihood of failure: as the asset health scores increase further so does the probability of failure rise at an increasing rate. The decision to replace the cables was a risk-based decision, informed by the outputs of our asset health model with an understanding of the consequences of failure including restoration time, the lead times for the design, procurement, installation, and commissioning.

The mass impregnated non draining cables required for this project are made to order, with only two manufacturers globally capable of producing them. Current worldwide demand has extended lead times to approximately seven years. In response to this significant supply chain constraint, Transpower has proactively secured a manufacturing slot for both the three replacement cables and an additional fourth cable. This enables timely completion of the cable replacement programme before 2032 and delivers an increase in link capacity to 1,400 MW.

To support the current 1,200 MW HVDC capacity requires all eight existing synchronous condensers and the static synchronous compensator (STATCOM) at Haywards to be in service. A reduction in the available synchronous condensers can have an impact on the HVDC transfer and the operation of the electricity market. To ensure high transfer capability, we are performing major refurbishments on the synchronous condensers between 2025 and 2030 to improve current asset health levels.

As part of the Net Zero Grid Pathway 1.1 programme, a new second STATCOM is to be installed at Haywards. This additional reactive support equipment will improve availability and reliability at the current maximum HVDC transfer level of 1,200 MW, while also enabling the increase to 1,400 MW that the fourth cable will deliver. The benefits of a fourth cable primarily arise from the South Island hydro providing firming as North Island intermittent renewable generation (i.e., wind and solar) increases.

Grid opex

Grid opex consists of two components:

Grid maintenance incorporates external costs associated with maintaining the grid. This is made up of:

- preventive maintenance (routine servicing or inspections);
- predictive maintenance (maintenance performed based on condition prior to asset failure);
- corrective maintenance; and
- proactive maintenance.

Asset management and operations cover the costs related to internal staff and consultancy associated with the grid divisions such as:

- investigations relating to the enhancement and improvement of our transmission system;
- investigations work related to condition-driven replacement projects;
- innovation and exploring new technology for the grid; and
- funding of our internal workforce i.e. asset management, planning, and network operations, which is essential to enabling all work on our network.

Grid maintenance

Grid maintenance covers all maintenance work on our HVDC and high-voltage alternating current (HVAC) transmission line assets and our substation assets. It is undertaken to address in-service deterioration of our assets, respond to transmission faults, proactively improve the assets, and implement projects to replace asset components. It excludes maintenance of ICT assets, platforms, networks, telecommunications, infrastructure and applications that enable these activities[3].

Our approach to long-term grid maintenance is to optimise our time-based maintenance through risk-based analysis. This approach establishes maintenance tasks for each specific asset where the intervention and the timing are determined based on factors such as current asset condition, historical reliability and criticality of the asset.

Our forecast grid maintenance is shown in **Figure 4**.

[3] Maintenance of communications assets is described in the IT Portfolio Plan – Telecommunications, Network, and Security

Figure 4: Forecast maintenance expenditure, RCP4 to RCP6 (excluding resilience)

RCP4 expenditure reflects the work required to enable deferral of capex, specifically an increase in our coverage of condition assessment information on conductors, increased maintenance on some towers to enable the tower to pole programme, and our improvements in sulphur hexafluoride (SF6) management. These increases are partially offset by improvements made through our preventive maintenance optimisation programme, which has allowed us to reduce preventative maintenance activities while maintaining the reliable and safe performance of the grid. Additionally, there is a reduction in capex as maintenance activities allow deferral of replacement of assets. We are currently reviewing our grid maintenance expenditure assumptions for RCPs 5 and 6, which may lead to a change in the expenditure profile in our 2027 AMP.

Asset management and operations

Our asset management and operations expenditure incorporate the essential costs for enabling the work on our network, including asset management, planning, scheduling of works, investigation, innovation, business improvement and network operations. It includes all the costs that are not allocated to capex in new assets (in accordance with our capitalisation methodology), including staff time and professional services.

The costs of ancillary services related to black start, over-frequency reserves and a share of instantaneous reserves, which support the operation of the power system, are also included.

The key asset management and operations activities are:

- long-term strategic planning for network assets while providing the required service levels;
- tactical planning to develop solutions to maintain and enhance the asset base in line with long-term development strategies;
- programming and scheduling of works based on the portfolio plans developed in the decision framework;
- safe and efficient delivery of project-based enhancements, refurbishments, and renewals;
- interfacing with service providers for scheduling and efficient delivery of maintenance programmes; and
- building on investments in digital switching and optimisation of outage processes, alarm rationalization and improved workflow management to deliver efficient day-to-day grid operation and real-time management of operating centers.

Our asset management and operations expenditure is shown in **Figure 5**. Expenditure is primarily driven by resources necessary to plan and deliver our investment programme over RCP4 and RCP5.

Figure 5: Asset management and operations expenditure including sustainability

ICT expenditure

Our ICT portfolios encompass the ICT infrastructure and applications that interface with the grid and enable our corporate processes and systems; they cover communications, cybersecurity, and end-user services. Our overarching ICT strategy[4] is to:

- use data and digital technology to accelerate our organisational effectiveness and deliver outcomes required to support the business in delivering our objectives against the challenges presented in *Whakamana i Te Mauri Hiko*;
- enable our workforce with enhanced data-driven decision making through investments in data and analytics and Digital Engineering; and
- evolve our future workforce while maintaining reliable and secure services, streamline our processes and drive better maintainability, supportability and cost-effective outcomes, with a focus on risk-based cybersecurity investments.

We respond to strategic priorities while taking advantage of opportunities enabled by emerging technologies and market trends. Overall, we consider that there is potential in future years to further enhance our business and processes by, for example, continued adoption of the Software-as-a-Service (SaaS) and cloud platform models for modern cloud-based services, enhanced use of data and analytics, adopting digital workplace technologies and intelligent systems as they become sufficiently advanced.

ICT capex and software-as-a-service (SaaS) opex

Our delivery model continues to evolve toward an affordability-optimised hybrid approach that progressively incorporates cloud-based (XaaS) capabilities where clear benefits are realised. This includes Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). This supports a reduction in on-premises footprint and improved operational efficiency.

In line with IFRS guidance, configuration and customisation costs for SaaS are expensed rather than capitalised. Accordingly, RCP4 and RCP5 forecasts reflect a progressive shift from Capex to consumption-based Opex. Capex and SaaS opex are presented together at a portfolio level to provide a consistent view of total investment. SaaS opex is expenditure incurred during a project for software consumed as service, including configuration or customisation. This differs from other ICT opex, which covers the recurring costs of running ICT services, including non-capitalised leases, third-party support and maintenance, outsourced services, licences, communications and control, and investigations.

The strategic direction for our base capex and SaaS opex forecast is outlined below for each portfolio[5]. All ICT portfolios include recurrent investments, which are defined in the relevant asset lifecycle management strategies for applications, infrastructure,

[4] ICT Strategy 2020
[5] ICT portfolios are described in section 2.1.1h

telecommunications and other ICT asset classes. The portfolio summaries below therefore focus on the additional non-recurrent modernise, benefits and compliance-driven investments that shape the capex and SaaS opex forecast.

Asset Management Systems. The strategic direction for the non-recurrent modernise, benefits and compliance driven investments in this portfolio is set out in *Asset Management, Network Risk and Planning systems, and Enterprise Information & Data* sub-strategies. These show how we progressively digitise and transform our asset management processes, improve information sharing and collaboration, and implement maturity improvements as outlined in our *Asset Health and Network Risk Roadmap*[6].

Transmission Systems. We have developed a strategy to modernise our supervisory control and data acquisition (SCADA) systems as outlined in our *Energy Management Systems and SCADA* sub-strategy. Our *Transmissions Systems* sub-strategy sets out our approach to modernising our grid-switching operations that are becoming more complex as work on the grid increases and increasing customer connections impact grid operations. Some examples of work ongoing in this sub-strategy include investment in digital switch management as a key enabler for remote switching capability in our substations, outage planning and execution, and improvements in our current device configuration management. Both sub-strategies enable us to support our grid operations teams to effectively manage the grid as we move towards a net zero carbon future.

Corporate Systems. The strategic direction for the non-recurrent modernisation, benefits and compliance driven investments in this portfolio is set out in *Enterprise Business Capability*, *Customer and Stakeholder Engagement*, *Transmission Pricing and Compliance* and *Enterprise Information and Data* sub-strategies. We intend to progressively digitise and transform our corporate processes and improve our collaboration across internal and external stakeholders to achieve higher levels of business performance. The largest Corporate Systems investment in RCP4 is the ERP modernisation, which will renew core enterprise capability, consolidate legacy systems, improve business processes and introduce a recurring SaaS/subscription-based cost profile.

ICT Shared Services: The ICT Shared Services portfolio supports the infrastructure, systems and processes required to deliver ICT services. Investment is primarily focused on risk-driven lifecycle activities to maintain ICT assets in a supported and fit-for-purpose state. Strategic direction is defined through the *Data Centre Services Modernisation* and *Digital Workplace* sub-strategies, with a mix of modernise, benefits and compliance-driven investments. We will continue to optimise the data centre footprint through a considered transition toward increased adoption of SaaS and cloud services, aligned to an affordability-optimised hybrid model. This will be paced to support market maturity and enable critical applications to progressively leverage these capabilities.

Telecommunications, Network and Security Services. Our Telecommunications, Network and Security Systems (TNSS) portfolio delivers services that provide a secure, high capacity and nationwide communications network and includes services ensuring the end-to-end protection against cybersecurity threats to our people, systems, and data. The strategic direction for this portfolio is to modernise our telecommunications network to ensure it continues to meet the needs of the business and is covered by the *Infrastructure* and *Telecommunications* asset lifecycle management strategies for recurrent maintain investments and by the *TransGO Refresh* and *Cybersecurity* sub-strategies for non-recurrent modernise and benefits driven investments.

In addition to the above base capex and SaaS opex portfolios, we are maintaining a forecast for regulatory purposes for the following:

Transmission Pricing Methodology (TPM) – ICT Enablement in RCP4. Following implementation of the updated Transmission Pricing Methodology (TPM), our focus in RCP4 has shifted to ensuring supporting ICT capabilities are stable, reliable, and able to meet ongoing regulatory requirements.

Building on the foundational changes delivered in RCP3, we have implemented enhancements to support key TPM calculations, including Regulatory Asset Base indexation, prudent discount application, and benefit-based investment assessments. The Grid Modelling Services (GMS) tool has continued to be developed and refined to provide critical inputs into these calculations.

Further targeted enhancements are planned during RCP4 to respond to outcomes of operational reviews and any required updates to the Transmission Pricing System (TPS). These investments will be prioritised to ensure continued compliance and to maintain accurate and efficient pricing processes.

RCP4 and RCP5

We estimated the need to increase our ICT expenditure during RCP4 to enable continued digitisation of our assets and to support delivery of a larger work programme.

Increases in ICT expenditure during RCP4 are primarily driven by the refresh of our TransGO network. This resulted in an uplift of approximately 17% in ongoing expenditure.

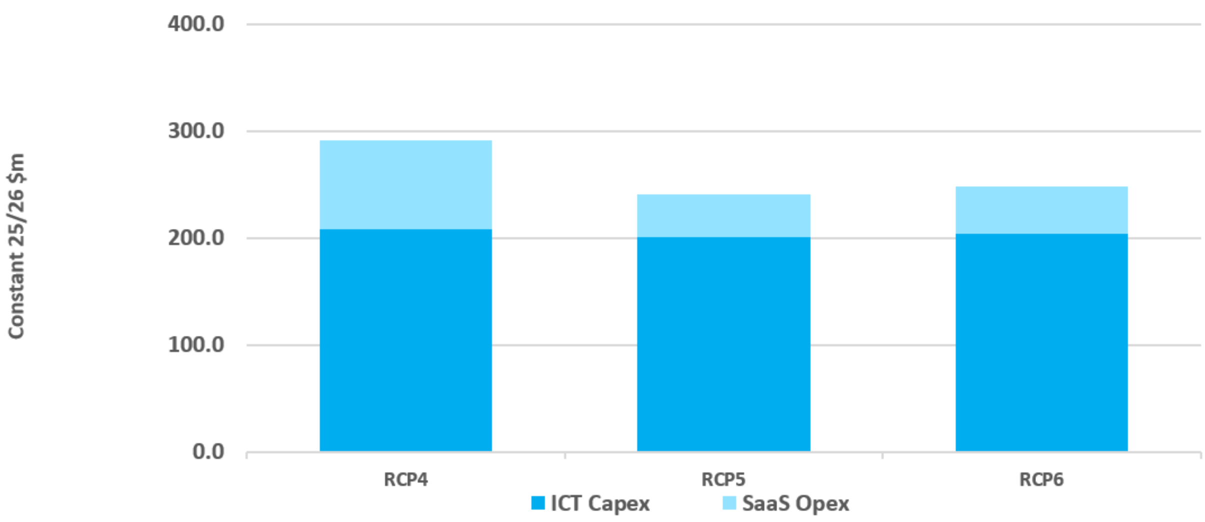
Looking ahead to RCP5, we expect spending to reduce as we complete major one-off modernisation programmes, including ERP, CRM and TransGO. However, some of this decrease will be partially offset by targeted investment in emerging and advanced

[6] Asset Health and Network Risk Roadmap

technologies to scale and sustain our digital capabilities, supporting increased system complexity, enhanced operational resilience, and more data-driven decision-making across the grid and market.

Over the long term, it is difficult to predict with certainty what technologies we will commission or exactly what techniques will be used to deliver them. Maintaining agility has the advantage of allowing us to consider emerging, cost-effective technologies and to adopt them if they are sufficiently mature. As such, we will continue to refine our forecasts over the period.

Figure 6: ICT Capex and SaaS Opex forecast by RCP (including TPM)



ICT opex

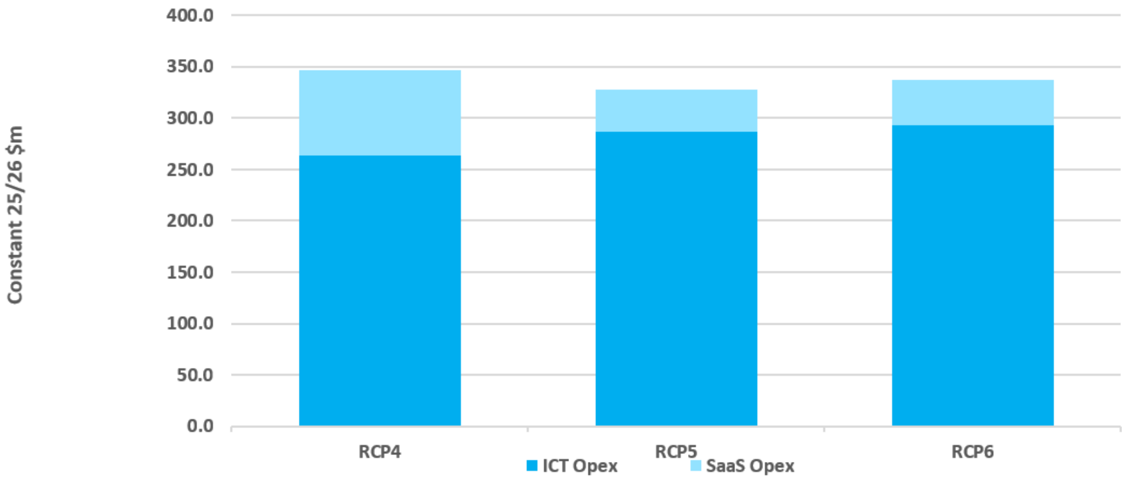
Our ICT opex covers the external costs to run our ICT function and comprises non-capitalised leases, third-party support and maintenance, outsourced services, licences, communications and control and investigations. This ICT opex does not include SaaS opex (covered above), and Grid maintenance expenditure for HVDC and HVAC transmission line assets, substation assets or communication-site and services assets associated with the operation of the grid. That expenditure is covered under Grid Maintenance.

We applied the base-step-trend approach to forecast our opex for RCP4. We used the FY22/23 actuals as a base from which adjustments are forecasted due to known initiatives and trends. This aligns with grid opex which also used FY22/23 actuals as the base.

Commodity ICT costs are expected to increase over time, reflecting ongoing investment to support grid operations. We will progressively adopt SaaS and cloud-based services (including IaaS and PaaS) where they deliver clear benefits, supporting optimisation of the data centre footprint. Cloud adoption will be balanced with the need to sustain secure, resilient and fit-for-purpose platforms for critical systems. While subscription-based costs will increase, these are expected to be partially offset by reductions in traditional infrastructure and support costs.

We continually review the balance between in-house and outsourced solutions to ensure operational support is cost-effective.

Figure 7: ICT opex forecast by RCP



Network Resilience

A resilient transmission service avoids extended power outages and quickly restores power when major events occur. It also ensures we fulfil our obligations as a Lifeline Utility under the Civil Defence Emergency Management Act 2002.

Major events stem from both natural hazards and asset-specific hazards. Relative to our international peers, a large proportion of our infrastructure is exposed to a broad range of natural hazards. Impacts from these hazards on our infrastructure could lead to a widespread and significant service interruption.

Changing climate exacerbates many of these threats and, together with increasing customer expectations of uninterrupted service, places expectations on us to invest appropriately to build resilience.

Our key objectives and strategic approaches are described by the four areas of resilience known as the 'four R's'.

- **Reduction:** Identification and mitigation of network vulnerabilities.
- **Readiness:** Contingency planning and preparation for major hazards.
- **Response:** Immediate actions before, during and after an event to make safe, and restore supply.
- **Recovery:** Post event reinstatement of network to provide pre-event security or better asset capability and supply.

Our capability to plan for resilience has matured significantly in the last few years, and we have dedicated funding for resilience workstreams in RCP4. Historically, our resilience investment has occurred as part of asset replacements by rebuilding to modern design standards. This investment was not identified or tracked as resilience in the past because it has typically occurred through grid upgrades and asset replacement, rather than through targeted investment programmes.

The resilience programme focuses on proactive investment on vulnerable and critical assets to reduce risk and improve readiness, where investment is required ahead of lifecycle investments.

The programme includes improving readiness and risk reduction for substation flood risk, seismic risks, building fire, volcanic ash impacts, land stability, common mode failures and wind and flood strengthening for towers. We are continuing to investigate mitigations for solar storm impacts and have the option to apply for additional funding for additional resilience mitigations during RCP4.

Some of the climate change related investments form part of the Transpower Climate Change Adaptation Plan[7], which is required as part of Aotearoa New Zealand's first national adaptation plan.

Not all resilience-related funding was approved as originally proposed, resulting in resilience funding constraints across Transmission Systems and Cybersecurity initiatives. To manage this, a prioritisation-led delivery approach has been adopted,

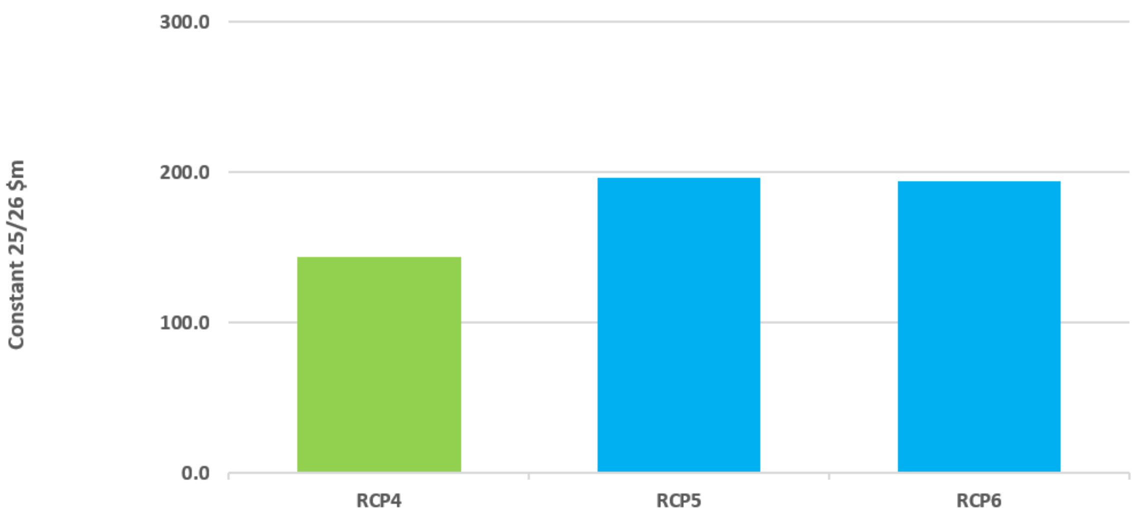
[7] Our **Climate Adaptation Plan** was published in September 2024

focusing available investment on critical operational, safety, and resilience capabilities while deferring or reducing lower-priority initiatives.

Residual funding gaps remain and are being actively addressed through ongoing governance and investment planning processes, ensuring that resilience improvements are delivered progressively in line with organisational priorities and funding availability.

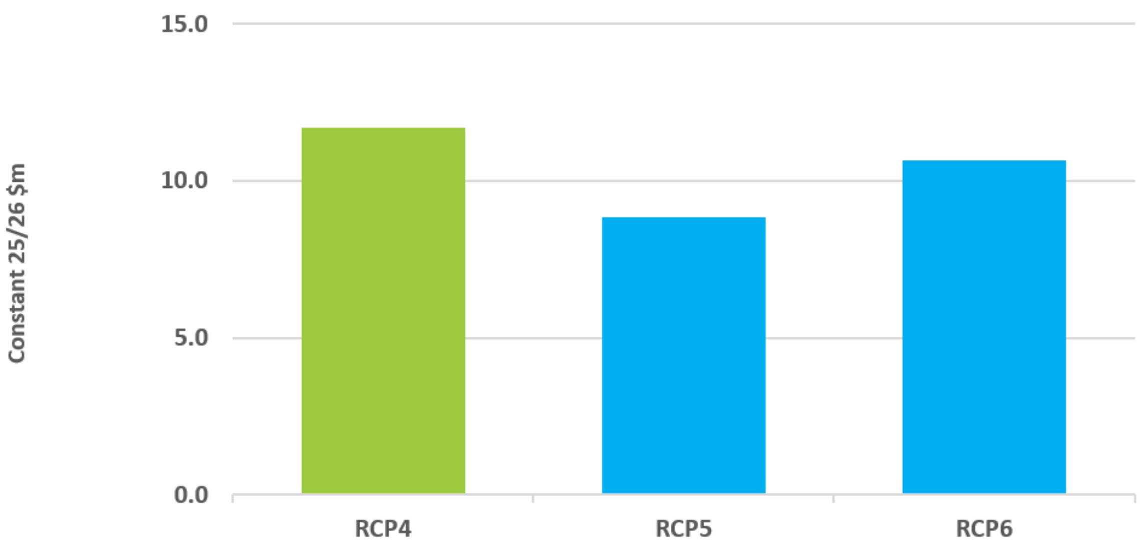
Capex for the resilience programme is forecasted at $143.7million in RCP4. In addition, under the uncertainty mechanism, there is a further $25.7million of unapproved resilience work, which forms part of a possible RCP4 reopener. RCP5 and RCP6 capex are forecast at $196.3 million and $193.9 million respectively. This is shown in **Figure 8**.

Figure 8: Grid resilience base capex



Opex for the grid resilience programme is forecast at $11.1 million in RCP4. Our resilience opex includes both emergency exercises and operational interventions to mitigate risks, where these are more appropriate than capex interventions. **Figure 9** shows our resilience opex for RCP4 to RCP5.

Figure 9: Grid resilience opex



Our resilience forecasts will continue to change as our approach matures, we continue to consult with our customers and stakeholders, and we continue to learn more about both the impact of natural hazards, and the cost effectiveness of our investments.

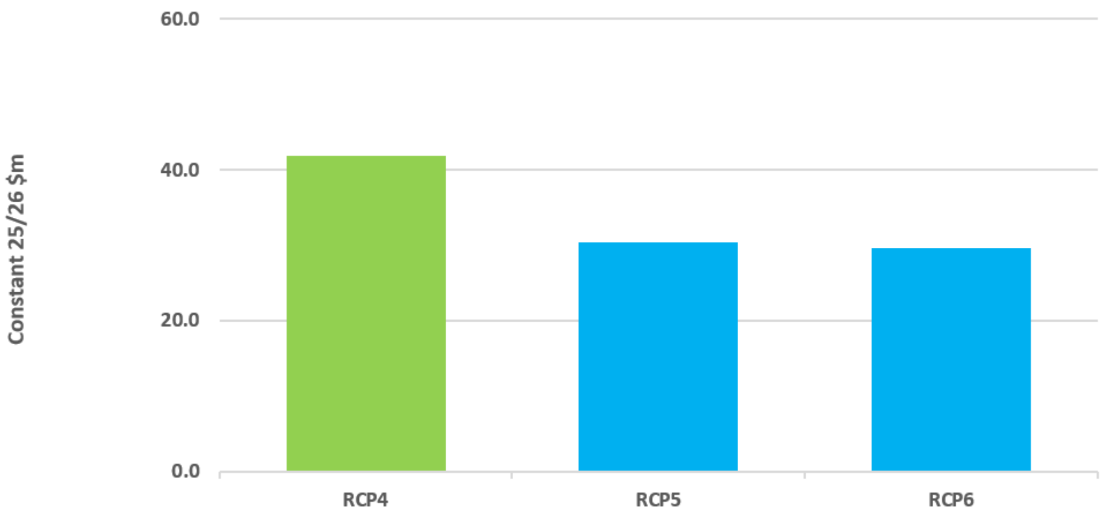
Business support expenditure

Business support assets cover our office buildings, vehicles and office equipment including office desks, chairs, meeting room furniture, laptops, and mobile phones. Since the relocation of our Wellington office in 2017, our business support expenditure has trended downwards. There are various refurbishments planned for our offices through RCP4 and we will continue to replace our passenger vehicles with plug-in hybrid or electric vehicles through RCP4.

Expenditure on the buildings and facilities that house and enable our grid assets such as control rooms, relay rooms, switchrooms, and substation grounds is all covered within our Buildings and Grounds asset class plan (ACP) and are not included within the business support expenditure profiles.

Our forecast capex is shown in **Figure 10**.

Figure 10: Business support capex by RCP



Expenditure forecast uncertainties

Our expenditure forecasts are based on the best information available when the plan was prepared in mid-April 2026. They are based on a disciplined asset management approach, current asset condition information, known customer and market requirements, and our latest view of delivery capacity and input costs. However, the scale and pace of change across the electricity sector means there are inherent uncertainties in any long-term expenditure forecast.

The most significant uncertainties relate to the timing and scale of electrification, new generation and load connections, asset condition, major project requirements, resilience needs, technology choices, workforce availability, and global supply chain conditions. International demand for transmission equipment, specialist resources, ICT hardware and digital capability is placing sustained pressure on prices and lead times. While these pressures may continue to affect the cost and timing of our grid, ICT, resilience and business support programmes over RCP4 and beyond, we seek opportunities to innovate and continue to deliver on our committed outcomes.

Climate change and natural hazard risks create further uncertainty. Our resilience programme will continue to mature as we gain better information on asset vulnerability, hazard exposure, customer expectations, and the effectiveness of potential mitigations. This may change the timing, scope or priority of resilience investments across future planning

We manage these uncertainties through regular forecast refreshes, portfolio governance, and reprioritisation of work.

Our Asset Management Approach

Our Asset Management Approach

A secure, reliable and affordable supply of electricity underpins the productivity of a modern economy. Electricity connects homes, businesses and communities. At scale it adds strength and resilience to an economy and enables innovation. We have a key role to play in Aotearoa New Zealand's journey to electrification. Our company-wide strategic and performance framework links our purpose and values to our strategic priorities, asset plans and performance measures, through to the work our staff and partners do every day.

Whakamana i Te Mauri Hiko[8] describes our changing strategic context, with climate change and other key trends creating the foundation for a scenario-based view of Aotearoa's energy future. Our corporate strategy *Transmission Tomorrow – Our Strategy*[9] (our strategy) builds on this context by setting out how we go about planning and developing the grid. It lays out our five strategic priorities and six performance objective areas.

Our asset management activities for both our grid and our ICT assets are directed by our company-wide strategic and performance framework. The six performance areas which underpin our five strategic priorities are detailed within our Grid Business Strategic Asset Management Plan, as shown in **Figure 11**.

Figure 11: Our strategic and performance framework

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[8] *Whakamana i Te Mauri Hiko* can be found **here**.
[9] *Transmission Tomorrow – Our Strategy* can be found **here**.

For each area, our Grid Network Strategy identifies network objectives which enable us to meet our objectives. The strategic priorities are also detailed within our ICT strategy, which defines our ICT strategic objectives as shown in **Figure 15**. While our strategic context continues to evolve, the five strategic priorities in our strategy reflects the need for action and coordination across the industry to enable the electrification of Aotearoa New Zealand.

Our grid and ICT asset management approach is described below.

Grid asset management

Our asset management goal is to balance the cost, risk and performance of our assets to ensure the grid delivers reliable, safe, sustainable, and cost-effective transmission services.

Grid Business Asset Management System (AMS)

Our AMS enables coordinated activity to ensure we provide safe, reliable, and cost-effective electricity transmission services. It ties together and aligns everything we do in asset management to ensure good practice is embedded into all levels of our asset management activities, from senior leadership decision-making to delivery of assets and maintenance interventions. The assets within our AMS include the physical grid assets, as well as our systems, processes, information, and people.

Governance

Our overall corporate governance structure incorporates integrated checks and balances which ensure appropriate oversight during the development and execution of our asset management activities.

Governance of the AMS is provided by our Management Operating System, Executive General Management Team, and Board of Directors.

We maintain organisational roles, responsibilities, and authorities consistent with implementing our policies, strategies, and plans. This includes executive management oversight and review. Asset management decisions within Transpower reside with the divisions as described in **Table 2**.

Table 2: Asset management divisions

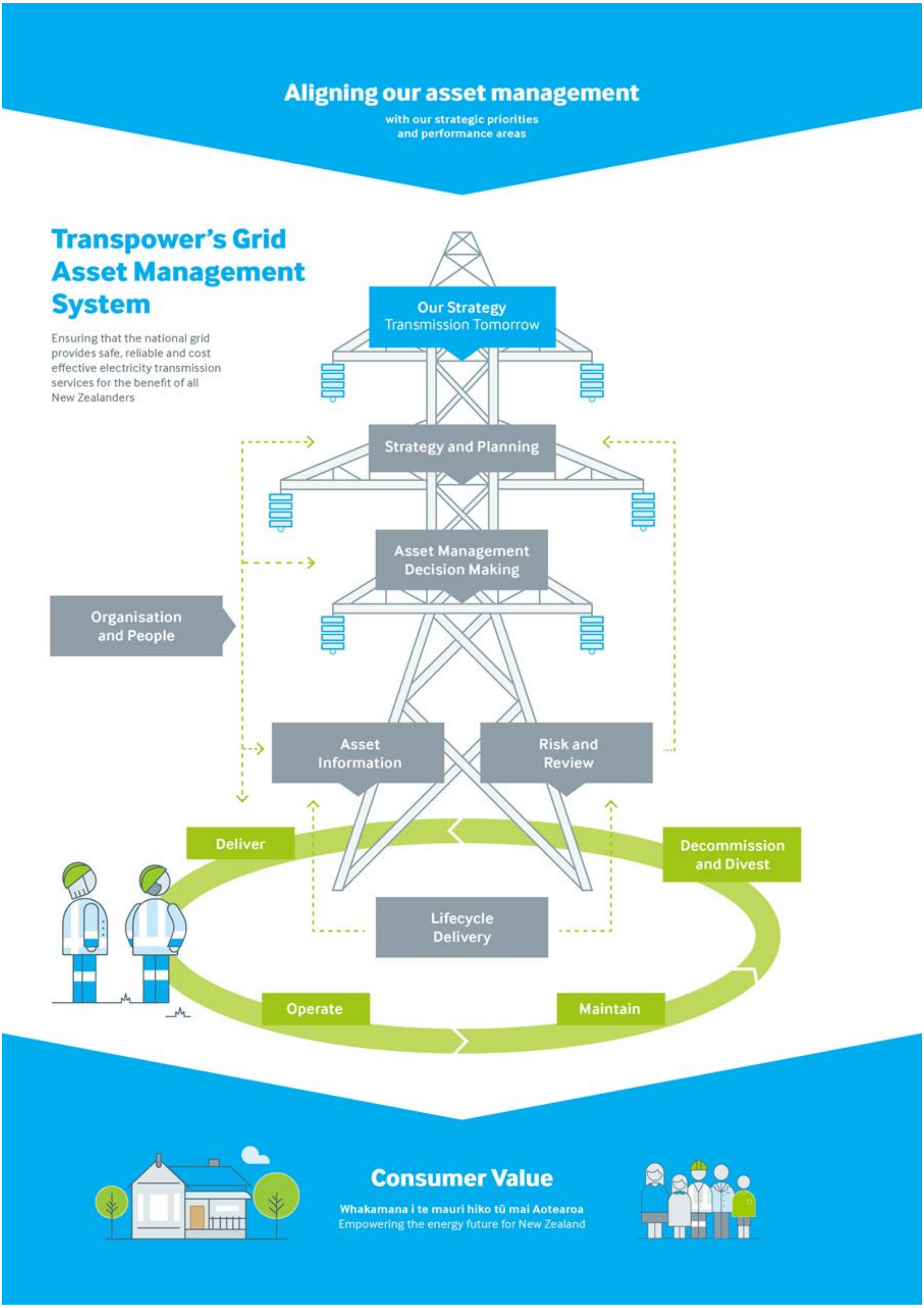
Asset category	Divisions	Responsibilities
Grid asset management	Grid Development	Responsible for identifying the future needs that users of the grid require over the next 20-30 years; strategic asset management; asset planning, delivery of engineering support for grid assets; asset information, and developing an economically justified AMP that delivers capability at the right time and the right cost while ensuring least lifecycle costs for grid assets
	Future Grid	Responsible to develop Te Kanapu, a 'Grid Blueprint' for Aotearoa. The Grid Blueprint will be a whole-of-system plan for New Zealand's power system that identifies an Optimal Development Path – what to build where, and when. It will pull together a vision for the transmission grid of the future (2050 and beyond) and show how long-term planned and coordinated investment can support both net zero and economic growth.
	Grid Delivery	Responsible for undertaking maintenance to maintain the performance of our grid assets such as substations and transmission lines; the project management of refurbishment and replacement works, grid enhancements, and customer-funded projects

	Operations	Responsible for 24/7 operational control of grid assets to enable equipment outages for maintenance, commissioning new assets or other works and ensure safe switching and accesses for work crews. Responsible for planning switching, real-time communications and coordination with service providers and the System Operator before, during and after planned and unplanned outages, including engagement and communication with customers on the scheduling and delivery of workplans and outage coordination. Also responsible for monitoring of grid asset and facility alarms and coordinating real-time responses to address these alarms with Transpower SMEs and Service Providers.
	External Affairs	Responsible for influencing environmental legislative and policy frameworks; Transpower's environmental management system and compliance; regular stakeholder engagement with a range of groups and individuals such iwi and landowners, and corporate communications
ICT asset management	Information Services and Technology	Responsible for maintenance and development of Transpower's ICT and development of asset management maturity of these assets
Business enabling assets and support functions	Corporate Services	Responsible for and provides a wide variety of services including finance, customer solutions, procurement and supply, treasury, and risk and assurance.
	Strategy, Regulation, and Governance	Responsible for the development and implementation of Transpower's business strategies; innovation and strategic change. Accountable for the RCP proposal process; delivery of the EMS Tradepoint service; oversight and management of all legal advice; development of corporate compliance framework; and administration of the Transpower Board and subsidiaries.
	People Services	Responsible for the company's corporate office property portfolio, oversight of health, safety and wellbeing, human resources and workforce development

AMS

The main activities and information flow within our AMS is shown in **Figure 12**. It reflects a holistic approach to asset management. Our AMS is captured in our asset management documentation.

Figure 12: Our AMS



Grid strategy and planning

The grid strategy and planning function aligns our asset management activities, and the outputs from our assets, with our organisation objectives from Transmission Tomorrow – Our Strategy. This stage consists of several interrelated activities used for asset planning. These require understanding asset management drivers, identifying, prioritising and integrating options, and estimating project costs.

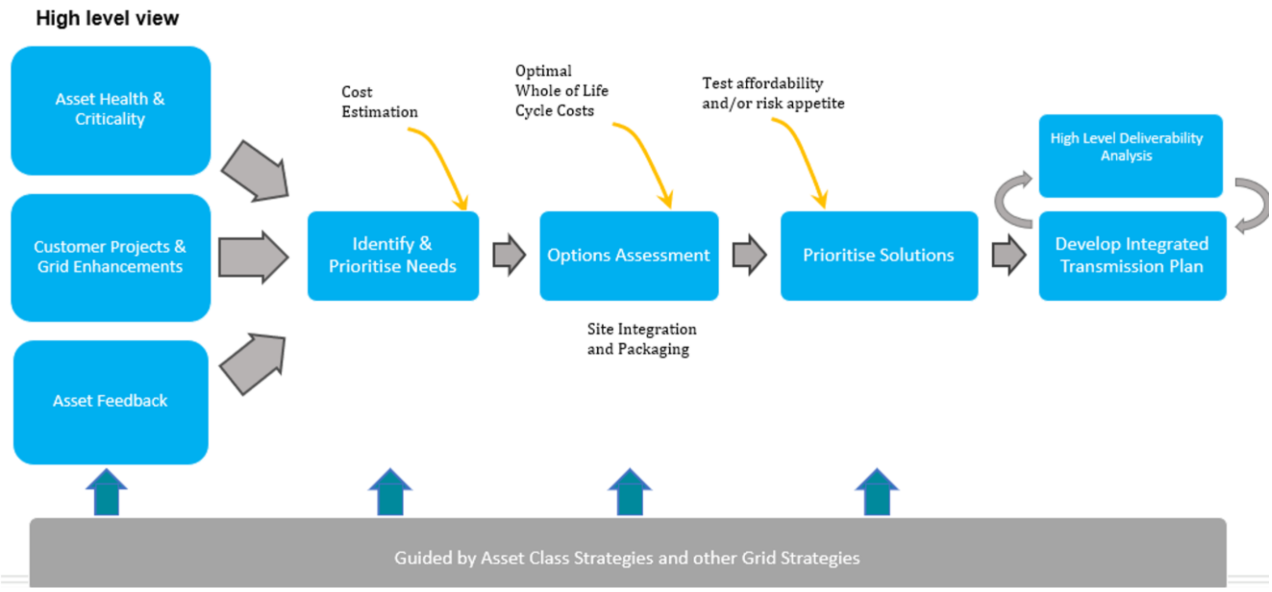
Grid asset management decision making

Effective asset management decision making is essential to maximise the value realised over the lives of our assets. The group of activities within this component of our AMS considers the challenges faced and the approaches to decision making throughout the asset lifecycle.

The Asset Planning Decision Framework (the Framework) provides a consistent, repeatable, risk-based approach for asset planning decisions. The key drivers for investment are safety, network performance, future demand, risk of asset failure, and cost performance.

A simplified representation of the Framework is in **Figure 13**.

Figure 13: Asset Planning Decision Framework (simplified)



Within the decision framework process, there are four key decision steps.

Identify the need. A need is a clearly defined problem and/or opportunity to be addressed. The need can arise from asset health, asset feedback, and alignment with other work such as resilience improvements, grid enhancements or customer funded work. Identifying the need includes establishing a need date, and the planning lead time (i.e. the total time required to identify the solution, approve the delivery business case, and complete/commission the delivery project). A need can include a group of problems that have a common solution.

Assess options for each need. Options to address the need are assessed. Where a sole option is prescribed by an asset class strategy, other options are not generally considered. Needs that are complex, expensive and imminent receive more rigour than those that are simple, inexpensive, or more distant in the future. A do-nothing option, representing the status quo, is always considered.

An option assessment will normally account for:

- all lifecycle costs to deliver, maintain, operate, and dispose of the option
- residual risk costs associated with the option, where the need date is not solely based on asset age or condition
- benefit, including risk mitigation or opportunity value, provided by the option
- maximum net benefit that can be provided by the option and the associated need date
- changes in the net benefit that result when the need date is delayed or advanced
- sensitivity analysis on both quantifiable and non-quantifiable factors where two options have the same net benefit.

The option with the highest net benefit, subject to sensitivity analysis, is selected as the solution.

Prioritise solutions. Solutions are, in the first instance, prioritised based on need dates. Where based on a risk assessment, further prioritisation is undertaken based on magnitude of net benefits, with solutions with the highest net benefit prioritised first. Where available, criticality is also utilised in prioritisation.

Develop a plan. A plan is developed to ensure solutions can be delivered feasibly, reliably, and efficiently, including accounting for funding and deliverability constraints. If all solutions cannot be delivered by the need date, we will consider initiatives to increase delivery or potentially re-phase work based on priority. The need date is the required commissioning date.

Lifecycle delivery

Most asset-related expenditure is invested in our lifecycle delivery activities. A focus on integration of activities across the lifecycle, strategy and planning, and asset management decision-making stages enables us to reduce costs.

Deliver

Our priority is to deliver capital investments, maintenance projects, and life-extension work safely and cost effectively. Doing so requires us to continually challenge and improve our standards and specifications, engineering design, project planning, project management, and construction skills to deliver the required quality and reliability to customers.

Operate

We operate the grid to deliver a safe and reliable transmission service to our customers. This involves 24/7 real-time monitoring of the grid, responding to alarms and grid events, and the planning and management of switching and access to assets to optimise network availability, maximise the amount of work per outage, while enabling maintenance and construction to be carried out safely.

Maintain

Assets on our network are maintained to ensure they remain safe, secure, and reliable. Decisions are made to ensure we effectively balance capital and operational investment when developing our maintenance approaches.

Decommission and divest

Asset disposal occurs when an asset is at the end of its useful life. There are several ‘triggers’ for disposal decisions, including poor condition, changes to safety or environmental standards, or changing need for the asset. Asset divestments, such as transfers to electricity distribution companies and other parties, are also made when they align with our long-term strategy and commercial interests.

Asset information

Good asset management relies on robust asset data and information. Our asset information systems capture our data and information, including quality requirements.

Good asset data has a critical role in driving better decision-making. Most of our asset strategies require consideration of condition and risk-based asset replacements to maximise our asset lives and minimise risks. We have significantly improved our asset information governance and invested in improving our collection and management of asset data, so that we can make decisions based on complete and accessible data. This challenge is significant but necessary, so our data, standards, and processes are fit-for-purpose.

We aim to collect the right data, of the right quality, at the right time, first time. We supply our service provider field staff with condition assessment photo guides and asset specific guidance on ratings, useful for driving consistency across service providers. For our substation and transmission lines assets, we have implemented a field mobility app enabling our service providers to access maintenance documentation and complete several tasks such as maintenance inspections, condition assessments, raise and manage defects, verify defects, add landowner notes, capture photos, and then upload directly to our AMS. This improves efficiency and simplifies capture, recording and reporting, ensuring up-to-date, quality data.

Drone use is now fully operational. Drones with high-resolution cameras flown by fully trained operators are now used for inspecting substations, structures, and lines. Drone use has a lower risk profile and increased safety benefits compared with traditional helicopter and climbing inspection methods and will reduce the need for outages. Drone use has, for example, allowed for urgent nationwide SF_6 outdoor circuit breaker inspections to be completed without the need for any outages, reducing the inspection programme from 12 months to 6 months, providing significant cost savings.

Our data management and analytics practice teams assist with modernising our enterprise data management and reporting platforms, supporting further enhancement of our asset information business capabilities, and streamlined delivery of asset information, which support asset management business decisions. We recently commissioned a new, centralised repository (integrated with our core applications) for storing photos and multimedia to ensure this content is easy to find, access and share.

Organisation and people

Our people and the structure of the organisation are highly interdependent and exert strong influences on our ability to adopt and embed asset management successfully. Therefore, we invest time and effort in ensuring we attract, develop, train and retain employees with the skills, performance, and behaviours that will support the successful delivery of our asset management strategy and objectives. This is important for delivering the level of business integration that characterises more mature asset management capability.

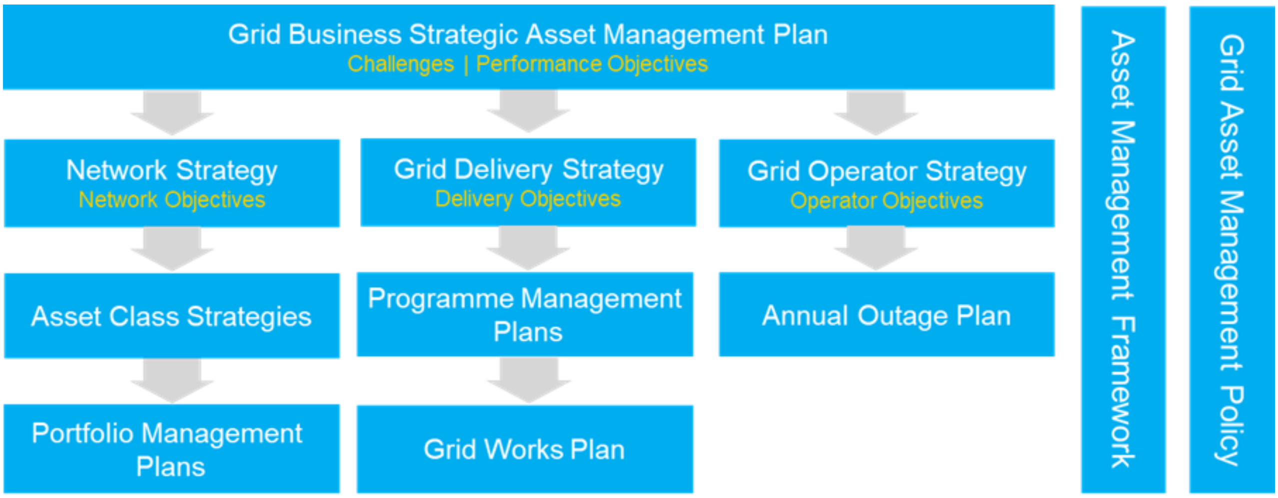
Risk and review

Risk and review includes the identification, understanding, and management of risk, and the establishment of effective feedback and review mechanisms. Collectively, these activities provide assurance that objectives are being achieved and enable the continuous improvement of our asset management activities. It provides important inputs to our strategy, planning, and asset management decision-making through monitoring asset health and the performance of our assets.

Grid asset management documentation

Our AMS is supported by our documentation. **Figure 14** illustrates the key grid asset management documents.

Figure 14: Grid asset management strategic documents



The grid business Strategic Asset Management Plan (SAMP) provides alignment between our corporate purpose and strategy and our grid business. It highlights the grid business challenges and identifies performance objectives to address them. Our Asset Management Policy guides the development of our asset management strategies, plans, and activities.

Our Grid Asset Management Policy

Our Asset Management Policy guides development of our asset management strategies, plans, and activities. It outlines the following principles:

- Alignment – ensure our asset management activities align with Transpower's strategic priorities and enable us to meet its safety, people, customers, financial, relationships, and sustainability performance targets
- Legislative compliance – ensure we comply with all relevant laws and regulations
- Customers and Stakeholders – consult our customers and stakeholders on matters relating to the management of our grid assets
- Planning – ensure we apply good electricity engineering practice to our asset management activities
- Resources – ensure we assign enough resources (people and money) to deliver on our asset management obligations
- People – ensure our employees are trained, competent, and demonstrate a commitment to and understanding of asset management
- Operation – ensure our grid assets deliver the performance expected of the grid by our customers and stakeholders.

- Improvement – ensure continuous improvement of our asset management system through effective systems and setting measurable objectives and targets.

The grid AMS Framework describes the key functions and activities, including the activities undertaken by our service providers and engineering consultants within our AMS. It is available for use by staff and contractors to understand the scope of the AMS and their teams' role in enabling our asset management objectives to be met.

Our Network, Grid Delivery, and Grid Operations Grid Operator strategies translate our SAMP's objectives and performance targets into activities and objectives that can be understood by those responsible for implementing them in our grid divisions. The asset class strategies provide the detail on how we intend to drive and achieve our asset management objectives. They set out approaches specific to the management of individual asset classes throughout their lifecycles.

The Portfolio Management Plans (PMPs) apply the relevant asset class strategy and describe the detailed planning approach for that portfolio of assets. In some cases, more than one strategy will apply to a PMP. Our PMPs contain forecast expenditure for 15 years.

Programme Management Plans describe the end-to-end delivery cycle for certain groups of asset portfolios. Programme Management Plans are grouped by asset portfolios having similar delivery methods so often address multiple PMP's. The focus of the Programme Management Plan is the period covered by the 2+1 year rolling plan but may also include reference to longer-term strategic risks and opportunities in the relevant programme.

The Grid Works Plan is a list of grid project work across the grid that Transpower intends to deliver within the next 5 years. It provides a view of all grid project work planned (certain and uncertain) and allows service providers to resource, price, and plan for delivery of the relevant works.

The Annual Outage Plan details all outages for the current year. The annual plan is required under the outage protocol with the Electricity Authority.

Grid Operations relies heavily on ICT tools and systems to undertake its functions, and these are linked to the ICT sub-strategies mentioned in more detail in ICT Asset Class Plans section.

Procurement

The global energy transition to electrification is underway. Large scale electrification globally, has resulted in grid expansion around the world, and competition for essential transmission infrastructure components. Competing demand has put further pressure on existing supply chain bottlenecks with costs and procurement lead times increasing.

We are responding to global competition by taking steps to manage and mitigate the risks to our supply chain through improved planning, working closely with our suppliers, earlier ordering, holding increased safety stock levels to buffer against potential disruptions and investing in greater warehouse capacity. For long lead-time equipment, early market engagement and timely commitment are important levers to improve delivery certainty.

Managing supply chain risk is a core part of Transpower's procurement function. As part of our normal procurement operations, the procurement function continuously monitors supply chain risk. This includes:

- close, ongoing engagement with key suppliers and logistics providers
- understanding where equipment is manufactured and how it is transported
- identifying which categories are more exposed to global disruption
- qualifying alternative suppliers or freight options where appropriate.

As fuel prices and shipping conditions began to change in response to broader geopolitical disruption and changing shipping conditions, our procurement teams proactively engaged suppliers early, rather than waiting for issues to arise. This early work helped clarify that:

- based on supplier and logistics advice, there is no confirmed material disruption to our deliveries to date
- the most likely near-term impact, if conditions persist, is increased logistics and fuel related cost pressure and more variability in transit times
- for long lead time equipment and critical spares, current conditions can become future delivery risk if disruption persists or escalates — so mitigations and trigger points are actively worked through with Transpower's Incident Management Team (IMT) and cross-business teams.

This supply chain view is shared within wider Transpower discussions where it is tested, refined and complemented by operational, technical, and financial perspectives. At this stage:

- there is no confirmed material supply disruption affecting delivery of our work programmes

- the IMT and cross-business teams actively monitor supply chain, fuel and logistics risks, with clear escalation pathways if conditions change.

Cost estimation

We use the Transpower Enterprise Estimation System (TEES), a cost-estimation tool, to support development of cost estimates for capital and cost database maintenance grid projects. TEES is integrated with our core planning and financial management systems (Asset Management Planning System and Financial Management Information System). It provides repeatable estimating processes and centralised management of foreign exchange and commodities escalation, supporting estimation accuracy and ensuring project forecasts are automatically updated as delivery dates shift.

TEES, together with standardised cost structures and estimation methodologies, supports consistency, transparency, and comparability of cost estimates across programmes and time horizons, enabling informed investment decision-making.

Projects are classified as either volumetric or non-volumetric works. Volumetric works are lower-complexity, high-volume activities and use building blocks to derive an estimated cost. Non-volumetric works are large-scale, complex projects that require investigation, optioneering, and progressively more detailed design. These projects typically follow a defined investigation framework, with estimates customised based on an agreed technical scope and basis of design. These two methods for estimating projects are as follows:

1. **TEES building blocks**
   Typically used for volumetric replacement, refurbishment, or maintenance projects allocated to service providers. Each building block has an agreed scope from which costs are derived. Cost components include materials, equipment, design, and overheads (internal and service provider). The methodology for creating or updating building blocks includes historical analysis of past projects, benchmarking against comparable projects, and custom estimate build-up for new activities.

2. **Custom estimates**
   Typically used for complex, large-scale projects where there is a high degree of site-specific variation or bespoke design and optioneering. Estimates are informed by a defined basis of design and are built within TEES using cost data from the master cost library.

Both methods use centrally managed cost data within TEES. Building blocks are adjusted when service provider contracts and rates for allocated work are re-set.

Cost data is refreshed through a structured annual update to reflect changes in market rates, contracts, delivery approaches, and external drivers. Targeted updates may also be made during the year where material changes occur, with all changes managed through controlled governance processes.

We continue to lift the efficiency and capability of our cost estimation function, with a focus on TEES cost data integrity, alignment to Association for the Advancement of Cost Engineering recommended practices and strengthening feedback loops between project delivery and estimation. Actual delivery outcomes and cost performance insights are used to improve cost data quality, building blocks, and estimating assumptions over time, supporting improved estimation accuracy and continuous improvement across the work programme.

Corridor management

Maintaining our relationships with communities, iwi, and landowners to ensure we can continue to access and maintain our assets is essential to network management.

We need access to our assets for routine inspection, maintenance, to resolve incidents, and for quick response in emergency situations. We must protect our current and future network from development that might impact on safety or constrain our operations.

In this context, we continue to secure corridors and enabling policies for the grid through implementing the National Policy Statement for Electricity Networks into regional and district planning documents. This work will ultimately result in council plans that will provide balanced controls on what can and cannot be developed in transmission corridors and adjacent subdivisions, to control inappropriate activities and under-build. Likewise, appropriate buffers are sought around substations to protect against reverse sensitivity issues and to provide future protection on cable routes where appropriate. We have considered ongoing requirements for corridor management in our maintenance budget allocation.

The Resource Management Act (RMA) is about to be replaced by two new statutes (Planning Act and Natural Environment Act). We anticipate a three-to-five-year transition as we move from the current RMA legislation to the new Acts and the National Instruments (which comprise the 'National Policy Direction' and 'National Standards') which will be a critical component of them. Under the new legislative framework, there is also going to be a major role for Spatial Planning, which will bring with it new engagement processes and a longer-term outlook (i.e. 30 years). As such, how we interact with local authorities, communities, iwi, and landowners will likely change at the regulatory level. Our legal and environment team were actively involved in preparing Transpower's submissions on the Planning Bill and Natural Environment Bill and are continuing to engage with Ministry officials as the process progresses, striving to get appropriate recognition for the National Grid where it is needed.

Technical standards and policies

Technical controlled documents (including design standards and standard drawings) are a cornerstone for managing asset risk. They cover design, procurement, construction, and operation, and incorporate legislative requirements, external standards, lessons learned and good industry practice. Such documents help ensure assets are built to meet our strategic objectives for each asset class.

We maintain a set of controlled documents that are an important part of our asset management process. They cover design standards, service specifications, and operating instructions. They refer to codes of practice or industry standards where relevant.

Standards typically cover technical or policy matters. They are required to go through a managed review and approval process. Table 3 describes the types of policies and standards that we use in our asset management processes.

Table 3: Document and policy types used in our asset management process

Document type	Definition
Corporate policy	Represents the core requirement of good governance (such as the code of ethics and conduct policy) and/or are applicable across the company
Asset strategy	Sets out strategy and objectives in relation to assets or asset lifecycles
Technical policy	Specifies our policy on general commercial and technical issues (e.g. asset maintenance or replacement.) They are split into: • general policies • lines policies • stations policies • communications and computing policies • protection policies • outage coordination
General and technical standard	Specifies approved systems, guidelines, and processes and defines a minimum level of compliance. They are split into: • administration and management standards • design standards • maintenance standards • construction standards • operations standards • procurement standards
Service specifications	Are published as schedules to contracts, incorporating the requirements of appropriate standards. They are split into: • administration • equipment maintenance • design, construction, and testing • environment and landowners • safety and worker competence • operating and emergency management • commissioning

Document type	Definition
Service advisory	Interprets, extends, or provides supporting information for a standard or service specification
Standard maintenance procedures	Sets out step-by-step procedures for scheduled services on each asset type
Procurement specification	Specifies the performance and technical requirements for equipment and materials to be purchased for Transpower use
Operational procedures	Operational procedures for control room-based activities
Business continuity plan	Ensures Transpower’s preparedness to be able to sustain business critical functions

ICT asset management

This section describes our approach to managing ICT assets, which is the software and hardware necessary to operate the grid and support our corporate functions. The ICT project portfolio is focused on the delivery and development of organisational capabilities required to achieve our strategic objectives. We adapt and respond to changes to our business requirements by reviewing and incorporating new and emerging technologies where appropriate.

ICT strategy

Our company-wide strategic priorities (**Figure 11**) are detailed within our ICT Strategy, which defines our ICT strategic objectives as shown in
Figure 15.

Figure 15: ICT Strategy enabling the acceleration of our organisational effectiveness

ICT strategic objectives and alignment

Our ICT capability supports the business to accelerate our organisational effectiveness by addressing key business drivers.

- *Strengthen customer collaboration*. Improve our customer engagement across all aspects of connections, operations, and investments through digital enablement.
- *Optimise our asset decisions*. With data and analytics investments, we can do the right work efficiently because we have access to accurate information about our network assets.
- *Improve our end-to-end works delivery*. Improve how we identify and schedule work and how staff and field workers operate as a fully mobilised, digitally connected field workforce.
- *Enable adaptive and proactive operations*. Effectively integrate distributed and intermittent generation which will require more adaptive and proactive operations.
- *Enable our future workforce*. Leverage opportunities created by advances in cloud services, automation, digital collaboration, and communications to enable our future workforce.

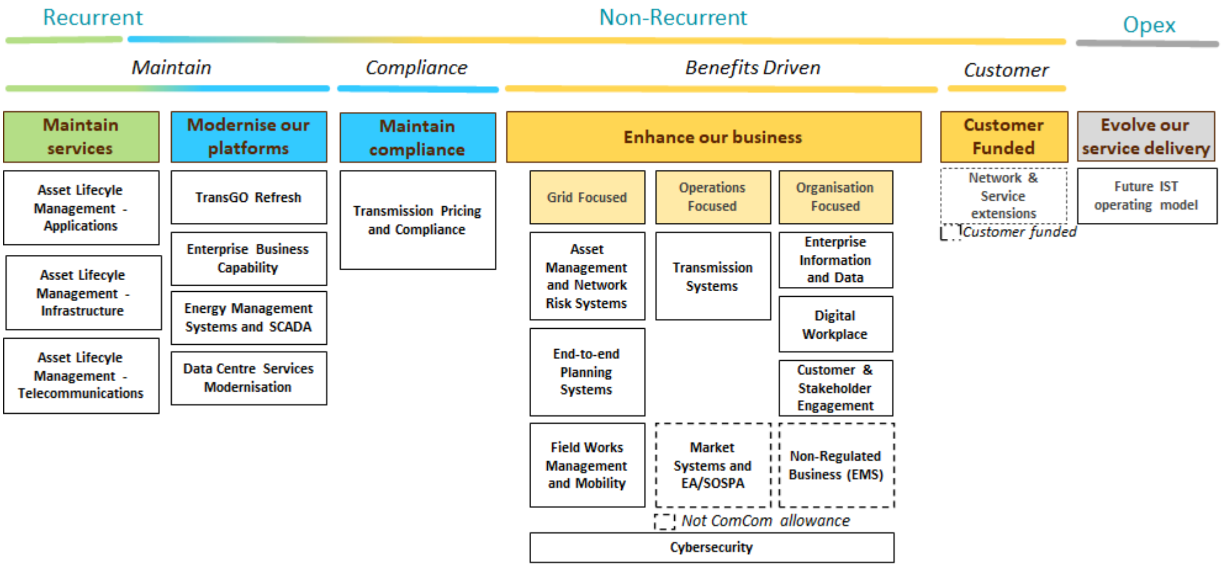
In response to these drivers, our ICT strategy defines five strategic objectives, outlined in **Table 4**.

Table 4: Our ICT strategic objectives

Enable a digital Transpower	Experiment with disruptive technology to determine value in our context. Where proven, adopt new value-adding technology to advance business capabilities in strategic focus areas. Focus on open data and modular systems using automation to digitalise our core business processes
Enable data-driven insights	Use data and analytics for proactive business decision-making to improve asset management and network risk decisions. Use insights to deliver grid works efficiently and manage the grid of the future. Leverage data and analytics to embed intelligence in our business functions
Adopt new ways of working	Adopt lean, agile and value-driven approaches to improve and optimise the delivery of services to our internal customers. Reduce service delivery timeframes and improve service quality by adopting DevOps practices
Drive cybersecurity by design	Design and manage our services for security. Enhance our cybersecurity practices for mobile and cloud services. Integrate security analytics into our cybersecurity function
Maintain and modernise services	Maintain and modernise reliable and resilient systems while delivering better customer engagement and experience. Deliver regulatory and compliance-mandated investments

To deliver our ICT strategic objectives, we have a series of sub-strategies to align our ICT investments to our strategic priorities. Our asset lifecycle management strategies focus on making sure we continue to proactively maintain our ICT assets by upgrading them to remain supported and fit for purpose. We have developed and implemented a *productisation*[1] framework and process to maintain the sub-strategies and to enable the continuous monitoring of the proposed programmes and portfolios. Our investments are grouped into programmes and categorised by investment type and investment category – see map below in **Figure 16**.

Figure 16: Overview of ICT sub-strategies and asset lifecycle management strategies cased on investment type



Our required business capability has been categorised into five core ICT asset portfolios in our past publications. For reporting consistency and ease of reference, we will continue to maintain this categorisation.

- **Asset Management Systems -** Support the physical assets, systems and processes required for provision and maintenance of transmission services.
- **Transmission Systems -** Enable real-time operation of the national grid, and day-to-day operations and maintenance activities.
- **Corporate Systems -** Support Transpower's core day to day business functions, providing shared capabilities across all business teams.
- **ICT Shared Services -** Support the ICT infrastructure, systems and processes required for delivery of ICT services.

- **IT Telecommunications, Network and Security Services -** Deliver the underlying data services and provide a secure, high-capacity and nationwide telecommunications network supporting grid operations, critical switching, and grid protection functions, network services supporting our corporate and critical communications services, and protection against cybersecurity threats.

A summary of our approach and expenditure associated with our ICT portfolios is presented in Section 5.

ICT Investment Framework

Our objective is to be flexible enough to change our ICT investment direction as technologies and organisational needs change. The rate of change makes it challenging to forecast the precise technologies we will develop during RCP4 and RCP5.

We have transitioned categorisation of our investments to consider investment type and investment category. This enables us to have a balanced investment portfolio as we innovate and transform functions to deliver new digital business outcomes.

- **Investment type.** We differentiate between:
- **Recurrent investments -** Regular expenditure that occurs periodically (typically at least once every 5 years).
- **Non-recurrent investments -** One-off expenditure or expenditure occurring infrequently (typically less than once every 5 years).
- **Investment category.** Our investments are categorised into:
- **Maintain -** Investments aimed at maintaining and updating existing ICT services, functionality, capability and/or market benefits through a regular upgrade programme (previously included in lifecycle classification).
- **Modernise -** One-off investments to modernise current capability or an end-of-life system replacement (previously included in lifecycle classification)
- **Benefits driven -** Investment in new capabilities to realise benefits for Transpower and electricity consumers (previously included in benefits driven and risk mitigation classification).
- **Compliance.** ‘Must do’ investments to comply with regulations or standard

Business support asset management

Our business support assets are categorised as:

- Office buildings
- Vehicles
- Minor fixed assets - office equipment
- Minor fixed assets – IT
- Residential houses.

Our management objective for business support assets is to provide the appropriate level of capability at the least cost but also reflect the diversity of the asset types.

Office buildings

Facilities management of our office buildings is managed centrally but undertaken by building services providers. Management of the leased offices, e.g. rent reviews, renewals, etc. are managed centrally. Our Auckland, Christchurch, and Hamilton offices and all warehouses and training facilities are on sites owned by Transpower. Budgets are centrally held for all the offices to ensure a consistent and cost-effective approach to this expenditure.

Vehicles

The vehicle fleet is managed by an outsourced provider. All the vehicles have global positioning system, (GPS) fitted to better manage the fleet and improve safety. We obtain monthly reports on the charges and lifecycle utilisation for each vehicle which, together with the GPS data, enables us to make informed strategic decisions about the vehicle fleet.

Minor fixed assets – office equipment

Office equipment is regularly maintained and generally replaced when it is unsafe, the cost of repair is not cost effective, or it requires refreshing. The budget for office equipment is held centrally to ensure a consistent and cost-effective approach to replacement.

Minor fixed assets – IT

Our minor IT assets comprise numerous commodity IT items such as tablets, laptops, keyboards, mice, monitors, and mobile phones. These are either maintained or refreshed.

Residential houses

The houses are predominantly ex-substation operator houses used up until the late 1980s that have been retained to act as a buffer between adjoining private properties. Some houses have been purchased as part of project work and retained as part of strategic landholdings for future line routes or substations.

The investment requirements for these areas are described further in the Business Support Asset Class Plan.

Sustainability

Our Sustainability Strategy,[10] is focused on improving the sustainability of our ongoing operations while driving long-term change. It is underpinned by an extensive implementation programme to ensure delivery across all divisions and teams within Transpower, along with our service provider, supplier, and community partners. Over the long term, we are striving to drive behaviour change so that the sustainable way becomes business as usual. Our Sustainability Strategy sets out goals and enabling actions across the three challenge areas shown in **Figure 17**.

Figure 17: Our Sustainability Strategy

Climate change

The electricity transmission system sits at the heart of Aotearoa New Zealand's transition to a net zero carbon future. Through our Te Kanapu future grid blueprint, we are preparing for a highly electrified, renewable economy out to 2050. Across all our potential future scenarios, electricity demand will grow significantly to drive both economic growth and emissions reductions. This transition is being led by the electrification of transport and the decarbonisation of industrial facilities moving away from fossil fuels. To enable this, we are proactively planning the grid to connect the substantial new renewable generation and load required, ensuring our infrastructure supports Aotearoa New Zealand to grow and thrive.

In addition, we are working hard to cut emissions arising across our supply chain, including how we build, operate, and maintain the grid; the energy use in our buildings and substations; and the electrification of our vehicle fleet. We are working hard to reduce our SF_6 emissions through ensuring we develop the right strategies for key pieces of equipment on the network.

Not only are we looking to reduce emissions, but we are also investigating whether we have the right resilience to meet the challenges of climate change and ensure our infrastructure is able to withstand more frequent and severe extreme weather events.

[10] Our Sustainability Strategy | Transpower.

Environmental stewardship

Given the scale and reach of our assets across many locations with high landscape, environmental, and cultural values, we have a responsibility to minimise the direct environmental impact of our operations. We aim to reduce the environmental impact and increase the efficiency with which we use materials and resources. As such, we seek to reduce contaminant discharges and minimise waste as well as restore the natural environment around our assets with the goal of creating a long-term net gain in biodiversity.

Sustainable business

We have a responsibility to consider the social and environmental impacts of all that we do and to report on our activities in a transparent way. We primarily do this through our Climate Standard and Climate Adaptation Plan reporting and our sustainability reporting in our Integrated Report.

Having highly engaged, skilled, and capable people is central to all that we do. It is essential that we make the most of the strengths inherent in having a diverse and inclusive workforce and culture. We are committed to workforce development and promoting health and safety across all spheres of our operations.

Much of our work to improve the sustainability of our operations can only be delivered in partnership with the community. We acknowledge the connection of mana whenua to the land and seek to partner with them to remediate the natural environment and minimise the impact of our work on sites of cultural significance.

More broadly, we acknowledge our responsibility to promote kaitiakitanga. This encompasses the enabling role the development and operation of our assets play in reducing emissions and protecting Aotearoa New Zealand from the worst impacts of climate change. We also seek to work with local communities to be a good neighbour and minimise the physical presence related to our assets. This includes working closely with landowners to minimise disruption associated with our work.

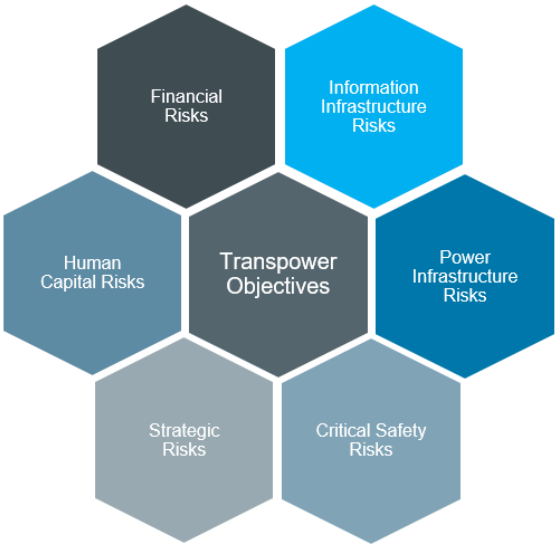
Our CommunityCare Fund is one of the ways we contribute positively to the communities we operate in. We support a wide range of community projects with wide-reaching and lasting benefits to the community and our Community Advisory Panel brings together a diverse group of people who work closely with their communities.

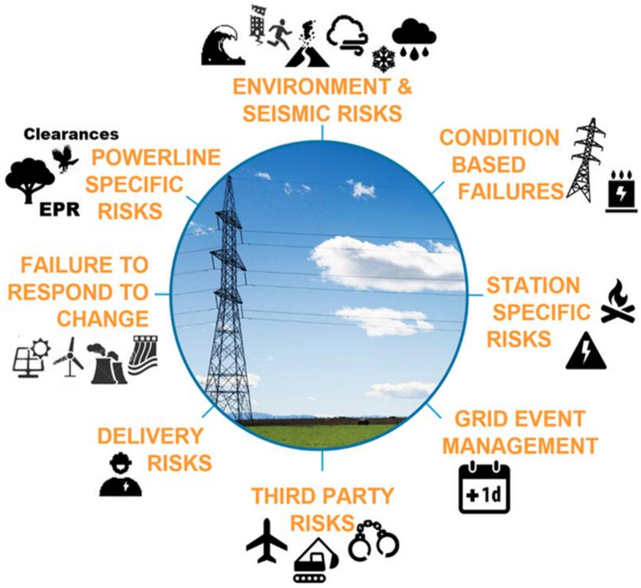
Risk management and performance improvement

Managing risk is an integral element of asset management and aligns with our corporate risk strategy. It is not a standalone activity, but integrated in everything we do, evolving over time to ensure we deliver our strategic priorities. Our approach to risk and assurance management is aligned with our corporate Risk Management Policy and guidelines.

Figure 18 provides a summary of the risks across our organisation and a summary of our grid infrastructure critical risks. Consequences of these risks include service performance, public safety, worker safety, environment cost and direct cost.

Figure 18: Organisation risks (left) our critical asset risks (right)





The risks are as follows:

- **Environmental and seismic risks** are natural hazards that regularly impact the grid. Our design standards ensure new assets are built to cost-effectively minimise vulnerabilities to these risks. We also review the vulnerability and criticality of existing assets to identify those where further strengthening or upgrading would provide a cost-effective risk reduction.
- **Condition-based failures** relate to the likelihood of an asset failing and the direct cost impact, as well as consequential impact to supply, safety, and environment. These costs and impacts are informed by asset health and asset criticality and are mitigated through proactive and systematic asset planning. Importantly, we must also apply a network approach to asset replacement investments to ensure other critical risks are managed.
- **Station and powerline specific risks** which include earth potential rise (EPR), conductor clearances, access and occupation from other asset owners, and vegetation management. Our design standards and routine inspections and assessments ensure these risks are managed.
- **Failure to manage change** includes changes in electricity demand, generation, and the societal expectations of reliable electricity supply, as well as our own challenge to properly embed new technologies and processes. Current and future risks need to be understood to ensure our design and investment decisions result in a 'path of least-regrets'.
- **Delivery risks** exist throughout our maintenance and capital delivery activities. For example, risks can originate from equipment selection, design, construction, commissioning, handover of key information, and testing errors. Delivery risks also include skill shortages and supply chain challenges.
- **Third-party risks** are more difficult to control, and recent events include inadvertent contact such as aircraft crashes and irrigators hitting circuits, but also criminal activity such as deliberate interference with grid equipment. The effort we put in to communicating risks to the wider community, including industry groups, is a key preventive measure.
- **Grid event management** is how we respond to a large grid event, including recovery from a black-start (or blackout) event, one of our largest risks. While a high-impact, low-probability (HILP) event, it is one we actively prepare for to improve grid resilience. Power system resilience is the ability to avoid electricity supply outages, or maintain or quickly restore service delivery, when events occur. It is connected to the ability of systems and people to anticipate, prepare, absorb, adapt, and rapidly respond.

We recognise there are areas of risk that relate specifically to particular assets, asset classes, or sites. Our asset management framework incorporates practices designed to identify and mitigate such risks.

Bow-tie risk analysis

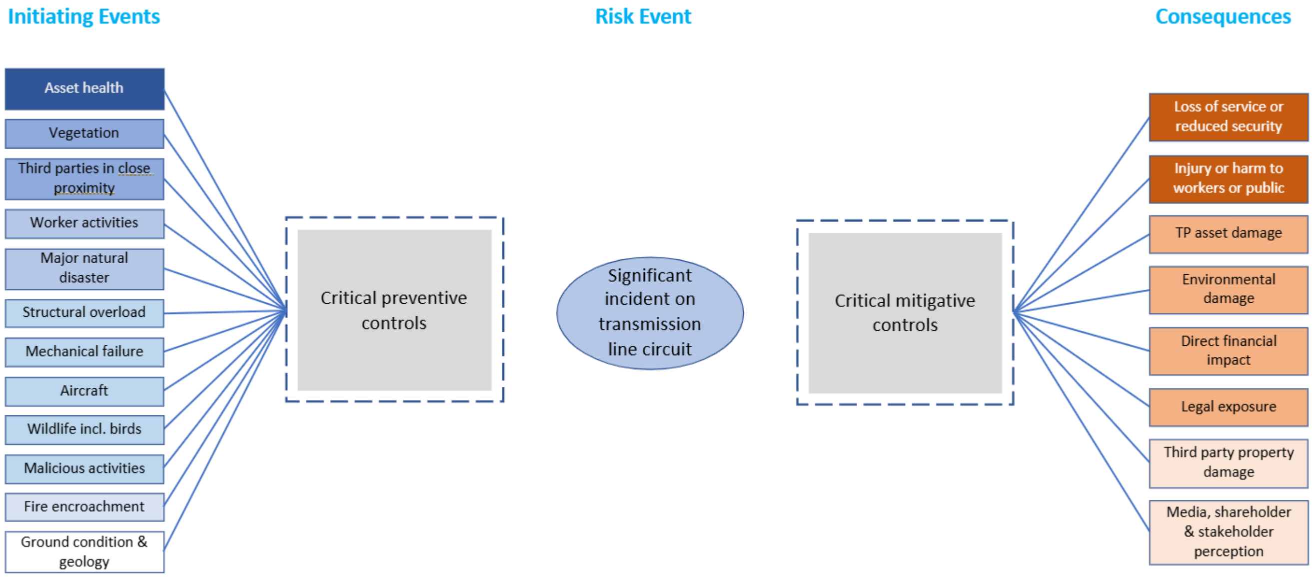
Bow-tie risk analysis is a key methodology of our corporate risk framework which is consistent with AS/NZS ISO 31000. The purpose of the bow-tie is to inform us about the most likely causes of asset failure, the consequences of that failure and, most importantly, what preventive and mitigative controls we apply that will have the greatest effect on reducing the risk. Bow-tie modelling improves our understanding and treatment of risks and is incorporated into our strategies and plans.

Figure 19 shows a simplified version of the bow-tie for 'Major Hazards and Degradation of Transmission Line Circuit'.

Our bow-tie models for power infrastructure include:

- Major hazards and degradation of transmission lines
- Major hazards and degradation of AC transmission cables
- Major hazards and degradation of HVDC converter stations
- Major hazards and degradation of substation primary assets, busses, structures and plant
- Major hazards and degradation of secondary assets
- Major hazards and degradation of accessways
- Major hazards and degradation of HVDC subsea cables
- Major hazards and degradation of reactive support assets
- Major hazards and degradation of buildings and grounds
- Major hazards associated with site occupation by customers.

Figure 19: Simplified bow-tie - Major hazards and degradation on transmission circuits



Our use of bow-tie risk analysis and our risk and resilience modelling consider both prevention and mitigation measures. Where the prevention of a causal pathway is cost prohibitive, or where consequences are major, we need to evaluate mitigation measures to reduce the impact.

Critical controls

Within a bow-tie, the controls can be preventive (reduce the likelihood of an event) or mitigative (reduce the impact if an event occurs), or both. A critical control is a control that has a significant effect on risk reduction or mitigation and appear almost universally across our bow-ties.

Table 5 lists the critical controls and a brief description of each.

Table 5: Critical Controls

Control name	Control description
Activity planning	Planning and preparation to ensure safe and effective site activities to minimise adverse operational or environmental events
Customers and third-parties procedures	Procedures to manage the risk of other parties' assets and activities within Transpower-owned sites
Asset implementation management	Designing, installing, commissioning and handover of primary and secondary assets to specified codes and standards to enable effective operational management
Asset information management	Identifying, structuring, collecting, storing, updating, retrieving, monitoring, correcting, and disposing of asset information and data to enable asset analysis and decision making
Asset maintenance	Undertaking asset inspections, maintenance programmes, remediation works, pest management, and reporting key information to decision-makers to determine asset health and optimise asset life expectancy, service performance, and lifecycle cost
Competency management	External skills, knowledge and capability management for working safely on Transpower assets to optimise asset reliability and efficiency
Grid planning	The processes within the Grid Asset Management Framework to determine and justify all grid expenditure to develop the ITP
Health and Safety Management System	Prescribed health and safety system including policies, procedures, field practices, and assurance across those
Management of change	Assessing, managing, and minimising the potential risks of changes relating to grid assets, associated processes and systems, and responses to changed circumstances
Operational parameters, monitoring and alarms	Setting and monitoring the capability and real-time information on availability and performance of key assets
Physical security	Mechanisms and processes in place at substations to manage physical access to (and around) grid assets, to ensure the safety of people and protect assets from damage (preservation), malicious activity and service interruption
Procurement	Developing and maintaining procurement specifications; manufacturing and supply; supplier pre-approval; managing the procurement process for goods and services, and contract management.
Quality assurance	Planning, execution, and reporting of assurance activities across all asset management functions, including gap analysis, and developing and monitoring timebound improvement actions.
Standards, procedures and specifications	Grid-related technical standards, procedures, and specifications used as mandatory reference material

Contingency management	Planning and management of operational contingencies for planned and unplanned grid events to enable restoration of service while minimising the impact on connected parties.
Protection systems	Planning, implementing, and maintaining asset protection schemes to sense system and asset conditions, to prevent asset damage and personal harm, and maintain security of supply. Prevent cascade failure of the grid and optimise network capacity
Incident and emergency management	The preparedness and capability to respond, resolve, and recover from events. These include service interruptions and incidents.
Stakeholder management	Identifying and understanding stakeholders' perspectives, managing their needs, educating and communicating key messages to ensure reliable and safe grid service
Warranties, insurance and indemnities	Commercial avenues to reduce the direct financial impact of unplanned interruption events

Control self-assessment

Undertaking control self-assessments on our critical controls gives assurance that our asset management practice is effective. They provide an opportunity to validate the definition of the control, the sub-control elements, and who is accountable for each element. Using criteria, the sub-control elements are assessed for both maturity and effectiveness, and opportunities for improvement are identified. Changes in control effectiveness are fed into our risk bow-tie analysis. Control assessment results and any corresponding changes in our risk bow-tie analysis are monitored by governance meetings and integrated into our corporate risk management system.

Improvement plans

As part of our risk management, we undertake detailed assessments of critical controls and identify improvement opportunities. The opportunities are prioritised by the control owners and, where appropriate, improvement actions assigned. These actions, along with our wider improvement plans, are tracked and reported on in accordance with our asset management governance structure that meets quarterly on continuous improvement. The improvement plans include initiatives such as:

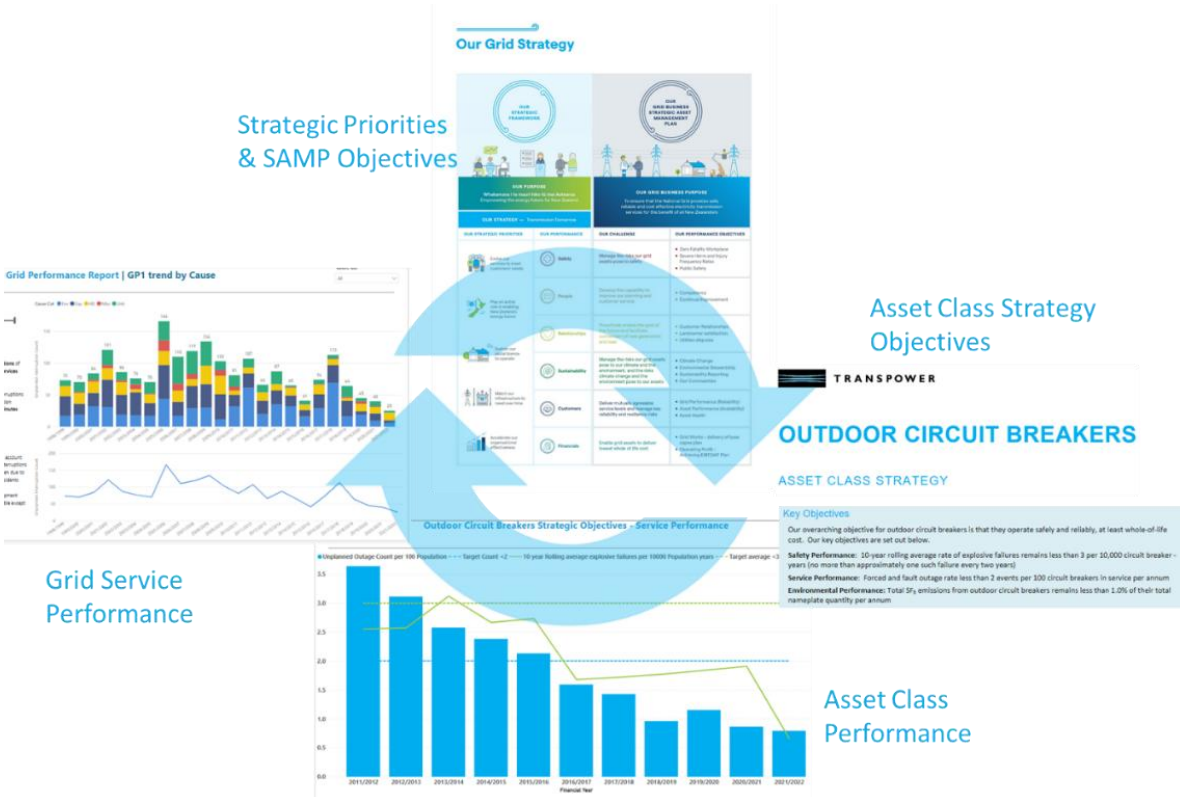
- Managing changes associated with the implementation of new grid technology
- Integrating processes and information for spares & inventory management
- Improving data acquisition and data quality
- Embedding quality management practices, including non-conformances
- Reducing human errors through digital switch management and remote switching

Measuring performance against objectives

Our Grid Business Strategic Asset Management Plan (SAMP) provides alignment between Transpower's strategic priorities and our grid business. The SAMP objectives cascade down to our asset class strategies via the asset class performance objectives.

The asset class performance objectives are measured and have a connection to the overall service performance and reliability of our network. This link between asset performance, service performance and our strategic priorities is shown in **Figure 20**.

Figure 20:Asset performance objectives



Site-risk review

Our site-risk reviews reflect our risk-based approach to asset management. We undertake three types of site-risk reviews:

- Major hazards – fire, natural disaster, high-impact low probability events (HILP), and other high impact events.
- Customer hazards – confirm access and occupation schedules, identify third party risks.
- Condition and reliability – review of site asset condition and performance to support management of operational risks and costs.

Major hazard site reviews can assess specific major hazards where desktop assessments are insufficient, e.g. building fire. We have undertaken analysis to systematically identify vulnerabilities across the grid for prioritised threats. These assist with understanding cost-effective preventive or mitigative solutions, e.g. flooding. Where credible risks are identified, we will evaluate risk and potential options, which may result in actions through our resilience or wider investment programme.

The site condition and reliability reviews are a mechanism to collaborate with service delivery and service provider team members on the effectiveness of current maintenance efforts, provide assurance over the condition of assets, and identify improvement opportunities for asset integrity and maintenance strategies. Typically, these reviews will provide recommendations for resolving unreported defects, improvements requiring engineering effort, or changes to the investment plan for asset refurbishments and replacements.

Our customer site-risk reviews resulted from the 2014 Penrose fire incident, where a customer cable joint failed, causing a serious fire. The ongoing site reviews act as an audit of our records, to ensure they align with what assets are on site. Another aspect of the reviews is to identify, monitor, and resolve risks to our assets, employees, and operations caused by customer assets.

Risk-based asset management planning

Together asset health, grid asset criticality, network resilience, risk-based maintenance, and readiness planning are key components to our risk-based asset management planning.

Asset health

Determination of asset health is a primary input into our replacement and refurbishment investment decisions. Understanding asset health for our assets is fundamental to planning and forecasting.

We use asset health models to predict how an asset will deteriorate and fail over time. Our asset health framework sets out a common health scoring across our asset classes, known as an Asset Health Index (AHI). An AHI is an indicator representing an asset's proximity to the end of its useful life. The end of useful life is when an asset will either need replacement or major refurbishment to extend life. Key principles guiding our asset health models are:

- Aligned and supported by the asset class strategy
- Integrated with the decision framework
- Making best use of our tacit expert knowledge
- Leveraging our empirical data where quality and correlation are strong
- Leveraging industry data, where appropriate
- Delivering value with respect to effort of modelling versus uncertainty
- Undertaking systematic and repeatable modelling.

How AHI is determined

The end of useful life is typically hard to predict, but when a combination of information is considered, an AHI can inform the expected time when an intervention is likely to be required.

The higher the AHI score, the more likely an asset is to fail. The common inputs into our asset health models are detailed below:

Nominal asset life
This is the 'normal expected life' for each asset class and the point at which significant signs of deterioration can be expected. The nominal asset life assumes normal operating conditions with respect to service duty and location. It is based on industry data, information gained from forensic assessments of assets that have performed well or performed badly, and our experience from observed data from the field.

Duty and location factors
With a known current asset health, a future asset health can be modelled. Depending on the asset class, our models forecast future asset health using duty, location, current observed, and measured condition, age, and reliability factors.

Current condition
The current condition of an asset is based on observed condition, or measured condition from test results. In most cases, asset condition is monitored regularly in accordance with our technical standards and asset class strategies.

Age
The asset age is used an input to the model as condition alone is often an imperfect measure, as it does not capture all failure modes or can be infeasible to collect.

Corrosion

The corrosiveness of the atmosphere significantly influences the condition and life expectancy of our grid assets. We have two methods of accounting for corrosion zone in our asset health modelling:

Corrosion codes
We have allocated the majority of our grid assets subject to corrosion-related degradation processes to one of six corrosion codes. **Table 6** shows the corrosion codes in use for transmission lines and typical environment applicable.

Table 6: Corrosion codes

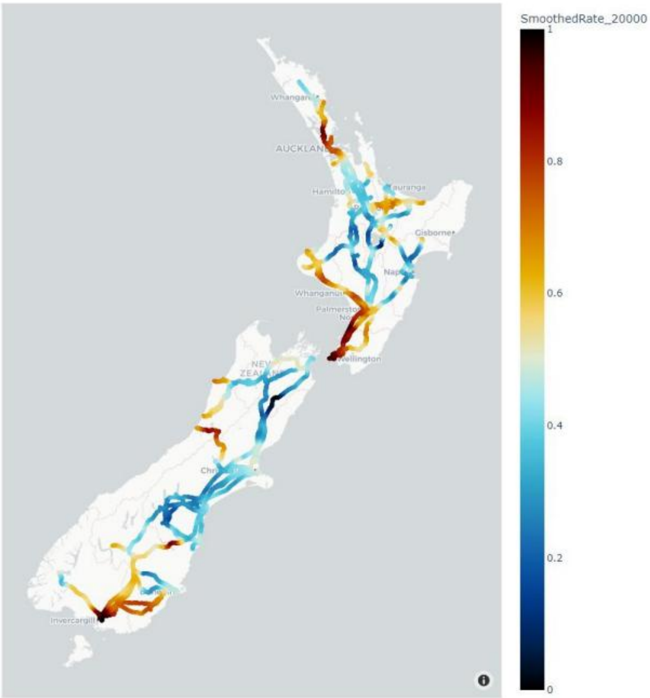
Corrosion code	Typical environment
100	Benign – dry inland area with low rainfall
80	Low – inland area, no coastal contamination
65	Moderate – minimal coastal contamination
50	Severe – moderate coastal contamination
35	Very severe – heavy coastal contamination
20	Geothermal – special – extreme coastal, industrial, and/or geothermal contamination

Condition Assessment (CA) Degradation Bands

We have also undertaken modelling of our observed CA degradation rates for our insulator, attachment point, and conductor portfolios. These asset health models use CA degradation bands to account for corrosion degradation processes.

Figure 21 illustrates an example CA degradation rate map.

Figure 21: Example CA degradation rate map



AHI bands

We define asset health on a scale of 0 to 10 for current health, and future predicted health can exceed 10[11]. The asset health aligns with the probability of failure (PoF). The higher the AHI score, the more likely an asset is to fail. Typically, the intervention criteria will be an AHI score of 8 (as shown in **Figure 22** but depends on the approach taken to manage replacement or refurbishment of the asset. For example, a risk-based approach may not proactively replace an asset based solely on an AHI score of 8.

Figure 22:Asset health score

For ease of understanding, we categorise the AHI into the eight bands shown in **Table 7**. The first band of 0–4 is wide, as PoF is considered the same for these AHI scores. The remaining bands are incremented by 1, with the exception of the last two bands which are 0.5. The last two bands are at smaller increments as the PoF increases more rapidly as the asset degrades further.

Table 7: Asset health bands and descriptors

<table>
<tr><th>AHI Band</th><th>AHI Range</th><th>Descriptor</th></tr>
<tr><td>1</td><td>0.5≤AHI<4</td><td rowspan="3">Good</td></tr>
<tr><td>2</td><td>4≤AHI<5</td></tr>
<tr><td>3</td><td>5≤AHI<6</td></tr>
<tr><td>4</td><td>6≤AHI<7</td><td rowspan="2">Fair</td></tr>
<tr><td>5</td><td>7≤AHI<8</td></tr>
<tr><td>6</td><td>8≤AHI<9</td><td rowspan="2">Poor</td></tr>
<tr><td>7</td><td>9≤AHI<9.5</td></tr>
<tr><td>8</td><td>9.5≤AHI<15</td><td>Very poor</td></tr>
</table>

We continue to focus on improving the maturity and coverage of our asset health models. Coverage by asset class is shown **Table 8**.

[11] The future health score is capped at a value of 15, which is higher than the cap that is applied to the current health score (10). This is to enable modelling of further deterioration of all assets.

Table 8: Asset health coverage by asset class

Asset group	Asset class	Asset group	Asset class
Transmission lines	Conductors (cct km)	Substations	Instrument transformers
	Earthwire		Outdoor circuit breakers
	Tower protective coating		Power transformers
	Tower steelwork		Indoor switchgear
	Tower foundations - grillage		Power cables - solid (km route length)
	Tower foundations – non-grillage		
	Foundation interfaces - towers		Disconnectors
	Pole foundations		Earth switches
	Pole structures		Wall and roof bushings
	Insulators		Local service transformers
	Attachment points		Low-voltage AC (LVAC) distribution
Secondary systems	Battery banks	Reactive	Synchronous condensers
	Battery chargers		Capacitors
	Protection relays		Reactors
	Outdoor junction boxes (ODJB)	HVDC	Converter transformers HVDC
	Substation management systems (SMS) asset types		Subsea cables HVDC
	Revenue meters		

Probability of failure (PoF)

The PoF used in asset health modelling is defined as the annual likelihood of a major failure due to degradation. For many of our asset health models, there is a corresponding PoF curve that shows the relationship between PoF and AHI. This can be used to inform the asset risk or risk of the portfolio over time. Developing the PoF curve can inform expected lives by identifying certain models or types that may have shown to have statistically shorter or longer lives.

Some asset refurbishment decisions are driven by economic factors, e.g. application of tower protective coating. In these cases, there is no material change in PoF from AHI 1 to 10.

Health-related major failure is defined for use in PoF and must meet three criteria.

1. Major work or impact: a replacement or major refurbishment required.

2. Failure urgency: operational decisions are urgent with respect to the asset class, and this is broadly consistent with international definitions used by CIGRE[12]/ITOMS[13].
3. Primary cause: the failure is asset health related, or for some assets, an environmental cause such as wind. Categorising an environmental cause as a health-related major failure is dependent on whether the conditions are within the design envelope of the asset. Extreme weather events that have return periods that exceed our design criteria, and events such as cascade failure, human error, and third-party action, are excluded from the health-related major failure.

Grid asset criticality

While asset health can indicate the PoF, asset criticality describes the consequence of failure. The risk associated with owning and managing an asset is derived using the likelihood and the resulting potential credible consequence of the failure.

We model asset criticality across five dimensions to calculate a monetised consequence. The monetised consequence is a societal cost and aligns with our corporate risk assessment matrix. The dimensions are additive and are as follows.

Service performance criticality
Estimates the impact of asset failure on transmission of electricity across our network. It is based on the cost of unserved electricity (value of lost load), the expected loads across a year, system configuration and coincident outages, and outages caused by failure of the asset. It represents the average impact (in dollars) on the wider network when an asset fails.

Public safety criticality
Estimates the impact of asset failure that could cause harm to the public. It is based on the expected consequence and does not anticipate worst case scenarios or HILP events. A primary contributor to public safety criticality is asset location and its surroundings.

Workplace safety criticality
Estimates the impact of an asset failure to our workforce. It is based on the expected consequences of asset failure rather than worst-case scenarios or HILP events. A primary contributor to workplace safety criticality is asset location and the probability of workforce presence around it. This accounts only for being near the asset when it fails; it does not consider the risk associated with any work being performed on the asset, for which an individual risk assessment is required.

Environmental criticality
Estimates the most likely environmental consequences of failure and is specific to the location of the asset and the risks the asset presents. It includes the potential environmental consequences of oil spill, oil fire, SF_6 leak, bushfire, and archaeological damage.

Direct cost criticality
Estimates the financial costs incurred in case of asset failure, including the average cost to restore service and to repair or replace the asset, and potential damage to private property.

Estimates of asset criticality are derived using a probabilistic approach to scenarios and rely on data available in our systems and in the case of service performance, from our power system models.

Site criticality and significance

Site criticality estimates the impact of complete site failure on transmission of electricity across our network, where site failure means all assets at a substation are removed from the grid. The analysis uses the cost of unserved electricity (site specific value of lost load) and the expected loads across a year. Unlike general service performance criticality, it does not consider a second order failure at other sites or circuits. The loss of a site could be caused by multiple different factors, such as flooding, earthquake, fire etc, which may have different restoration times. Due to this, site criticality is calculated as a rate ($/h) and therefore provides a relative ranking of a site's importance, rather than a cost per event.

We have used this quantified criticality, combined with black-start and regional contingency plans to categorise our substations and line sections into national, regional, and local significance ratings.

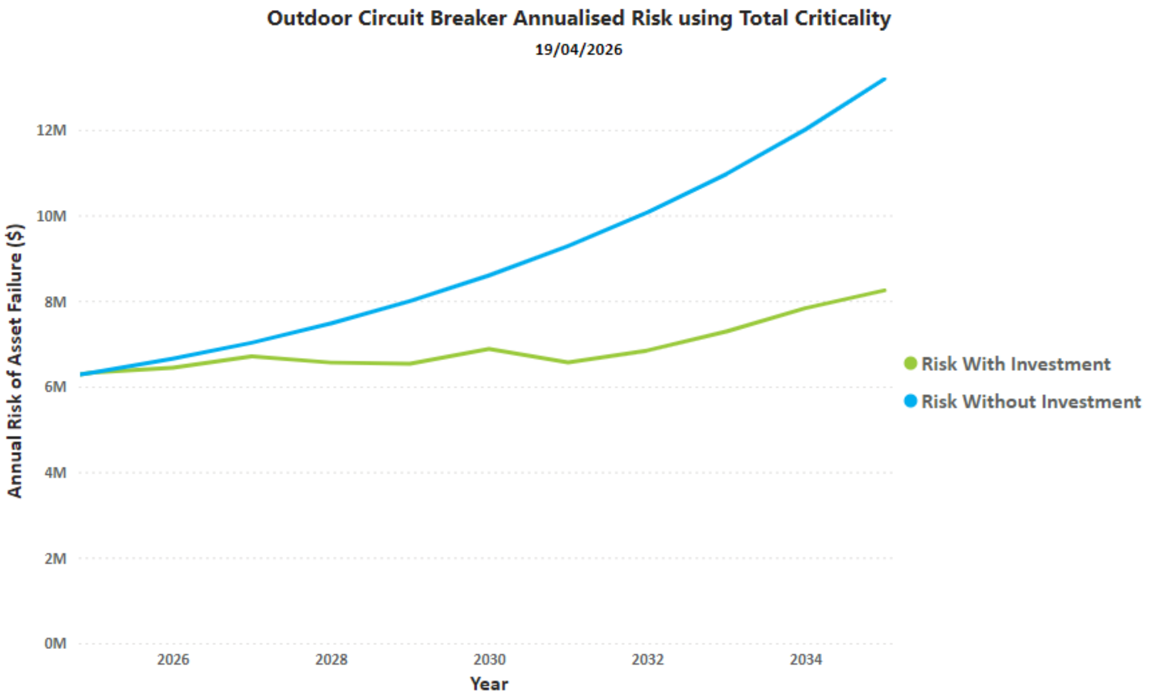
[12] International Council for Large Electric Systems; founded in 1921
[13] International Transmission Operations and Maintenance Study

Condition based asset risk

Asset risk profiles are calculated by combining PoF (derived from the asset health models) and consequence of failure, derived from asset criticality.

We use the asset risk information to help understand the cost-effectiveness of risk reduction interventions and support prioritisation of our plans where required. This information is part of solution prioritisation within the Asset Planning Decision Framework. It is worth noting that the risk profile is for condition-based failure risk and does not include our other critical risks. For example, only 30% of service interruptions are due to asset failure, and even then, not all asset failures are from life-ending degradation. **Figure 23** shows the combination of PoF, derived from asset health and criticality, to present a future risk profile with different investment scenarios.

Figure 23: Outdoor circuit breakers risk profile with and without investment



Improvements in asset health and network risk

We are committed to continually evolving our maturity in asset health and network risk. We have benchmarked other utilities and assessed our maturity in these areas. This information, combined with our operating context, informs areas for improvement.

As a prudent, customer-focused business, we must ensure improvements deliver value that outweighs the cost of those improvements. Our improvement plan focuses on enhancing areas that provide the most economic value and risk reduction.

Recent improvements in capability include our ICON programme which has lifted our ability to forecast our conductor replacement need considerably. This has been achieved through a comprehensive programme of data collection, modelling, and analysis. We have also improved our ability to forecast degradation rates relating to corrosion on transmission line assets through using our historic CA scores instead of historic corrosion zones.

To complement asset health and criticality models, we are also developing more decision support tools, such as options assessment and risk assessment tools.

From an ICT perspective our continued investment in tools and associated integration continues to support the breadth and sophistication of models needed. For example, recent investment in Python tools and deployment pipelines enables more flexibility, integration, and automation. Our investments in data and analytics will help to simplify the process of combining data and generating insights that feed into our models.

Risk-based maintenance

Our maintenance allowance increased for RCP4 to manage increasingly aging assets, reduce our overall capex spend by maintaining assets for longer, and improve environmental outcomes such as reducing SF6 gas leakage.

Our long-term goal is to maintain our assets using increased proportion of risk-based maintenance. This approach establishes maintenance tasks for each specific asset where the intervention and the timing are optimised based on factors such as current asset condition, historical reliability, and criticality of the asset.

To support this goal, we have developed a tool to prioritise our ongoing defect management/remediation work, using likelihood of failure and criticality. The Work Order Risk Prioritisation (WORP) tool works by scanning the description of our defect work orders and categorising them into word clusters using machine learning techniques. It calculates the frequency and relevance of terms in each cluster, sorting and ranking them based on likelihood, and consequence, which is provided by our criticality framework.

We also utilise reliability informed maintenance (RIM), which includes the principles of reliability-centred maintenance, to further review and optimise the work that should be included within our maintenance programmes, and at what frequency, on each asset. The RIM approach also includes preventative maintenance optimisation. The RIM programme is expected to increase condition-based predictive maintenance and reduce time-based preventive maintenance. The programme aims to ensure the least whole-of-life costs for the level of asset reliability required. Asset planning uses RIM to inform decisions on allocation of spend.

Our RIM programme is ongoing and reviews targeted areas each year.

Grid Resilience

Whakamana i Te Mauri Hiko recognises that factors affecting our transmission service requirements will change rapidly over the next 30 years. The decarbonisation of the energy sector will see more reliance on electricity and societal expectations for a resilient service is increasing.

A resilient transmission service avoids power outages or quickly restores service delivery when major events occur. As a lifeline utility under the Civil Defence Emergency Management Act 2002, we must be able to function to the fullest possible extent during and after an emergency, even though this may be at a reduced level.

A large proportion of our infrastructure is situated within areas prone to natural hazards. Aotearoa New Zealand's environmental and physical features mean that our critical infrastructure is exposed to a broader and more consequential range of shocks, particularly natural hazards, than any other developed country,[14] and climate change will increase both the frequency and the magnitude of many of the natural hazards that occur. Our infrastructure has potential to be impacted by other major hazards as well, such as building fires, damage by third parties and criminal sabotage.

Our risk review process identifies and collects information to understand the network hazard exposure, vulnerabilities, service impacts, and direct impacts for a range of credible resilience threats, including common mode failures, physical security and natural hazards. The risk review process includes collaboration with researchers and other agencies including Local Government and within the energy sector.

Figure **24** outlines the major hazard threats, vulnerabilities, and potential mitigation strategies for the transmission network.

[14] https://www.lloyds.com/worldatrisk

Figure 24: Threats to transmission networks

		THREATS	GRID MAJOR HAZARDS
NATURAL HAZARDS		Seismic	• Substation buildings, equipment, and bus structures • Transmission lines, HV and underground communication cables • Accessways
NATURAL HAZARDS		Volcanic	• Insulator flash-over from ash • Mechanical line loading damage • Disruption to electronics, AC systems • Lahar impacting sites, lines, accessways • Pyroclastic density current flows impacting stations, lines, and access ways
NATURAL HAZARDS		Tsunami	• Towers and poles • Substations • Subsea cables[15] and cable stations
NATURAL HAZARDS		Space weather	• Transformer damage due to geomagnetically induced currents • Reduced security: voltage control, protection and GPS clocks
NATURAL HAZARDS	WEATHER RELATED RISKS	Land stability	• Towers, poles, and communication cables • Access ways • Landslides damaging buildings and structures
NATURAL HAZARDS	WEATHER RELATED RISKS	Flooding	• Towers, poles, accessways, and communication cables • Towers and poles in braided rivers • Substations, control equipment, and cables
NATURAL HAZARDS	WEATHER RELATED RISKS	Severe wind and tornadoes	• Substation asset damage • Transmission lines and optical ground wire failures • Increased bush fire risk
NATURAL HAZARDS	WEATHER RELATED RISKS	Snow & ice	• Increased mechanical loading on lines and optical ground wires • Increased mechanical loading on buildings
NATURAL HAZARDS	WEATHER RELATED RISKS	Increased temperatures	• Derating of all current carrying assets and a shift to a summer peak • Insufficient cooling of control equipment, particularly at stations
NATURAL HAZARDS	WEATHER RELATED RISKS	Bush fire	• Bush fire encroaching assets • Transpower's assets starting bush fire
ASSET RISKS		Common mode failure	• Overhead earth wire failures • HV power cable joint and termination failures • Critical tower foundations understrength • HVDC converter station control system failures • Synchronous condenser auxiliary plant failures
ASSET RISKS		Third party activities	• Malicious attacks: cyber and physical • Non-malicious activities: unauthorised entry, third party utility asset risk, and poor housekeeping • Physical impacts with our assets: land, air, and water
ASSET RISKS		Significant Asset fires	• Substation building • Switchyard

[15] Subsea cables include subsea communication cables.

We are delivering proactive risk reduction and readiness workstreams on the grid, following the approval of this funding within the RCP4 programme of work. The workstreams under investigation for delivery, or in delivery, include:

- Seismic strengthening of buildings
- Flood – hardening critical and vulnerable HVAC and HVDC towers in braided rivers
- Flood – resilience solutions at substations
- Fire – stopping, detection and suppression upgrades to substation buildings
- Volcanic – hardening transmission lines for a volcanic ash event
- Land stability work for towers and poles
- Hardening bridges and access tracks against land instability and flooding
- Pre-enabling works for major failures of non-air bushings/gas-insulated switchgear (GIS)
- Remove earth wire overhead stations – common mode failure risk mitigation
- Hardening HVDC towers against wind damage
- Portable
- switchroom, control room, and protection solutions to minimise response time, and emergency exercises

Other areas we continue to work on include solar storm preparedness and reviewing our spares holdings.

Climate reporting and adaptation planning

Preparing for, and responding to, climate change is integral to our business, both in terms of the risks it presents to our assets and service and how it drives electrification.

Since 2024, we have published annual Climate Statements – climate-related disclosures required by the Aotearoa New Zealand Climate Standards. This builds on four years of previous voluntary climate-related disclosures.

We also published our first dedicated climate adaptation plan to make New Zealand's electricity transmission system more resilient to climate change. Our adaptation plan sets out a journey, recognising the need to adapt to climate change over time as we replace aging assets, build and operate new assets for the grid and for customers, and through our proactive resilience programme. This progressed our action in the National Adaptation Plan to develop and implement a Transpower climate adaptation plan.

Our adaptation plan sets out a five- year action plan. We are focused on continuing to build capability and further integrate climate adaptation into our asset management approach, as well as delivering tangible improvements in climate resilience and adaptive capacity.

We are continuing to refine our understanding of climate related risks and opportunities and have started to deliver our climate adaptation plan, with work underway on Dynamic Adaptive Pathways Planning, and transmission line ratings.

Collaboration on resilience and adaptation

We see the benefit of working together on resilience and adaptation – from understanding risks, to responding to emergencies, through to longer term adaptation planning.

Our decisions, and outcomes for New Zealand, also depend on the response of our suppliers, and other stakeholders such as central government, councils, communities, Māori, the wider energy industry, and other critical infrastructure providers. Some risks, options and decisions are beyond our direct control.

Working together supports informed, efficient, and integrated resilience and adaptation planning, for both our infrastructure and power system, and for wider national, regional, and local planning. We collaborate on resilience issues to understand needs, assess options, and develop business cases to deliver projects. We are joining a growing number of adaptation conversations across Aotearoa.

We recognise the knowledge and insights our stakeholders bring from their work on adaptation, such as experts, councils and Māori. We continue learn alongside others working in this space and aim to contribute to developing innovative and practical approaches to adaptation.

Readiness planning

We apply a range of approaches to ensure we prepare for and respond well to unexpected events. We apply a Coordinated Incident Management System as our standard approach for managing major incidents and have contingency plans and spares available to address grid asset failures.

We have readiness plans for real time, for different types of events, and for specific assets. Our readiness planning framework uses four pillars: the plans, alignment across teams and with customers, resources such as spares and service providers and training. The ongoing development and review of readiness plans aims to ensure we have adequate preparation for the first 24-48 hours of an event that we can foreshadow as part of scenario planning.

Readiness exercises

We also undertake readiness exercises, such as emergency tower structure deployment and business continuity exercises and will ensure that the additional portable/mobile solutions planned for delivery during RCP4 will also have associated readiness exercises in place.

Spares

Our spares are condition-monitored, maintained, and ready for immediate installation and service.

Our substation spares include the following.

- One spare emergency portable 33/22/11 kV switch room that can be deployed in the event of a major failure of a medium-voltage (MV) switchboard. This could also cover a failure of an entire outdoor 33 kV switchyard under an event such as a major fire, landslide, or earthquake.
- A mobile substation (15 MVA 110 kV/33-22-11 kV) which can be used at N sites where site made ready works have been undertaken (provided it is not in use for project works).
- Twenty strategic spare transformers which provide coverage for 99 percent of our entire present and future three phase power transformer assets with the aim to restore full security of supply within 4 weeks of a major transformer failure. On-site spares are provided at most sites where single-phase transformers are installed. In addition, spare power transformer components such as high-voltage (HV) bushings, Buchholz relays, pressure-release devices, etc. are available to respond to any partial transformer failures. We also have agreements with distribution companies to share smaller sized transformer spares in an emergency.
- Quantities of strategic circuit breakers are maintained. This is typically two circuit breakers per type are kept as spares, including appropriate quantities of components, e.g. trip coils, contacts, gauges, SF_6 gas etc., that can be used for emergency response."
- Spare cables, cable joints and cable terminations are held in Transpower's stock, or, for newer standardised installations, these are held by the manufacturer. Some spare components have limited shelf-life and are replaced every 5-10 years. Throughout RCP4, we are purchasing additional spare cables, joints, and terminations.
- Spare conductors, insulators, and hardware are available to respond to outdoor structure and buswork failures. Typically, 36 insulators for each voltage rating are held as spares.
- Instrument transformer spares are available in all voltage ratings to respond to failures. Typically, six spares for each rating type are maintained as spares.
- Minor LVAC equipment is typically readily available from commercial suppliers.

Our transmission line spares include the following.

- 163 km of spare conductors, insulators, and hardware that are specific to each service area.
- 42 emergency response structures and poles strategically located throughout the country including HVDC.

Following the Rangitata river flooding in November 2019, which washed away several towers, we undertook a lessons-learnt exercise to review our response. From this, we have completed an end-to-end review of the emergency lines spares and processes, our inspection specifications, and our Transmission Line Emergency Management Plan. This has resulted in an updated strategic spares policy and refurbishment of our emergency restoration structures. Following this event, we have also commenced a review of our key towers in waterways to ensure we have the appropriate levels of resilience to these types of major event.

Our HVDC spares include the following.

- HVDC emergency spares, including converter transformer bushings, voltage dividers, control system and valve hall components, wall bushings, filter coupling caps, DC current transformers and circuit breaker spares for converters and filters.
- HVDC subsea spare cable joints and cable terminations. Some spare components have limited shelf-life and are replaced at regular intervals.
- Eight HVDC temporary pole structures.
- Specialist tools and equipment to complete emergency work.

Our reactor assets spares include:

- Spare oil-filled shunt reactor.
- Spare capacitor cans.
- One 110 kV 50 MVAr capacitor bank.
- Components for capacitor banks, power electronics, and synchronous condensers (including consumables).

Secondary assets include:

- Some 1,800 spare protection relays for a population of over 13,000 and over 400 variants.
- Maintain approximately 4% holdings of modern battery charger spares for both rectifier modules and fully assembled chargers, taking into account future replacement/upgrade work.

Digital SMS spares include:

- Dedicated spares and on-hand project stock for all SMS hardware elements.
- Selected salvaged/reconditioned stock for older / legacy components.

Grid asset class plans

Grid asset class plans

Our grid asset class plans describe the approach, plans, risks, and capex and opex forecasts for our grid assets.

We have categorised our expenditure into seven portfolios within which we categorise 21 asset class plans. The portfolios are as follows.

Grid Maintenance: Grid maintenance covers all maintenance work on our HVDC and HVAC transmission line assets, substation assets, and communication-site and services assets (excluding communications bearer and network assets). Such work is undertaken to address in-service deterioration of our assets, respond to transmission faults, proactively improve the assets, and implement projects to replace asset components. We have one asset class plan for maintenance.

AC Substations: A substation contains a set of equipment, including power transformers, that enable energy transfer between voltage levels. A substation solely for the purpose of transmission rather than supply is called a switching station. Our substations have power system equipment that operates at 220, 110, 66, 50, 33, and 11 kV. AC substations encompass all the electrical equipment within a substation boundary. We have 10 asset class plans associated with AC stations.

Transmission Lines: Our transmission line assets transport electricity from generation sources around the country to where it is consumed within our homes and places of business. They consist of transmission towers, poles, foundations, conductors, earthwires, insulators and other hardware. We have six asset class plans associated with our transmission line assets.

Buildings and Grounds: Our buildings and grounds assets provide the accommodation, services, and physical security for critical grid equipment and systems. They cover the buildings, site infrastructure, building services and security fences. We have one asset class plan that covers all our buildings, building services, and grounds assets.

HVDC Assets: Our HVDC assets include the interisland HVDC link. The HVDC consists of HVDC converter stations, cable stations, undersea Cook Strait cables, electrode stations, sea and land electrodes, communication systems connecting the system to control centres, harmonic filters, and supporting reactive power assets. The HVDC assets are covered in one asset class plan.

Reactive Assets: Our reactive assets include our dynamic and static reactive assets on the grid. Our reactive assets incorporate capacitor banks, reactors, synchronous condensers, static VAR compensators (SVCs), STATCOMs, and associated control, protection systems, and auxiliary systems. Reactive assets are covered in one asset class plan.

Secondary Assets: Our secondary assets support the overall operation of the grid and provide essential services for the monitoring and control of equipment. They cover the protection, station DC systems, revenue metering and substation management systems. Our secondary assets are covered within two asset class plans. Our asset class plans document the basis for the forecast expenditure in more detail. The operation and maintenance costs that span our grid asset portfolios are described below.

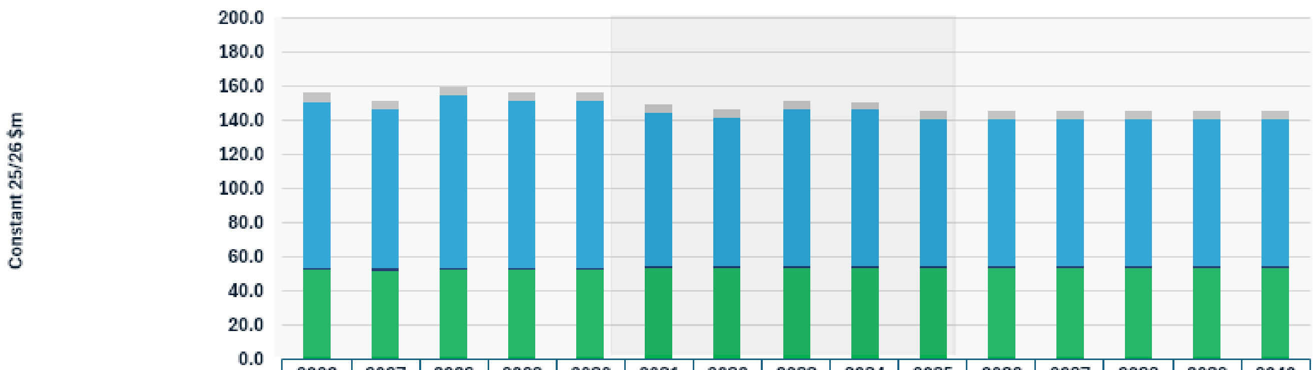
Grid maintenance

Grid maintenance covers all maintenance work on our HVDC and HVAC transmission line assets, substation assets, and our communication-site and services assets (but excluding communications bearer and network assets). It is undertaken to monitor and address in-service deterioration of our assets, respond to transmission faults, proactively improve the assets, and implement projects to replace asset components. We categorise grid routine maintenance work into four main work types. These are preventive, predictive, corrective, and proactive maintenance work.

Our approach to long-term grid maintenance is to optimise our time-based maintenance through risk-based analysis. This approach establishes maintenance tasks for each specific asset where the intervention and the timing are determined based on factors such as current asset condition, historical reliability, and criticality of the asset.

Our forecast grid maintenance, along with the trend, is shown in **Figure 25**. The forecast for RCP4 is $781.8 million, $744.4 million for RCP5, and $728.7 million for RCP6. We are reviewing RCP5 and RCP6 and there is potential that the combination of maintaining an ageing asset base, optimising opex capex trade-offs, and a greater visibility of asset condition, may increase RCP5 and and 6 when the review has been completed.

Figure 25: Grid maintenance forecast expenditure



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Corrective Maintenance	6.5	5.2	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Predictive Maintenance	96.2	93.2	101.6	98.3	98.4	89.8	87.2	92.2	91.4	86.2	86.2	86.2	86.2	86.2	86.2
Proactive Maintenance	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Preventive Maintenance	53.1	52.2	52.3	52.7	52.6	53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8

ICT Infrastructure is integral to our grid maintenance activities and a key area for our continued investment in innovation, efficiencies and optimisations. This includes our core systems such as our asset information system (Maximo), our Asset Management Planning system our inventory management and our Health and Safety Management system. Our field workforce mobility app (Mātai) has improved the speed and accuracy of collecting grid maintenance information as an input into our WORP tool and our broader asset planning functions. Ongoing investments in Mātai and our cloud-based photo storage system (Recollect) are continuing to improve feedback from the field about observed risks, issues, hazards, and non-conformances.

These capabilities drive the quality of maintenance improvements and increase first-time fixes, providing engineers with quick access to defect information and photos to advise on the best course of remediation. We are implementing the use of drones and machine learning to support the analysis and life extension of our conductors, through our ICON programme. We are initiating our site digitisation roll-out as a key enabler to improve our maintenance effectiveness and efficiency. This will reduce site visits and enable quicker access to accurate information.

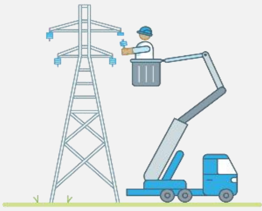
Our data and analytics programme is starting to provide improved awareness and readiness for planned and unplanned asset maintenance activities, such as outages. The programme also improves the accuracy of our work order management data, which will better quantify the impacts of minor failures.

Asset class snapshot

Maintenance opex

RCP4 (forecast in 2026 constant $s)

$781.8m



Maintenance opex by type

	RCP4
Preventive	$263.0m
Predictive	$487.7m
Proactive	$5.9m
Corrective	$25.2m

Asset class strategy

Our maintenance work programmes are determined from our asset class strategies, maintenance service specifications, and standard maintenance procedures (SMPs).

Each grid asset class strategy sets out the high-level maintenance required for the asset class to ensure the asset performance aligns to the asset class objectives. Our maintenance service specifications then establish the work that needs to be carried out on each asset type, clarify the details of what is involved, and assign a priority to the work. SMPs define, at task level, the current appropriate practice for maintenance on all asset types. The SMPs provide for consistent practices over a diverse asset base, by a field workforce that is geographically spread and managed by different service providers. Service provider personnel must use the SMP documents while on the job. Typically, these are attached to the maintenance work orders and accessed via the Mātai app in the field. The maintenance expenditure forecasts presented in this plan are the total sum of the work required from these strategies, service specifications, and maintenance procedures.

Maintenance categories

We categorise grid maintenance into four main work types, as summarised **Table 9**.[16] The work types are distinguished by how the work is initiated. This enables relatively granular tracking of maintenance interventions and their costs and drivers.

Table 9: Maintenance work types

Work type	Description
Preventive	Routine servicing or inspections to prevent failure or understand asset condition. This is our most regular asset intervention, so is a key source of effective feedback to the overall asset management system
Predictive	Maintenance performed based on known equipment condition before its condition deteriorates into an unsatisfactory state (e.g. outside service specification). Unlike corrective maintenance, this work occurs prior to failure. Activities include condition-based repairs, vegetation control, and additional targeted condition monitoring
Proactive	Improvement work initiated from formal analysis and investigation by the engineering or reliability teams to reduce risk or provide an efficiency gain. Activities are driven by either tactical or strategic reliability analysis, and include special inspection, reliability-driven corrective work, and one-off condition-monitoring tasks
Corrective	Fault response or maintenance work undertaken to restore an asset to service, make it safe or secure, or prevent an imminent unforeseen event that causes damage, degradation, or an operational failure. Corrective maintenance work is usually identified directly because of a fault or during preventive maintenance inspections

Forecasting approach

We use base-step-trend and bottom-up forecasting approaches for the maintenance forecast. The application of the approach is dependent on the availability of information and the degree of uncertainty in the forecast volume of work required. **Table 10** summarises the forecast approach we use for each maintenance category.

16 Routine maintenance expenditure also includes routine service charges such as site leases.

Table 10: Maintenance forecasting approach

Maintenance type	Forecasting approach
Preventive maintenance	Bottom-up
Predictive maintenance	Base-step-trend and bottom-up
Corrective maintenance	Base-step-trend
Proactive maintenance	Base-step-trend

Base-step-trend

The base-step-trend provides a controllable approach to ensuring that the incremental rolling incentive mechanism works as intended and is used by many utilities and economic regulators to forecast recurring expenditure.

The base-step-trend approach involves the following main components.

Base expenditure. A key requirement of the base-step-trend forecasting framework is that the base amount included in the forecast must be representative of the future expenditure requirement and be cost efficient. That is, the base expenditure is a 'revealed cost' that represents the ongoing, efficient maintenance expenditure requirement over the forecast period.

Step changes. Increases or decreases in costs, relative to the base expenditure, required to meet the needs of the network or to allow for external requirements. These can be one-off or ongoing changes and involve a change in the scope of work delivered.

Trends. Reflect the expected changes in cost.

Base-step-trend is utilised to forecast expenditure categories that have a reasonable degree of consistency from year to year and are built up from large volumes of smaller items. This applies to predictive, corrective, and proactive maintenance categories.

Bottom-up

We use a bottom-up approach to forecast preventive maintenance expenditure. The bottom-up approach is used as our AMS contains the forecast annual work volumes for each job type, specified according to our standard maintenance procedures. To obtain the expenditure forecast, we multiply the work volumes by the relevant unit rates. The unit rates are based on those currently agreed with our service providers.

We also use a bottom-up approach to forecast our maintenance project work over the near term: between 1 and 5 years depending on the portfolio. Longer-term maintenance project spend forecasting utilises a base-step-trend approach and is informed by our asset health models.

Provisions

During RCP2 we began provisioned funding for earth potential rise, under-clearance and asbestos mitigation. These obligations are necessary but uncertain, and this value has and will continue to change as the work is progressed. This work has continued into RCP3 and 4, with further provisions taken where new risks have been identified. It is considered predictive maintenance but is excluded from the future forecast expenditure as it has already been accounted for in prior years. Under-clearance does enter the forecast from 2028 onwards, as the provision was only for high-risk sites, which are expected to be completed by then. The remaining under-clearance will be lower risk and un-provisioned.

Maintenance plans

The maintenance plan for each maintenance work type is described below.

Preventive maintenance

Preventive maintenance predominantly consists of delivering our risk and/or time-based maintenance schedules. This work enables us to understand the condition of our assets, identify defects, undertake small servicing jobs to maintain assets and to meet statutory and compliance requirements. Preventive maintenance is our most regular asset intervention and is a key source of asset information feedback to our AMS.

Maintenance drivers

The main drivers of preventive maintenance activities are:

- Asset-specific characteristics including age, asset type and manufacture.
- network risk and criticality
- compliance with safety and other regulations.
- These are used in the development of the preventive maintenance approach within the asset class strategies, the maintenance tasks set out in the asset service specifications, and SMPs.

Work activities

The main preventive maintenance activities are as follows:

- **Inspections:** Non-intrusive checks, patrols and functional testing to confirm safety and integrity of assets, check continued fitness for service and identify follow-up work.
- **CA and condition monitoring:** Periodic measurement activities performed to monitor asset condition and to provide systematic data for analysis.
- **Servicing:** Routine tasks performed on the asset to ensure that its condition remains at an acceptable level.

Several preventive maintenance optimisation exercises have been implemented over the last ten years which look to ensure we do the most appropriate level of PM maintenance across our AC substation and transmission lines assets. During the same period, we have identified new requirements or gaps in our preventive maintenance schedule that has led to an increase work in some portfolios.

We also regularly review our asset reliability via our reliability informed maintenance (RIM) activity. This can identify gaps and needs in our preventive maintenance schedules as well as provide insight into potential optimisation. Our RIM may increase maintenance activity across both preventive and predictive categories but is expected to reduce whole-of-life cost, with a focus on improving asset reliability.

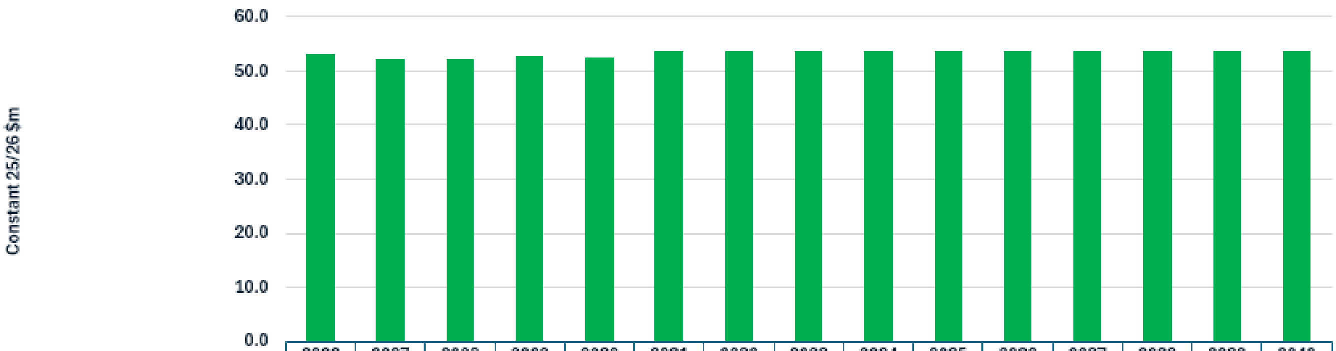
Unit costs

Our base preventive maintenance forecast uses the unit costs currently agreed with our service providers. These are set out in our price books, a component of our maintenance service provider agreements. These are usually repriced on an annual basis and compared across all service providers to ensure they are in line with the market.

Preventive maintenance expenditure forecast

Our preventive maintenance forecast has been derived from the forecast work volumes within our asset management system multiplied by the unit costs for the works activity type. In addition, the preventive maintenance forecast includes non-field work components such as service provider fixed overhead fees. Figure 26 shows the forecast preventive maintenance expenditure.

Figure 26: Preventive maintenance forecast expenditure



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Preventive Maintenance	53.1	52.2	52.3	52.7	52.6	53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8

Predictive maintenance

Predictive maintenance addresses defects identified through the preventive maintenance and asset feedback processes, i.e. in response to condition-based inspection and monitoring programmes. Predictive work is carried out prior to failure or before asset condition deteriorates to an unsatisfactory state.

Maintenance drivers

The main drivers of predictive maintenance activities are asset condition, asset criticality and compliance with safety regulations. These are used in the development of the predictive maintenance approach within the asset class strategies and the maintenance tasks set out in the asset service specifications, and SMPs.

Work activities

The main predictive maintenance activities are:

- **Rectifying defects:** Repairing assets or replacing minor components to correct defects, address wear and tear or repair damage, or to return the asset to a condition that complies with a defined standard.
- **Targeted condition monitoring:** Using specialised test equipment to validate condition or predict the likelihood of failure.
- **Vegetation control:** Cutting and/or trimming vegetation to maintain electrical clearance standards.

We typically address around 15,000 defects per year. While in any given year more defects than this might be identified, maintenance intervention timing is optimised.

Our Mātai application streamlines data collection in the field ensuring accurate prioritisation via the WORP tool.

Predictive maintenance also includes some replacement and refurbishment of assets that are deemed to be opex. These are managed as maintenance projects or predictive maintenance large work orders.

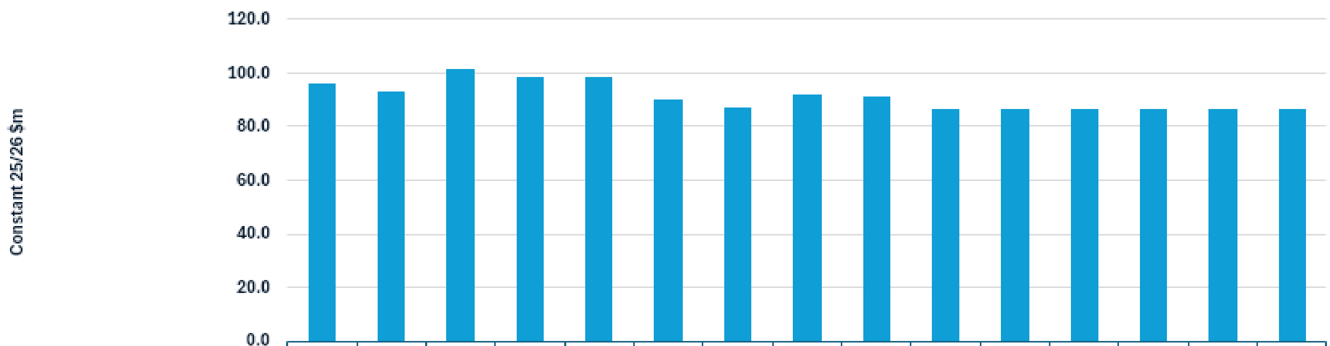
Predictive maintenance can be impacted by some capex lead initiatives that reduces total capex and whole of life cost but increases opex. An example of this is the tower-to-poles initiative which reduces whole of life costs but may increase maintenance work.

Predictive maintenance expenditure forecast

Our predictive maintenance expenditure trend can be seen in

Figure 27. There is an increase in RCP4, compared with RCP3, which is driven by a step change increase in key maintenance programmes as our assets age and we adapt our strategies to support sustainability and climate change objective. The lower forecast from 2031 onwards is due to assumptions on specific programme completion and overall expected efficiencies across the portfolio. The assumptions are being reviewed which may lead to a change in the expenditure profile in our 2027 Asset Management Plan.

Figure 27: Predictive maintenance forecast expenditure



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Predictive Maintenance	96.2	93.2	101.6	98.3	98.4	89.8	87.2	92.2	91.4	86.2	86.2	86.2	86.2	86.2	86.2

Proactive maintenance

Proactive maintenance incorporates improvement work initiated as a result of formal asset performance analysis and investigation. It is used to prevent the failure of equipment in the future by determining potential root causes of failure.

Maintenance drivers

The key driver for proactive maintenance is reliability or cost improvements.

Work activities

The main proactive maintenance work activities are as follows.

Special inspection: Special reliability engineering inspections to further determine fault causes or validate findings.

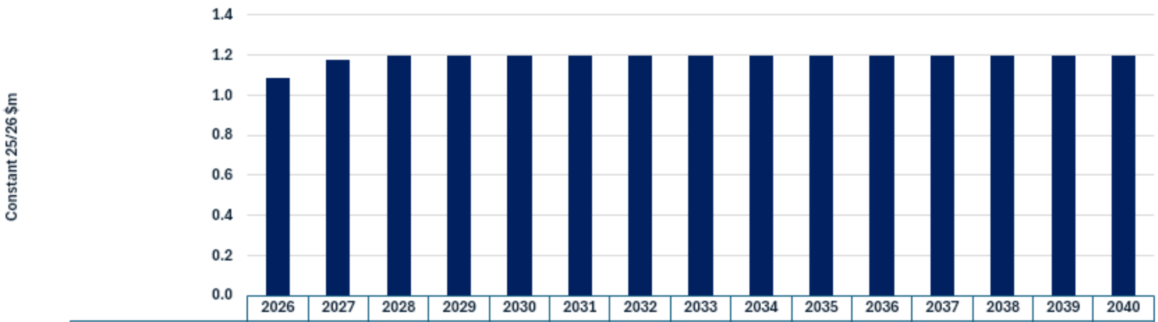
Reliability driven corrective work: Improvement modifications, design changes, or adjustments undertaken as scheduled activities that are planned and scheduled in advance to address reliability concerns.

Condition monitoring: One-off condition monitoring using specialised test equipment to further determine fault causes or to validate findings for root causes analysis or reliability engineering purposes.

Proactive maintenance expenditure forecast

Figure 28 shows our proactive maintenance forecast. Proactive maintenance expenditure is expected to continue at a similar level in the future.

Figure 28: Proactive maintenance forecast expenditure



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Proactive Maintenance	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2

Corrective maintenance

Corrective maintenance involves fault response activities or maintenance work following a fault. The work is undertaken to return equipment from an unsatisfactory or failed condition back to a serviceable condition. Its purpose is to restore an asset to service, make it safe or secure, or prevent an imminent event that will likely cause damage, degradation, or an operational failure.

Maintenance drivers

The key driver of corrective maintenance is safety and reliability.

Work activities

The main corrective maintenance activities are as follows

Fault restoration: Immediate response to repair a fault that has safety, environmental, or operational implications.

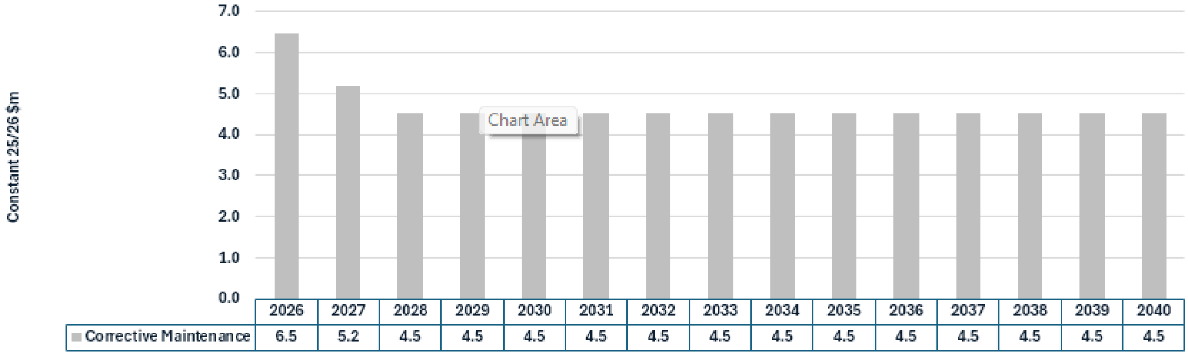
Repairs: Work necessary to repair damage or to prevent the failure or rapid degradation of equipment that is in an unsatisfactory condition.

Inspections: Information gathering that is not directly related to the fault restoration activity itself.

Corrective maintenance forecast expenditure

Figure 29 shows our corrective maintenance expenditure. Our aim for RCP4 was to reduce our corrective maintenance expenditure to align with industry best practice by improving our prioritisation and optimisation of our maintenance work. Our forecast assumes a constant level of corrective maintenance during the planning period, and although the actual spend will fluctuate from year to year, greater reliability and robustness is expected from new equipment installed as part of our asset replacement programme. This, combined with our proactive resilience investment programme is expected to support our assumptions. However, recent expenditure has been higher than expected, and our forecast assumptions are being reviewed which may lead to a change in the expenditure profile in our 2027 Asset Management Plan.

Figure 29: Corrective maintenance forecast expenditure



Substations

Our AC substations comprise all the primary assets within the substation boundary. They enable safe operation of the grid, transform transmission voltages, and are the points of connection to transmission lines, generating stations, lines companies and direct connect users.

Our AC Substations portfolio includes the structures on which primary equipment is installed, the HV electrical conductors and cables connecting the primary equipment within the substation, and the LVAC supply system for the substation itself. It covers 10 asset classes.

- Power transformers
- Indoor switchgear
- Outdoor circuit breakers
- Outdoor instrument transformers
- Power cables, including between substations
- Outdoor disconnectors and earth switches
- LVAC distribution systems
- Structures and buswork
- Other substation equipment
- Outdoor 33 kV switchyards: ODID conversion

Our AC substation portfolio assets do not include our Secondary Assets, Communications, and Building and Grounds. It is also atypical in terms of the boundary between the grid and our customers' assets compared with international peers. For example, we own many transformers and switchgear for supply at the lower voltages of 11 kV or 33 kV to a customer. This means there is a relatively large number of these assets on the grid that, in other countries, would typically be owned by electricity distributors. This proportion is decreasing over time through mutually beneficial opportunistic divestment, transferring some of these lower-voltage assets to local electricity distributors.

Our AC substation assets are generally older than those of our international peers. We do not believe having older assets is an issue as our replacement strategies primarily focus on condition and risk-based replacements instead of age. This requires reliable asset data and a more extensive focus on modelling, which we are continuing to develop to ensure we set robust investment and maintenance expenditure plans.

Where possible we align our condition-driven investments with E&D plans to ensure our substations have the capability and flexibility to keep pace with advances in consumer technology, and that they enable electrification and renewable connections while continuing to support a reliable and safe network.

Our Digital Engineering strategic programme of work will enable creation of digital representations of the physical characteristics of assets, also known as digital twins. Digital Engineering is being implemented across all our substation sites in the next 15 years, prioritised to support those sites in the forward work programme. Digital Engineering will enable cost and time savings across the project and asset lifecycle.

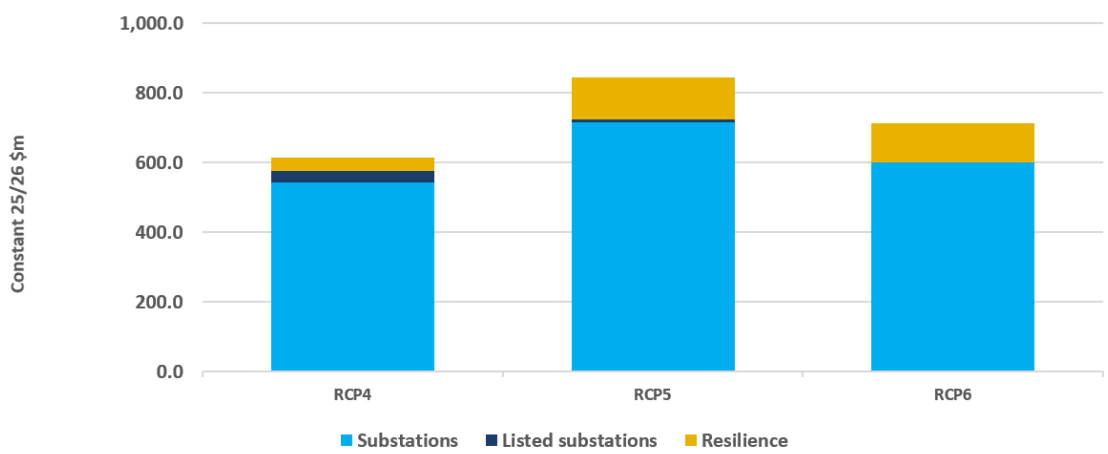
Remote switching minimises safety risks and reduces the time to undertake switching activities, thus reducing overall outage requirements. Our Digital Switch Management (DSM) programme (funded by the ICT Transmission Services Portfolio) is a key enabler for remote switching across our devices. We will commence trials of remote switching in RCP4 to capture the full benefits of DSM.

The key investment themes within our AC substations are as follows:

- Power transformers: During RCP4 there is a need to begin replacing units that have previously undergone life extension or those units where life extension is not possible.
- Environmental factors: Our renewed approach to management of SF_6 gas includes reliance on life extension to delay the replacement of some circuit breakers until alternative technologies (SF_6 free) can be developed and tested. An increase in maintenance expenditure in life-extension work will enable these assets to remain in service beyond their current expected lives while limiting SF_6 gas loss. Management of SF_6 leakage from HV GIS indoor switchgear is targeted through online monitoring, proactive refurbishment work and accelerated replacement where necessary.
- Remaining AC substations: Previously implementing asset health models and improvements in our asset data resulted in life extensions in many asset classes through both more targeted condition-based replacements and refinement in strategy to undertake more proactive maintenance. In RCP4, many of these deferral benefits have been realised and the overall capex trend is increasing as assets reach replacement criteria.
- Station Strategy: Many of our station have multiple primary assets that are due to be replaced, combined with resilience, climate adaptation, and customer work. This presents opportunities to review substations long term strategies to ensure the site is futureproof, as well as synchronising and combining major works and assets for efficiencies.

The capex by RCP is shown in **Figure 30**. There is a forecast increase in substations work from RCP4 to RCP6, as we see an increasing need to undertake condition-based replacements to maintain a safe and reliable network.

Figure 30: AC substations capex by RCP



Grid Development Other and Substation General

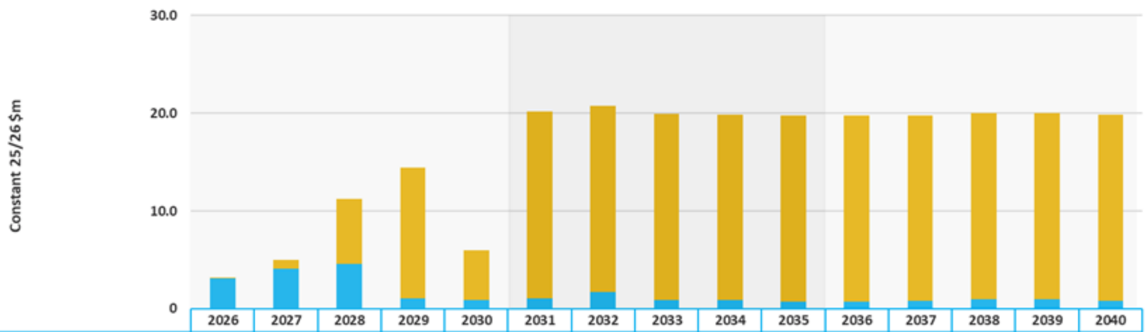
Within this expenditure, funding is provided to operational teams, as yearly contingency allowances, to support fault response activities where the activity should be capitalised rather than a maintenance expense. Examples of this are replacement of relays, pole structures and instrument transformers. This expenditure sits alongside our corrective maintenance programme. Funding is based on historical expenditure which can vary year to year.

Also included is funding to install primary assets for us by Grid Skills to train our service providers. These assets are generally used to support training modules and the replacements planned in RCP4 are to ensure the training assets are aligned to the in-service assets on our grid.

Resilience projects make up most of the planned expenditure in this category. The resilience funding covers resilience work to mitigate flooding in our substations with RCP4 work primarily in 2027 and 2028. Resilience expenditure is forecast to increase based on projections of increased frequency and severity of extreme weather events. The expenditure is required to identify and mitigate the substation sites most at risk.

Figure 31 shows the grid development other and substation other actual and forecast capex

Figure 31: Grid development other and substation other and forecast capex



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Resilience	0.0	0.9	6.7	13.4	5.1	19.1	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Other general substation work	3.1	4.1	4.6	1.1	0.9	1.0	1.7	0.9	0.9	0.7	0.7	0.8	1.0	1.0	0.8

Substation risk, resilience, and sustainability

Our substations face many vulnerabilities and major hazards. To address this, our resilience programme includes specific strategic programmes to manage substation fires, flooding, seismic events, volcanic eruptions and space weather. We are also working on several sustainability workstreams such as laminated wooden buildings, low-carbon concrete and solar panel installations to support our Sustainability Strategy and reduce the carbon emissions from our activities.

Consolidated simplified bow-ties

We have developed two simplified bow-ties describing major hazards and degradation of primary assets in a substation, and a significant incident on a transmission cable circuit. These are as shown in **Figure 32** and **Figure 33**. The bow-ties inform us of the most likely causes of failure across our AC substation assets, along with the most likely resulting consequences of failure.

Our risk modelling has identified which preventive and mitigative controls[17] are to be used to reduce the likelihood of a significant initiating risk event occurring on our primary assets within a substation and to reduce the consequential impact of that event. We have used the bow-tie analysis to:

- inform ongoing maintenance activities
- determine the type of CA undertaken
- inform our procurement specifications to ensure assets procured suit Aotearoa New Zealand conditions
- ensure our new assets are designed, installed and commissioned to the latest specifications and standards
- ensure appropriate signage so third parties are alerted to the presence of our assets
- ensure robust asset management systems are in place.

Each of our substation asset class plans advises the predominant likely causes of each asset class failure and the critical controls that we have implemented to reduce the likelihood and resulting impact of a failure.

[17] The Risk Management and Performance Improvement section of this AMP details each critical preventive and mitigative control.

Figure 32: Major hazards and degradation of primary assets in a substation simplified bow-tie

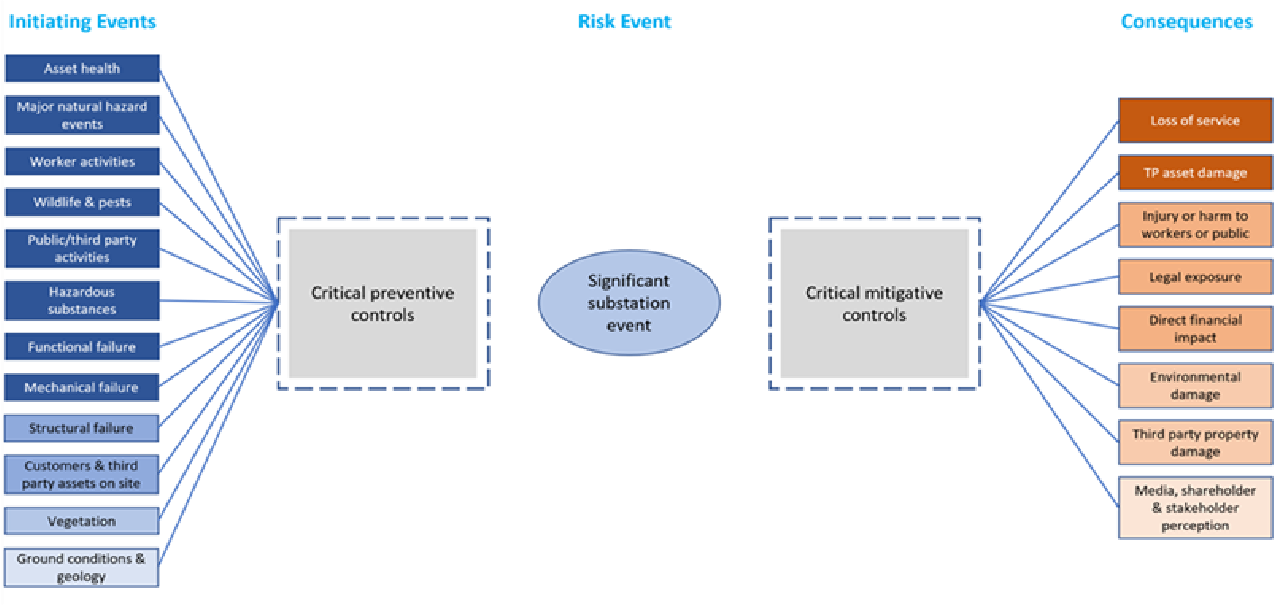
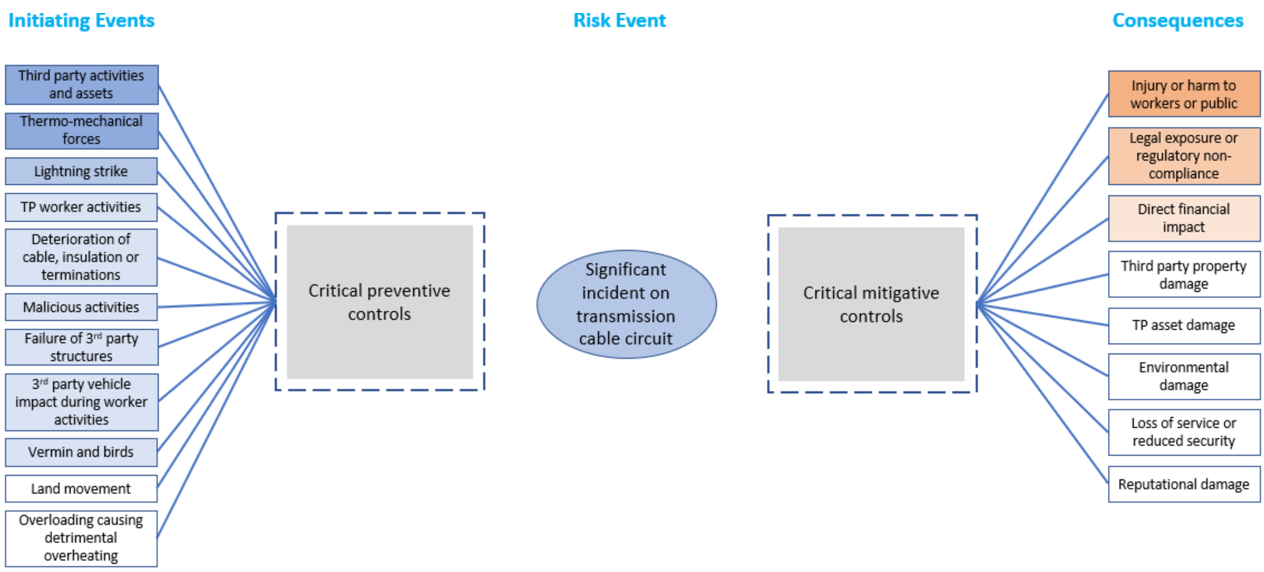


Figure 33: Significant incident on a transmission cable circuit simplified bow-tie



We use the bow-tie analysis to inform our preventive and mitigative control activities.

Our preventive activities include our inspection and maintenance programme, workforce competency management, and asset management activities such as lifecycle planning. We also undertake condition monitoring which is carried out using the output of the inspection and maintenance programme.

Our mitigative control activities include a range of approaches to ensure we respond well to unexpected events. This includes holding critical spares strategically located throughout the country which are condition monitored, maintained and ready for immediate installation and services. We also have incident and emergency management plans, specialist contracts for short notice emergency work, and undertake emergency exercises.

Common terms

Within the AC Substations portfolio there are some common terms used. These are:

- **HVAC:** High voltage alternating current.
- **HVDC:** High voltage direct current.
- **Substation:** A general term to cover substations, power stations and switching stations. Often the terms station and substation are used interchangeably. A building, structure or enclosure incorporating equipment used principally for the control of the transmission of electricity.
- **Switchyard:** An area enclosed by a security fence, containing normally live conductors and/or other exposed materials.
- **Switching station:** A substation solely for the purpose of transmission rather than supply.

Maintenance – tests, inspections, and condition assessments

We undertake proactive, preventive, predictive and corrective maintenance on our substation assets. As part of our maintenance activities, we undertake regular inspections and condition assessments to ensure our assets are maintained in an appropriate condition and operate as required.

Table 11 shows the frequency of the general condition monitoring tests and inspections undertaken on the full substation.

Table 11: General tests, inspections and CAs undertaken on all substation assets

Activities	Frequency
Station Level 1 Inspection: A general visual inspection including housekeeping, collection of protection operation data, minor servicing, and security and functional checks. The inspection covers but is not limited to: • Buildings and building services, including security, safety, and fire protection equipment • Indoor and outdoor equipment, including switchyard grounds • Transformer condition checks, including on-load tap changer operation & silica gel replaced when saturated • Health and site safety equipment, e.g. defibrillator checks and burns kits are clearly marked and in date	2 monthly
Station Level 2 Inspection: This covers the same station assets and inspections as Level 1 but is a more comprehensive inspection. It requires a more detailed visual inspection of the equipment and includes operational checks (which may require the opening of cubicles, panels, etc. with the objective of identifying any significant deterioration or damage that has occurred since the previous level 2 inspection), thermographic survey, hazardous substance level 1 Inspection, hazardous substance location certification, and hazardous substance stationary container test certification.	1 yearly
Oil Services Inspection: Visual inspection of oil interception facilities including but not limited to: • Oil interceptors and discharge system soakage holes free of visible hydrocarbons and debris • Drainage sumps emptied with buffer water retained and free of visible hydrocarbons and debris • Oil storage tanks, oil spill trailer and spill kits free of damage, secured and in good operational order	6 monthly

The specific tests, inspections and condition assessments for each asset type are outlined in each substation asset class plan.

Risks and uncertainties

The following are the material risks and uncertainties associated with this portfolio:

1. There is increasing uncertainty related to customer investment plans and proposed divestments of connection assets. This may impact the timing and scope of programmes that include connection assets such as outdoor-to-indoor (ODID), where we seek agreements with customers before proceeding.
2. As global electrification continues, sustained cost escalations and long lead time equipment continue to have an impact particularly on our power transformer programme.

Asset class plans

The following sections describe in more detail our asset management approach for each of the AC substation asset classes. These asset class plans describe the strategy, asset characteristics, management approach and expenditure profile for each asset class. The expenditure covers the capital requirements, along with any specific maintenance projects to be undertaken.

Power transformers

We have two categories of transformers: power transformers and auxiliary transformers.

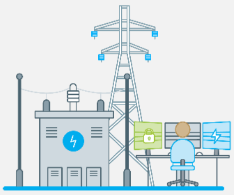
- Power transformers are bespoke, have long lead times, and are generally the highest-value assets in substations.
- Auxiliary transformers (sometimes called local service) are of much lower value and have shorter lead times. Although less critical to the supply of electricity, they are critical for station and communication supply.

Asset class snapshot

Population

325 Power transformers

313 Auxiliary transformers



Capex

RCP4 (forecast)

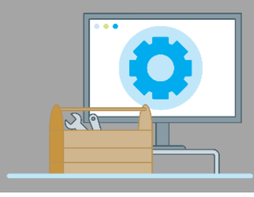
$209.1m

Power transformer asset health

- 71.7% Good
- 23.9% Fair
- 3.2% Poor
- 1.3% Very Poor

Work programme

	RCP4
Power transformers	19
Bushings	42



Asset class strategy

Objective
Safe and reliable operation, at least whole-of-life cost.

Measure
Reduce forced and fault outage rate for power transformer banks to fewer than 18 events per year.

Asset strategy
Targeted and prioritised investment based on unit-specific quantified benefit (monetised risk) analysis to meet our asset performance measures.

Investment need is primarily based on asset health and risk. We undertake quantified benefit (monetised risk) analysis to evaluate and prioritise solutions based on unit-specific probability and consequence of major failures. Rare but severe failure modes are included in the evaluation of options. Instead of just full replacement it considers investment in specific risk mitigations. This includes site-specific solutions, such as adding a firewall, refurbishment, corrosion repaints, tap changer overhauls, corrosive sulphur oil replacement, bushing replacements, and, if required, the full replacement of the transformer.

Alternative options are compared using net whole-of-life costs, including annualised risk costs. Our quantified benefits approach shows that maintenance or refurbishment options can often extend the remaining life of the assets. There is generally no economic benefit from replacing transformers unless the winding is showing end-of-life signs or the existing unit is undersized, and the impact of a failure is significant. Compared with past age and condition-based replacement approaches, this strategy often extends transformer life and defers replacement. However, transformer end-of-life failure is hard to predict, and we remain mindful of taking a balanced approach that considers the overall asset condition.

Auxiliary transformers are often replaced as part of other major works on site, e.g. transformer replacement or a 33 kV ODID conversion project, or where an unacceptable condition level has been reached.

Figure 34 shows the population and age profile of our power transformers by type. Our older transformers are predominantly single-phase transformers, while all transformers that have been replaced or installed in the last 40 years are three-phase units.

Figure 34: Power transformer age profile

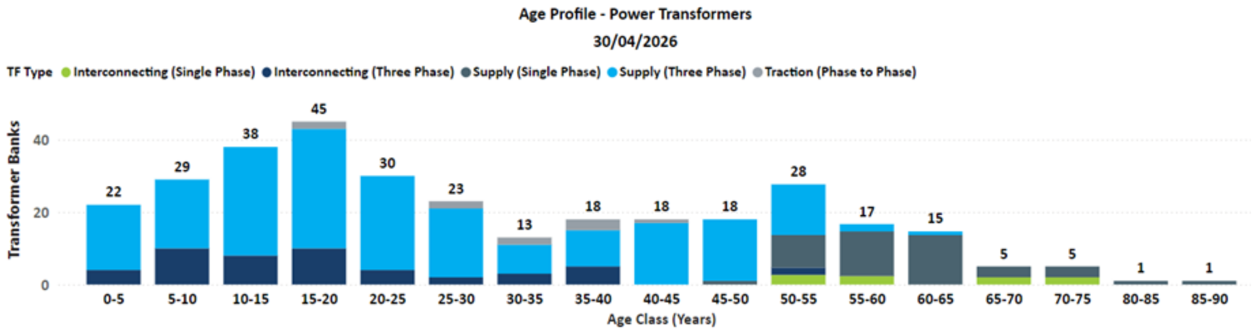
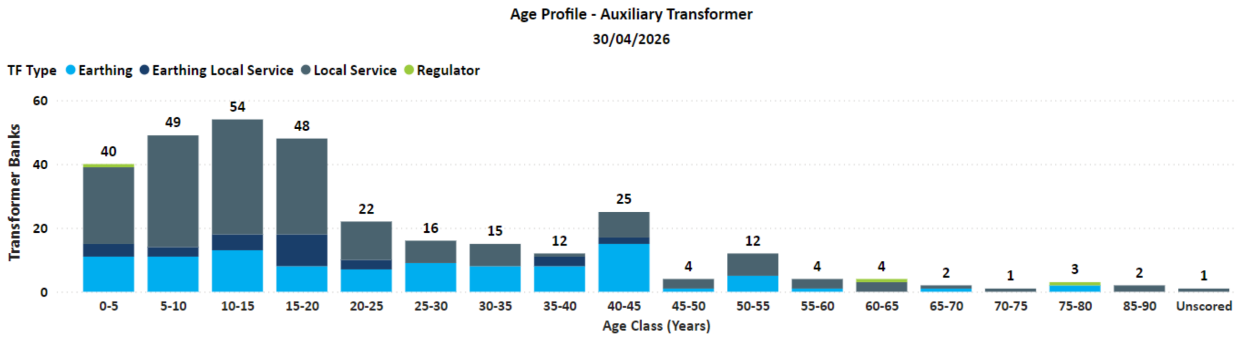


Figure 35 shows the age distribution of our local service, earthing, and regulating transformers. The fleet is younger in comparison to power transformers.

Figure 35: Ancillary transformer age profile



Lifecycle – deliver, operate, maintain, decommission, and disposal

Delivery times for new power transformers include allowance for investigation, detailed design, procurement, outage planning and coordination with other works at the site. It typically takes 2-3 years to complete all work.

We plan and manage outages in a way that creates a safe environment for employees while minimising disruption for customers. We undertake regular condition assessment and planned maintenance in accordance with our standard maintenance procedures and routine substation inspections. Our programme of routine condition monitoring-inspections is in

Table 12.

Maintenance activities include routine on-load tap changer maintenance; replacing Buchholz relays which have mercury contacts to remove risk of tripping during earthquakes; corrosion control and repainting as condition dictates; corrosive sulphur oil replacement; replacement of faulty or defective instrumentation; and bund repairs.

Table 12: Transformer condition monitoring and inspections

Activities	Frequency
Dissolved gas analysis sampling, oil screen tests	Annually
Diagnostic inspection, service, and testing	5- yearly
Major service of on-load tap changer (frequency based on type)	2, 4, 8 or 10-yearly
Furan oil test, oil anti-oxidation inhibitor level test (transformers from 1975)	4-yearly
Winding temperature monitor calibration check	10- yearly

We scrap decommissioned end-of-life power transformers. The oil is sold to a licensed oil dealer for regeneration and re-use.

Metals such as steel and copper are sold to scrap dealers. A few decommissioned transformers are retained as spares for specific sites where justified. Where transformers have been replaced before end of life (for added capacity at that location) these transformers are stored and reused as replacements at other substations, kept as strategic spares, or on-sold to third parties.

Accelerated electrification may result in more replacements before end of life, and we will continue to identify opportunities to re-use as part of system planning when working with customers on their capacity needs.

Asset risk – health and performance

Figure 36 and Figure 37 show the asset health forecasts. The auxiliary transformers have recently been added to the asset health model, although the outputs are yet to be fully implemented into our planning. However, we do not foresee a material change in replacement volumes compared with our current approach.

Figure 36: Local service transformer current asset health

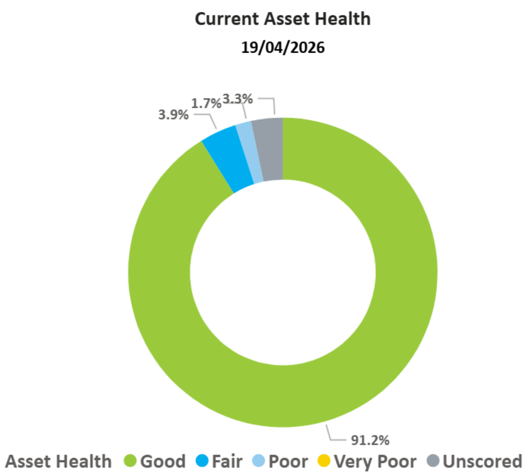


Figure 37: Power transformer asset health

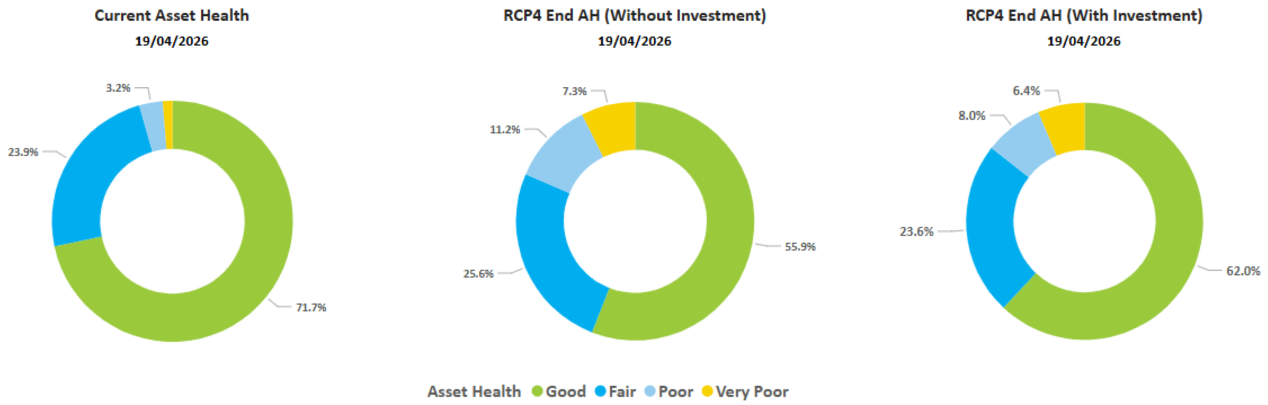


Figure 37 shows a decline in asset health over RCP4. Our asset management approach is to continually review and reprioritise our work plan to minimise the risk. As the opportunities for life extension works reduce during RCP4 and RCP5, we expect an increasing requirement to begin replacing assets that have previously undergone life extension or those assets where life extension is not possible.

The predominant causes for power transformer failure are insulation failure, mechanical failure, over-rating, and material degradation. The three key preventive controls critical to reducing the likelihood of a service failure event are good procurement processes, adherence to system operating protocols, and maintenance.

Good procurement processes ensure good design and quality in manufacturing which includes having representatives on site to witness factory acceptance tests of all new transformers.

We undertook a review of our asset health model calibration in 2021. The risk profile for the portfolio is shown in **Figure 38**. The risk-based planning approach ensures our investment is targeted to those transformers that are the most critical to maintain reliable supply to our customers. Beyond RCP4 (2030) modelling uncertainty begins to increase.

Figure 38: Transformer risk profile

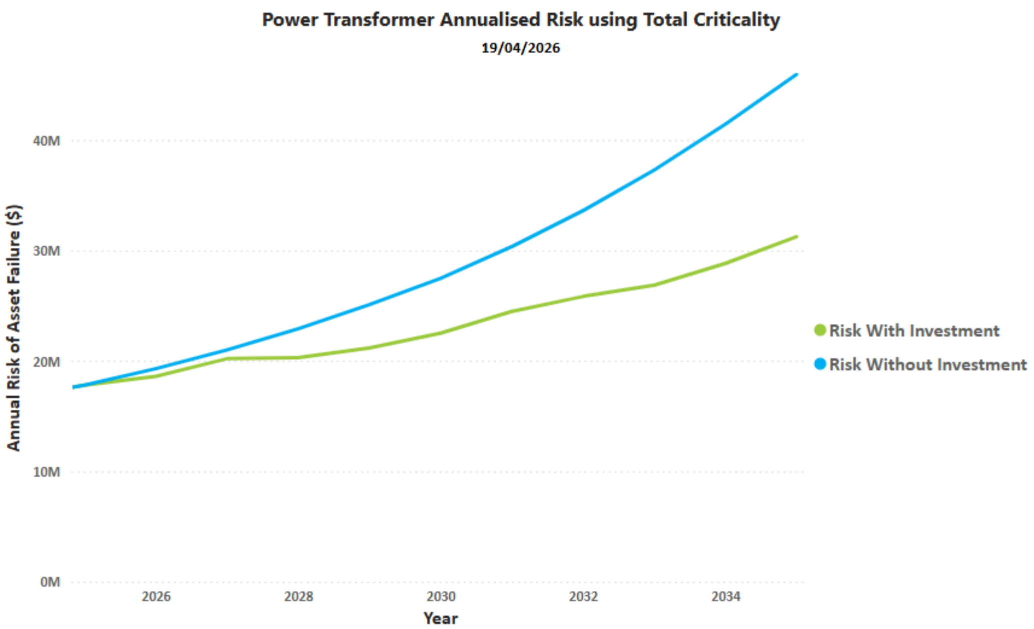
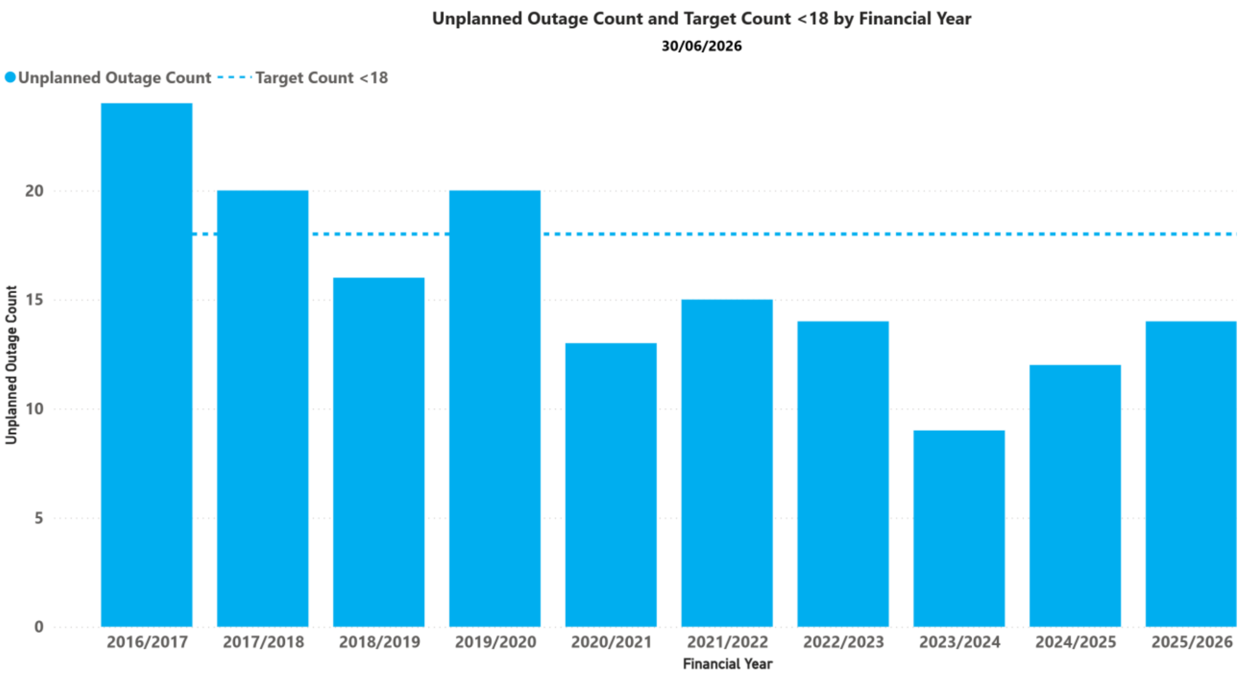


Figure 39 shows a decreasing trend of unplanned outages. Asset performance is influenced both by our transformer replacement programme, targeting old and poor condition single-phase units (from 2008 onwards), and our life-extension programme, targeting major component refurbishment or replacement (from 2017 onwards).

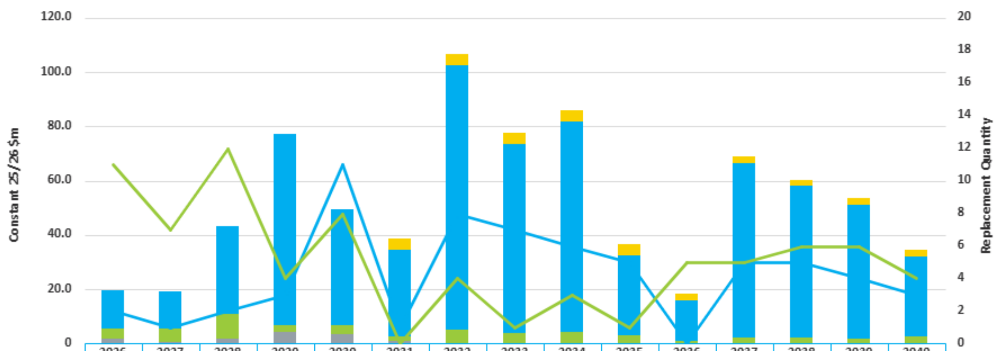
Figure 39: Power transformer performance



Forecast work and capex

The expected quantity and cost of work to be delivered in this portfolio to achieve the levels of risk and asset health noted above are summarised below in **Figure 40**.

Figure 40: Transformer forecast capex and quantities



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Resilience	0.0	0.0	0.0	0.0	0.0	4.1	4.1	4.2	4.2	4.2	2.3	2.3	2.4	2.4	2.4
Power transformers	14.2	13.7	32.5	70.7	43.0	32.2	97.4	69.4	77.5	29.5	15.0	64.3	55.6	49.2	29.7
Bushings	3.6	4.7	9.0	2.3	3.1	1.5	5.0	3.9	4.3	2.9	0.9	2.1	2.2	1.7	2.4
Other (Firewalls, strategic spares, etc.)	1.8	0.8	1.9	4.3	3.6	1.0	0.2	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.1
Power transformer Qty	2	1	2	3	11	1	8	7	6	5	0	5	5	4	3
Bushings Qty	11	7	12	4	8	0	4	1	3	1	5	5	6	6	4

Opex: The Opex forecast covers the condition monitoring inspections and maintenance activities outlined in the lifecycle section of this ACP.

Capex: The forecast capex is based on our approach to extend transformer life and risk-based replacements. This approach has resulted in an overall reduction in the number of total unit replacements planned, compared with a condition-based replacement programme only.

The bushing replacement programme is expected to reduce significantly in RCP5 and beyond, as most transformers suitable for this option will have been addressed.s

Due to the risk-based investment approach, as load growth changes due to electrification, we expect this might require us to bring forward some investments. We closely monitor the condition of transformers and the consequences of failure to ensure our forward investment plan manages this risk. We also collaborate closely with the system planning team to monitor and respond to the potential future load profile changes.

With the global supply constraints, limited suppliers, and increasing customer requirements, we are endeavouring to accelerate procurement for items with long lead times, e.g. transformers and disconnecting circuit breakers, to maintain asset health. We also undertook a review of our spares policy to ensure it still meets our requirements. There has been signifcant inflationary cost pressures across all parts of the supply chain which have had a material impact on the cost of delivering power transformer projects. While volumes begin to increase over RCP4 and RCP5 we have seen a disproportional increase in costs.

Indoor switchgear

Indoor switchgear is an integrated assembly of circuit breakers, instrument transformers and busbars that provide switching and control functions for the grid. These functions are essential for limiting safety risk to workers and members of the public, minimising asset damage and ensuring reliability of supply during faults on the power system. We have two categories of indoor switchgear: medium voltage (MV) which covers indoor switchboards operating at 11 – 33 kV and high voltage (HV) gas insulated switchgear (GIS) technology at 110 kV and 220 kV.

Asset class snapshot

Population

HV

65 220kV SF6

9 110kV SF6

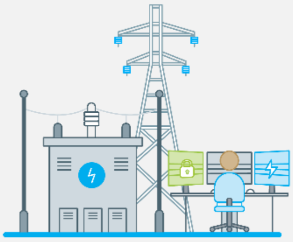
MV

13 Air break - magnetic

10 Bulk oil

183 SF6

889 Vacuum



Capex

RCP4

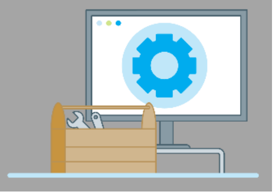
$46.3m

Asset health

- 99.2% Good
- 0.1% Fair
- 0.7% Poor

Work programme

	RCP4
MV Switchboards	3
HV GIS	2



Asset class strategy

Objective

Safe and reliable operation, at least lifecycle cost.

Measures

- 66-220 kV: No more than one unplanned outage per year of any indoor circuit breaker (excluding protection, SCADA, and human error).
- Below 66 kV: Fewer than nine unplanned outages per year of any indoor circuit breaker (excluding protection, SCADA, and human error). No unplanned outage of any indoor circuit breaker for longer than 7 days.
- SF_6 emissions from all indoor switchgear remain less than 0.3 per cent of their total nameplate quantity per year.

Asset strategy

- Needs are prioritised based on criticality ranking, and analysis of the potential for severe failure modes and site-specific consequences.
- All indoor switchboards with oil circuit breakers to be replaced by mid RCP4.

Investment need is primarily based on risk, replacing MV switchboards that have strategic (such as obsolescence) or safety concerns. We forecast to replace all switchboards that have these identified concerns investigated during RCP4 and replaced early in RCP5.

Beyond RCP4, our replacement forecast is based on a combination of asset health factors, including age, condition, and reliability. This includes assessment of specific factors such as spare parts availability. We are continuously improving our health modelling and forecasting tools to implement a more robust approach to asset investment for older switchgear that has no current safety or strategic concerns to extend life. We hope to enhance the asset health model for fixed pattern switchgear with a digital connect condition-based monitoring platform.

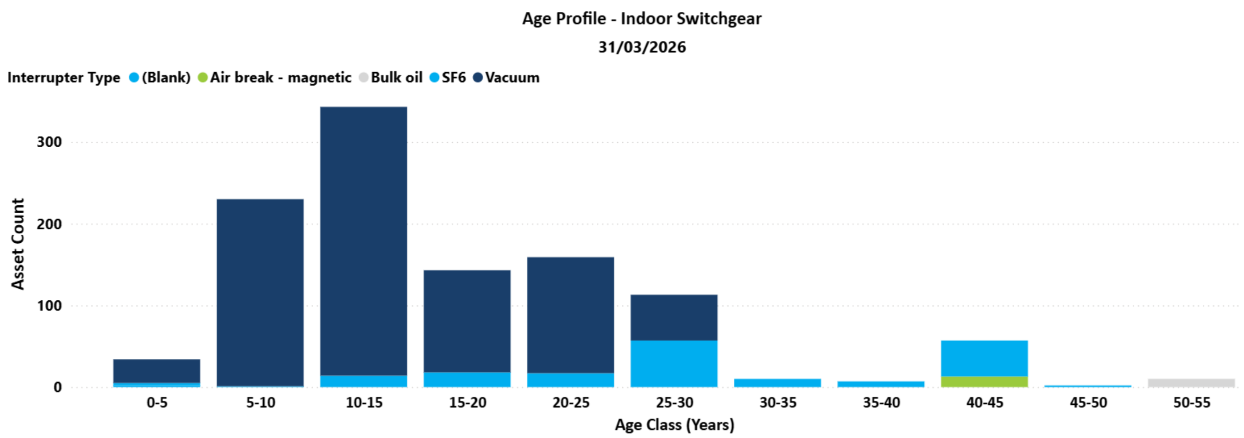
The life expectancy for each type of MV indoor circuit breakers is generally 35–50 years. The options considered for MV indoor switchgear are retrofitting arc fault containment (where technically feasible), retrofitting arc flash protection, retrofitting with new circuit breakers (if the existing equipment will support this), and full replacement. We undertake a feasibility and risk assessment to determine the most cost-effective approach. If the assessment shows safety improvements cannot be retrofitted, full replacement is often required.

Our approach for HV GIS switchgear is to obtain the maximum possible life from the existing installations, by identifying and managing operational defects. No current life-expectancy criteria have been set. Well-performing HV GIS switchgear is expected to have a life of more than 75 years with regular maintenance and repair. This depends on the ability to source critical spares and manufacturer's support. Options for HV indoor switchgear are refurbishment or component replacement. We use economic analysis and advice from the original manufacturer to determine the most effective approach.

The number of MV indoor switchgear installations has increased as our Outdoor-to-Indoor programme converts our outdoor 33 kV switchyards to indoor switchgear. An emerging trend of customer work has also increased the number of switchgear panels installed and, in some cases, complete switchboards.

Our indoor switchgear population and age profile is shown in **Figure 41**.

Figure 41: Indoor switchgear age profile



Lifecycle – deliver, operate, maintain, decommission, and disposal

Delivery times for new indoor switchgear is 24–36 months from business case approval to completion, depending on project scheduling and procurement lead times. Design and procurement to be completed within the first 12 months, with the following years allocated for construction.

When outages are required to provide a safe environment for employees and service providers to install new or maintain existing switchboards, we coordinate with the affected customer to minimise disruptions to customers and end users.

We undertake regular condition assessments and planned maintenance in accordance with our standard maintenance procedures. The specific tests and inspections for indoor switchgear are outlined in **Table 13**.

We now have online monitoring capability of SF6 gas bays on the HV GIS.

Table 13: Indoor Switchgear condition monitoring and inspections

Activities	Frequency
Diagnostic inspection and service (frequency based on type)	5- or 10-yearly
External inspection - certificate of inspection for hydraulic accumulators and air receivers	Annually
SF_6 gas moisture test	8 yearly

Our maintenance activities on our indoor switchgear include:

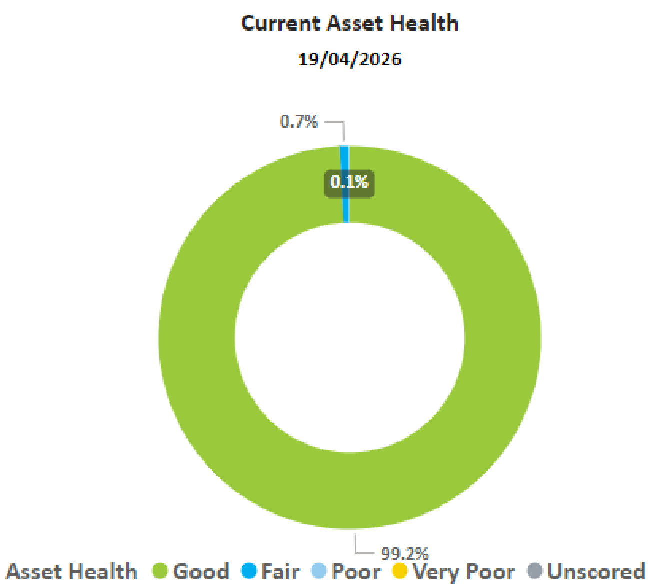
- Replacing components when they have worn out or show signs of deterioration.
- Cleaning the indoor switchgear and room.
- Sealing vermin entry points and rodent control.

We evaluate whether decommissioned equipment can be repurposed as spares to support legacy assets that continue to be operational. Our decommissioning process includes safe worksite management and responsible scrap disposal. In decommissioning SF_6 circuit breakers, we recover SF_6 to avoid emissions into the atmosphere. Disposal of porcelain and oil from bulk oil circuit breakers are managed to comply with hazardous waste regulations.

Asset risk – health and performance

Figure 42 shows the current asset health of our indoor switchgear. Most assets are less than 15 years old, and we are still refining our approach to model degradation of these assets. We will continue to develop our model for indoor switchboard health to ensure appropriate interventions as the fleet ages.

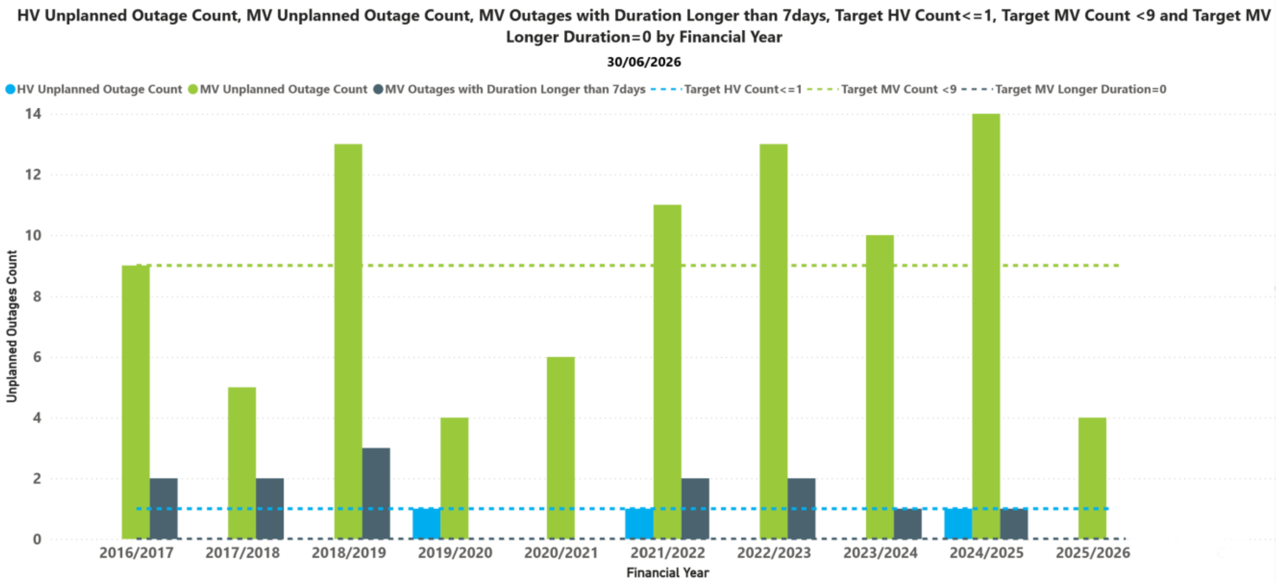
Figure 42: Indoor switchgear current asset health



The predominant causes for indoor switchgear failure are insulation deterioration, material degradation, mechanical failure, SF_6 leakage, mechanical stress, poor installation practice, inadequate cable support systems leading to early failure of bushings, pests, and vermin also contribute to failure. The preventive controls critical to reducing the likelihood of failure are our inspections and maintenance programmes, including condition-based maintenance, and procurement specifications suitable for Aotearoa New Zealand conditions and quality assurance practices during commissioning. We are improving indoor switchgear asset management by mitigating MV breaker mechanical failures through regular exercising, advancing condition-based monitoring, implementing HV GIS SF_6 trend monitoring and OEM inspections.

Indoor switchgear performance is shown in Figure 43.

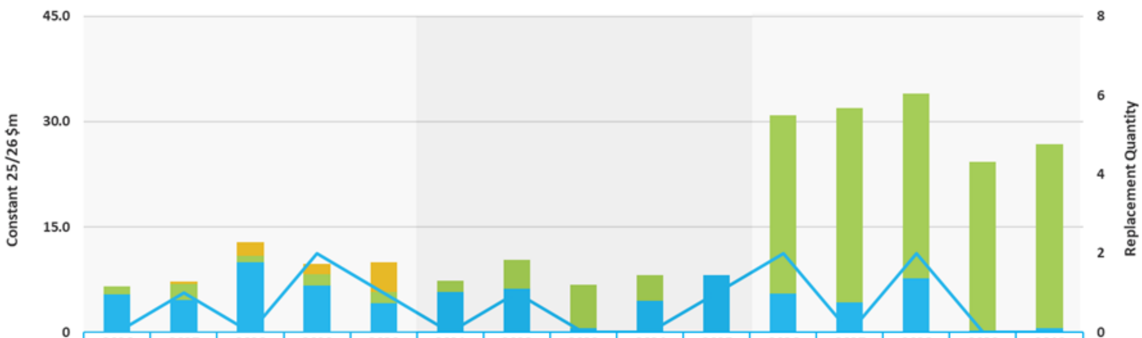
Figure 43: Indoor switchgear performance



Forecast work and capex

Indoor switchgear capex is shown in **Figure 44**.

Figure 44: Indoor switchgear forecast capex and quantities by year



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Resilience	0.0	0.3	1.9	1.5	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gas Insulated Switch gear	1.2	2.3	1.0	1.5	1.6	1.6	4.1	6.1	3.7	0.0	25.4	27.6	26.4	24.1	26.2
Switch boards	5.4	4.6	9.9	6.7	4.2	5.8	6.2	0.6	4.5	8.1	5.5	4.3	7.7	0.2	0.6
Switch boards qty	0	1	0	2	1	0	1	0	0	1	2	0	2	0	0

Opex: The forecast includes the condition monitoring inspections and maintenance activities outlined in the lifecycle section of this ACP. In addition to this, at-risk HV switchgear will have intrusive inspections and planned SF_6 seal replacements.

Capex: The RCP4 forecast focuses on managing risk with the replacement of the MV switchboards. By mid RCP4 the last of the bulk oil indoor switchboards will be replaced. Beyond RCP4, the forecast is based on asset health factors including age and condition. The forecast consists of refurbishments and replacements.

HV GIS strategies for RCP4, RCP5, and RCP6 include OEM non-intrusive inspections with PD & UHF testing, asset strategy investigations for life-extension projects and contingency plans to help ensure these assets meet or exceed their life expectancy without undue failure risk. These projects will be scoped following OEM non-intrusive inspections and asset investigation phases. The major expenditure for GIS replacement in RCP4 for Rangipo site renewal works is now cancelled, we have found that the SF6 seal repairs have been successful and now target the RPO GIS for full life expectancy.

There will be contingency projects built in for the HVGIS in all RCP periods to RCP 7, along with End-of-Life investigation review ~15 years out from the expected replacement. The increase in RCP6 HVGIS capex is provision for age-based replacements. RCP4 OEM non- intrusive inspections and asset strategy investigations will determine the timing and need of these.

RCP4 resilience funding includes portable substation capability to support duty and emergency standby requirements. At present, the approved scope provides for a single portable switchroom to enable rapid response and maintain service continuity during contingency events.

There has been significant decrease in expenditure for MV switchgear replacements in RCP4, RCP5 and 6 as we mature with a reviewed asset health model giving better data based decision making extending asset life, with plans for digital connect IoT platforms to be trialed and rolled out we expect to see further asset lifecycle extension with RealTime condition-based monitoring.

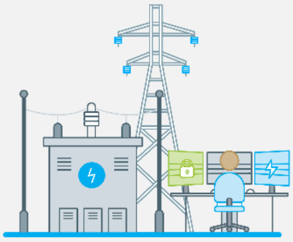
Outdoor circuit breakers

Circuit breakers are used to rapidly disconnect electrical equipment from the grid. Correct operation is vital for limiting safety risk and ensuring reliability of supply. In addition, circuit breakers are used to control the flow of power around the network. This asset class plan includes all outdoor type bulk oil, minimum oil, SF_6, CO_2 and vacuum circuit breakers. It specifically excludes any outdoor circuit breakers associated with the HVDC system, synchronous condensers, and dynamic reactive power installations[18].

Asset class snapshot

Population

53 Bulk oil
21 CO_2
1 Minimum oil
1195 SF_6
30 Vacuum



Capex

RCP4 (forecast)

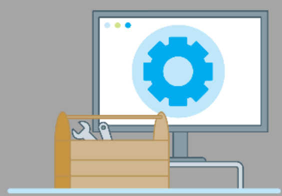
$45.6M

Asset health

- 94.7% Good
- 4.7% Fair
- 0.4% Poor

Work programme

	RCP4
Outdoor circuit breakers	94



Asset class strategy

Objective

- Avoidance of explosive failures
- Retain the technical expertise to maintain, repair and replace of fleet
- Meet the 2050 net zero emission targets
- Outage avoidance. Failure to trip or mal operation can cause an outage affecting many customers

Measure

- Zero workplace fatalities or permanent disablement caused by the operation, install and maintenance of outdoor circuit breakers
- Unplanned outage rate fewer than 1.5 events per 100 circuit breakers in service per year.
- 10-year rolling average rate of explosive failures remains fewer than one (no more than approximately one such failure every 2 years).
- Achieve the net zero emissions target by 2050.

Asset Strategy

Replace remaining bulk oil circuit breakers by 2030. Replace other circuit breaker types based on condition and asset health modelling. We will use forensic examination of dismantled circuit breakers to provide detailed feedback on asset condition to support decision making about ageing populations.

Outdoor circuit breakers are generally replaced based on asset health. Life expectancy is between 25 and 55 years, dependent on factors such as corrosion zone, duty, and performance. Some breakers are approaching, or are already exceeding, their normal

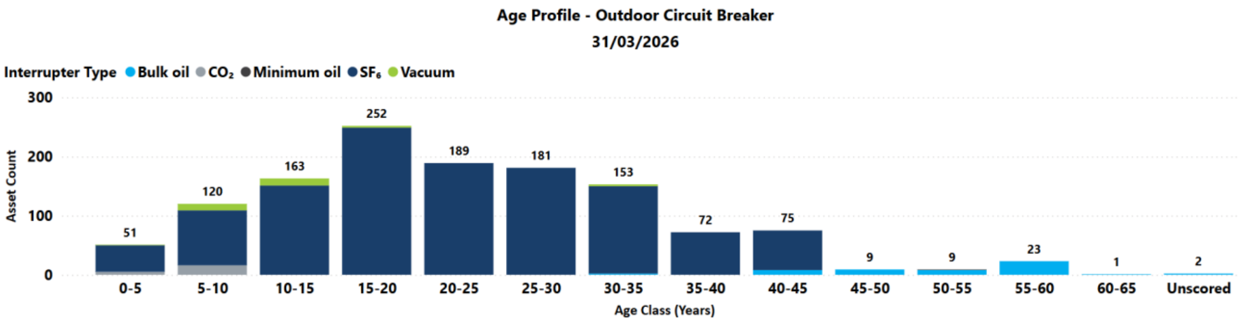
[18] These circuit breakers are managed within the HVDC and Reactive Assets portfolios

expected life. As we plan replacement on observed condition and not solely on age, this does not automatically trigger replacement.

Approximately 80% of our outdoor circuit breakers use SF_6 interrupters. To achieve our carbon emission reduction targets, as outlined in our Sustainability Strategy, we will extend the lives of SF_6 breakers where possible through activities like pole refurbishment and component replacement. This will enable replacement by SF_6-free alternatives when these technologies become available

Figure 45 shows our outdoor circuit breaker population and age profile.

Figure 45: Outdoor circuit breaker age profile



Lifecycle – deliver, operate, maintain, decommission, and disposal

The typical delivery timeframe for new outdoor circuit breakers is 24 months from business case approval to completion. Design and procurement are completed within the first 12 months, with the final year allocated for construction. Where procurement lead times (currently up to 32 months) extend beyond this window, early procurement of equipment is undertaken to meet the 24 month duration.

We plan outages to provide a safe environment for employees and service providers to undertake the work while minimising disruptions to customers and end-users. Older circuit breaker designs often fail today's safer working practice distances to energised equipment. Therefore, additional plant may be required to be removed from service to complete these works.

We undertake regular condition assessments and planned maintenance in accordance with our standard maintenance procedures. The specific tests and inspections for outdoor circuit breaker are outlined in Table 14.

Table 14: Outdoor circuit breaker condition monitoring and inspections

Activities	Frequency
External inspection – certificate of inspection for hydraulic accumulators and air receivers	1-yearly
Time travel and contact resistance tests (high-operation circuit breakers only), unitised compressed air system diagnostic inspection and service	2-yearly
Laboratory gas analysis – SF_6 circuit breakers (high operation circuit breakers only) and GIS maintenance	4-yearly
SF_6 gas moisture test – SF_6 circuit breakers (selected circuit breakers only)	8-yearly
Diagnostic inspection and service (frequency based on type), internal inspection – certificate of inspection for air receivers	4, 5, or 10-yearly

Maintenance activities on our outdoor circuit breakers include oil filtering or replacement in bulk oil circuit breakers, SF_6 top ups or gas replacement, corrosion control, cleaning of dropper/jumper contacts after thermography, replacement of fasteners, replacement of corroded pipework, pole refurbishments and seal replacements and modifying a part of the circuit breaker, e.g. replacement of the SF_6 filling point.

Our decommissioning process includes safe worksite management and responsible scrap disposal. In decommissioning SF_6 circuit breakers, we recover SF_6 to avoid emissions into the atmosphere. Porcelain and oil from bulk oil outdoor circuit breakers are disposed of in compliance with hazardous waste requirements.

Asset risk – health and performance

Figure 46 shows the current asset health of our outdoor circuit breakers and the impact of our planned RCP4 investment without and with investment. We are strategically maintaining ageing 110kV and 220 kV circuit breakers while we await non SF_6 replacement technology, so a small decline in asset health is to be expected.

Figure 46: Outdoor circuit breaker asset health

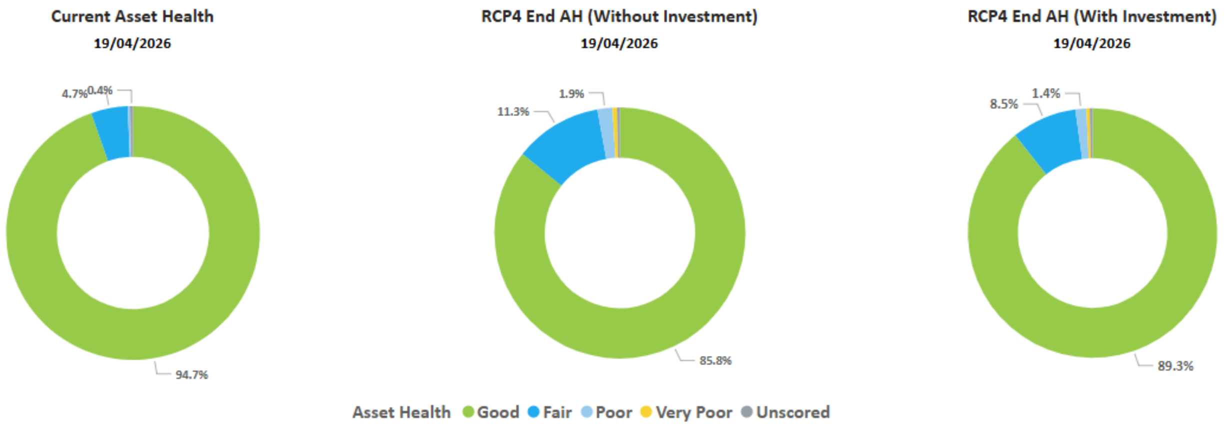
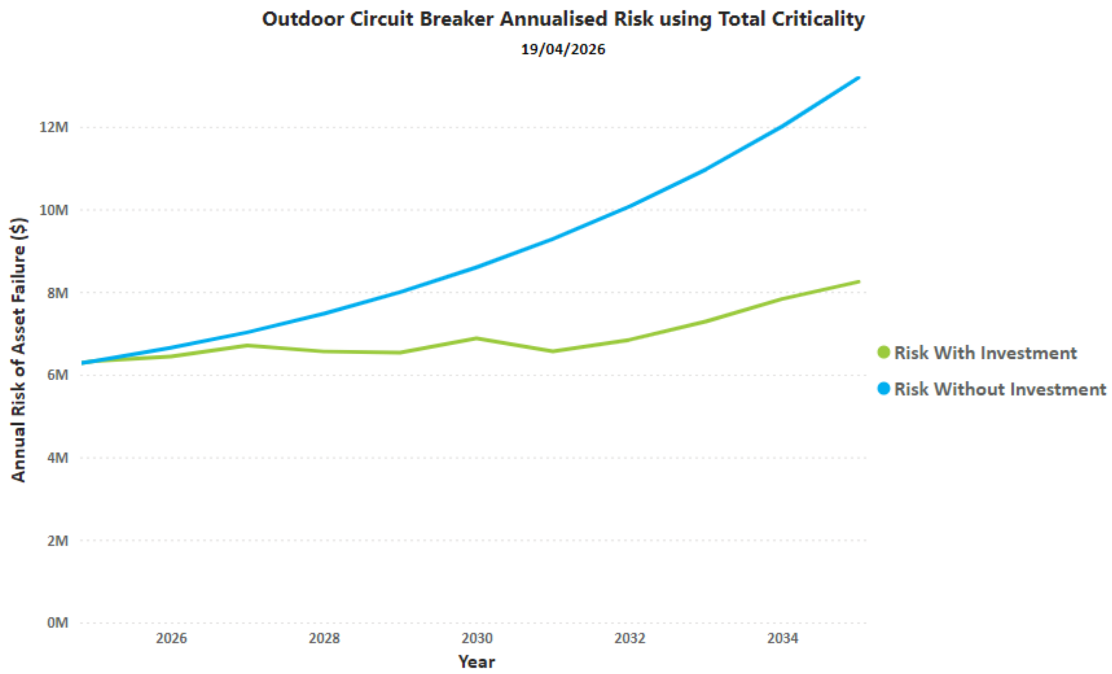


Figure 47 shows the annualised risk of our outdoor circuit breaker with and without investment. This shows we are keeping the risk in check.

Figure 47: Outdoor circuit breaker annualised risk

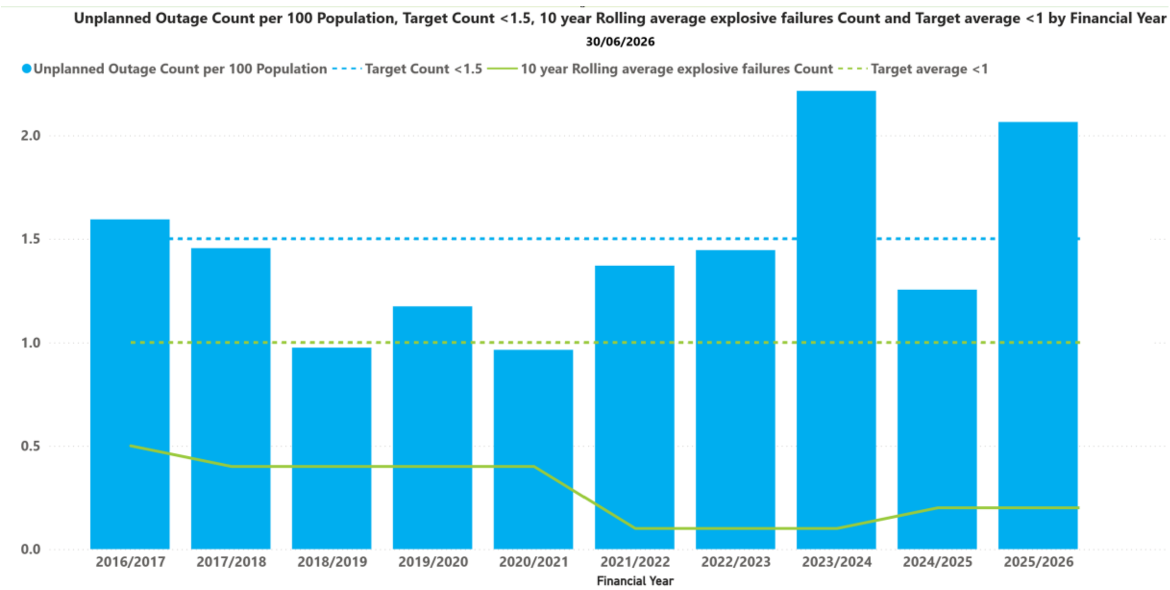


The predominant causes for outdoor circuit breaker failure are insulation deterioration, corrosion or material degradation, pests and vermin, and mechanical failure. The preventive controls critical to reducing the likelihood of failure are our inspections and maintenance programmes, including condition-based maintenance, and procurement specifications suitable for Aotearoa New Zealand conditions.

Figure 48 shows the unplanned outages and explosive failures 10-year rolling average. There has been a jump in gas leaks and incomplete operation in the past 12 months. The gas leaks are an ongoing concern and reflective of an aging fleet. We are proactively undertaking pole refurbishment plus seal replacements on poor performing models and currently introducing a targeted approach to live SF6 gas pressure monitoring. The monitoring will ensure timely coordination of pole refurbishments and limit future SF6 leaks. We are tracking within our strategy target for explosive failures.

SF_6 leaks in 2023/24 were the main contributing factor for the spike in unplanned outages.

Figure 48: Outdoor circuit breaker performance



Forecast work and capex

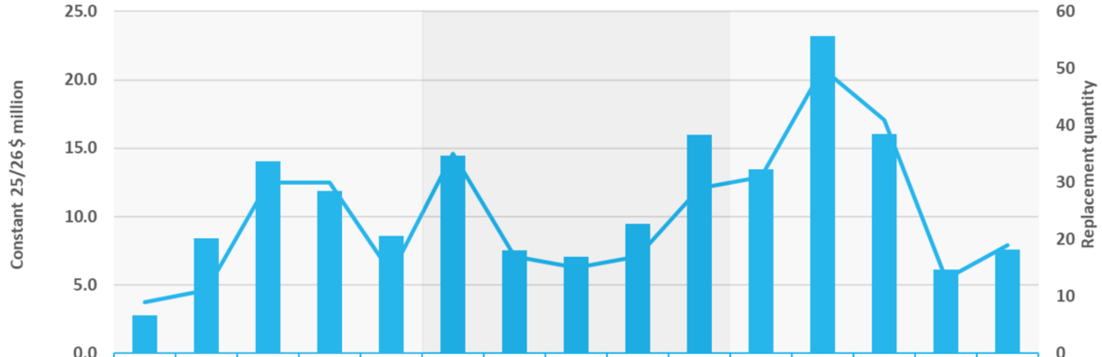
Opex: The forecast opex for outdoor circuit breakers covers the condition-monitoring inspections and maintenance activities outlined in the lifecycle section of this AMP. To meet our long-term goal to achieve our net zero emissions target by 2050, we are proactively undertaking SF_6 circuit breaker pole replacements on known poor performers as part of a mid-life refurbishment programme. This will allow a life-extension opportunity while we await SF_6-free alternatives that are not yet available at all voltage levels.

Capex: Figure 49 shows the expenditure and deliverables forecast. The implementation of our asset health model and the shift in typical life expectancy from 35 to 45 years for most circuit breakers has continued to reduce the investment need in early RCP4. In

Figure 49 we start to see increased asset replacements occurring through RCP4, with the replacement of the remaining bulk oil circuit breakers; however this is dependend on alternative technologies to support the implementation of our SF_6 strategy. The increase in outdoor circuit breaker replacements from late RCP5 into RCP6 is due to a large group of circuit breakers reaching their replacement trigger. This is amplified by SF6 life-extension work deferring some RCP4/RCP5 replacements into RCP6.

As noted in our opex, we will be undertaking proactive circuit breaker pole replacements in lieu of asset replacements and introducing targeted SF_6 gas pressure monitoring, while we are waiting for alternative non-SF_6 circuit breakers to come to the market for our 110 kV and 220 kV network. This has reduced circuit breaker replacements in RCP4 and RCP5.

Figure 49: Outdoor circuit breaker forecast capex and quantities



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Outdoor Circuit breakers	2.8	8.4	14.0	11.9	8.6	14.4	7.5	7.1	9.4	16.0	13.4	23.2	16.0	6.1	7.6
Outdoor circuit breakers Qty	9	11	30	30	14	35	17	15	17	29	31	50	41	13	19

The increase in outdoor circuit breaker replacements from late RCP5 into RCP6 is due to a large group of circuit breakers reaching their replacement trigger. This is amplified by SF6 life-extension work deferring some RCP4/RCP5 replacements into RCP6..

Outdoor instrument transformers

Instrument transformers are essential to the protection and monitoring of the grid. Their purpose is to convert high voltages and currents to lower levels that can be safely measured by power system protection and instrumentation equipment.

Asset class snapshot

Population*

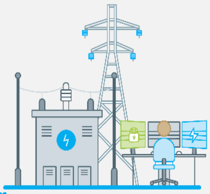
811 Voltage transformer

293 Neutral current transformer

3,474 Current transformer

994 Capacitor voltage transformer

Made up of a count of each individual single-phase set



Capex

RCP4 (Forecast)

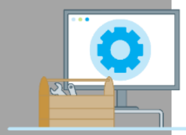
$52.4.0M

Asset health

- 90.9% Good
- 7.4% Fair
- 1.2% Poor

Work programme*

Transformers:	RCP4
Current	156
Voltage	29
Capacitor voltage	9
Neutral current	7



*Is at the device position level and typically a three phase set of assets.

Asset class strategy

Objective

Safe and reliable operation, at least whole-of-life cost.

Measure

- 10-year rolling average rate of all unplanned outages to be fewer than five events per year
- 10-year rolling average rate of explosive failures to be fewer than one per 10,000 instrument transformer-years (approximately one such failure every 2 years).

Asset strategy

Replace based on health, subject to a nominal life expectancy of 45 years with a tolerance of 5 years either side to enable efficient project bundling or to allow for prioritisation of replacement based on asset criticality.

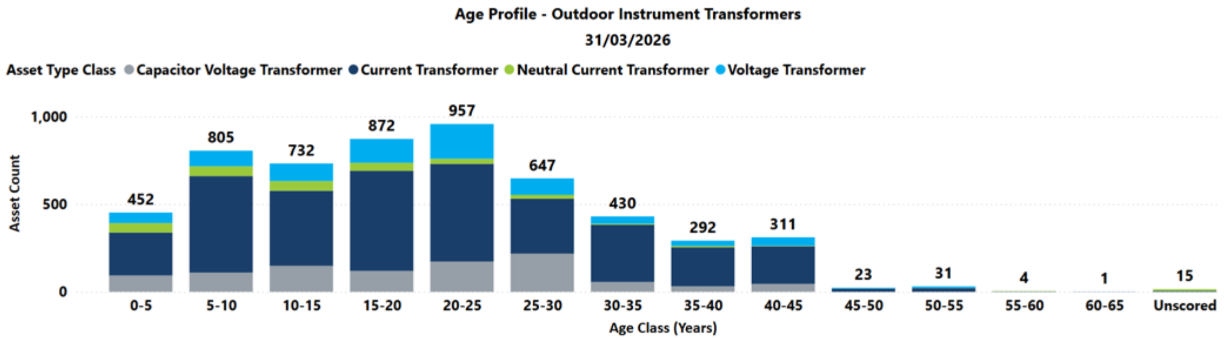
Investment need is primarily based on asset health. We generally expect instrument transformers to have a life of 35–55 years, depending on factors such as manufacturer, model, normal expected life, age, location, reliability, measured condition, and observed condition. We undertake forensic investigations to determine whether life extension can be achieved for models with substantial populations.

Replacement is usually the only option for outdoor instrument transformers as repairs are not viable. Outdoor instrument transformers are typically hermetically sealed units and cannot be inspected internally. Internal repairs are not cost effective due to the low capital cost of replacement. Some external repairs can be cost-effective, and these are considered, where appropriate.

Our specification for seismic resilience is high. We manage this requirement through our procurement specification that requires a high-performance standard which is supported with evidence of compliance from the supplier.

Figure 50 shows the population and age profile of our outdoor instrument transformers.

Figure 50: Outdoor instrument transformer age profile



Lifecycle – deliver, operate, maintain, decommission, and disposal

Delivery times for new instrument transformers is 18 months. This is due to increasing electrification internationally, global demand for primary equipment has increased significantly. We now undertake prepurchase of instrument transformers before business case approval to ensure construction is delivered on time. Business case approval remains 24 months to completion. This enables the design to be completed within the first 12 months, with the final year allocated for construction. We are qualifying new suppliers where the lead time is less than 12 months.

We plan outages to provide a safe environment for employees and service providers to undertake the work. Where possible, this is aligned with other work to minimise disruptions to customers and end-users.

We undertake regular CAs and planned maintenance in accordance with our standard maintenance procedures. The specific tests and inspections for outdoor instrument transformers are outlined in Table 15.

Table 15: Outdoor instrument transformer condition monitoring and inspections

Activities	Frequency
New instrument transformer warranty inspection	4-years (one off)
Diagnostic inspection and service –porcelain insulated voltage transformers	5-yearly
Calibration testing of instrument transformers that are primary inputs to revenue metering installations	8-yearly
Diagnostic inspection and service –all current transformers and non-porcelain insulated voltage transformers	10-yearly

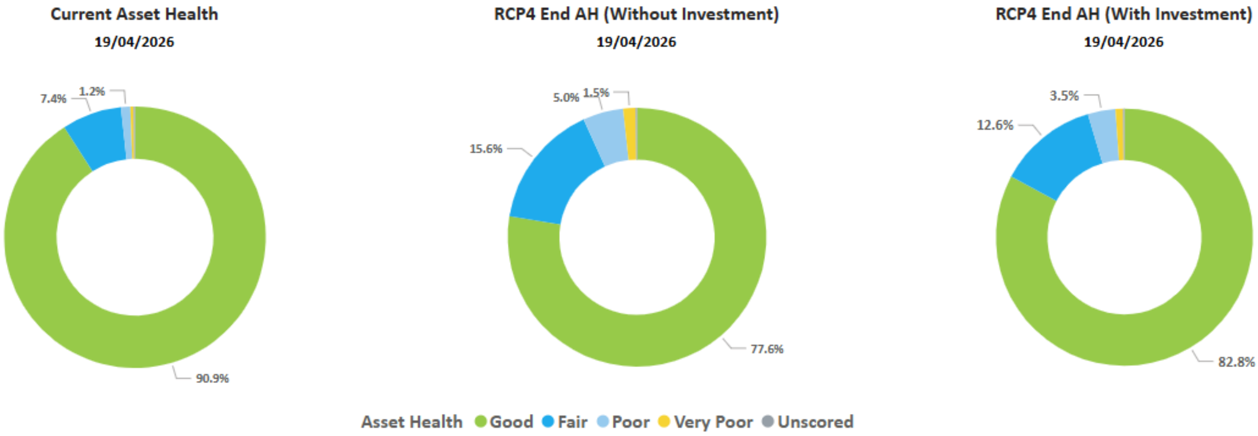
Our maintenance activities on our outdoor instrument transformers include checking oil level gauges and inspecting for oil leaks, inspecting bellows for damage or leaks, inspecting insulators for damage, performing insulation resistance tests for both primary and secondary windings, performing capacitance tests (applicable for capacitive voltage transformers only), performing power factor tests and undertaking corrosion control.

We follow a decommissioning process as per our standard that includes safe work site management and responsible scrap disposal. Disposal of porcelain and oil from outdoor instrument transformers is subject to hazardous waste management requirements. To limit our carbon footprint, where practicable, we re-use existing instrument transformer foundations.

Asset risk – health and performance

Figure 51 shows the current health of our instrument transformers and the forecast impact of our planned investment. The very poor assets with investment at the end of RCP4 represent 0.95% of the fleet. The assets are reviewed to understand the cause, and plan actions appropriately to replace the asset or address the cause of data inaccuracies leading to higher asset health scores.

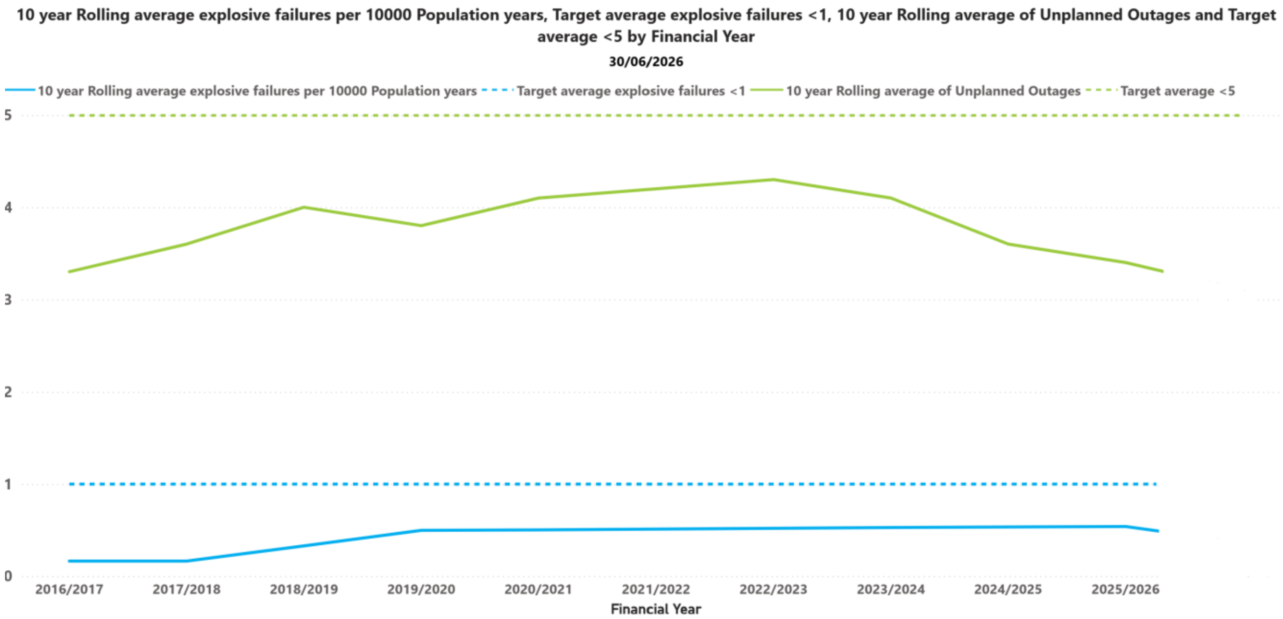
Figure 51: Outdoor instrument transformer asset health



The predominant causes for outdoor instrument transformer failure are insulation failure, material degradation or corrosion, mechanical failure, and wildlife encroachment. The three key preventive controls critical to reducing the likelihood of a failure are undertaking inspections and maintenance, procurement specifications and AMS and condition monitoring.

Figure 52 shows the 10-year rolling average of explosive failures per 10,000 population-years. It also shows the trend of unplanned outdoor instrument transformer outages over the last 10 years. Our performance is good, as we tracking within our targeted range.

Figure 52: Outdoor instrument transformer performance



Over an 18-month period from 2018, we had five failures of outdoor instrument transformers of the same model and manufacturer. Our risk assessment of those failures resulted in a decision to withdraw all remaining units from service across our network. We have identified an issue with another model of instrument transformer from a different manufacturer. A nationwide inspection programme confirmed serious deterioration resulting in a reduction in life expectancy for this model. The earlier than expected retirement of this model is included in the forecast quantities and expenditure predominantly in the early stages of RCP4.

Forecast work and capex

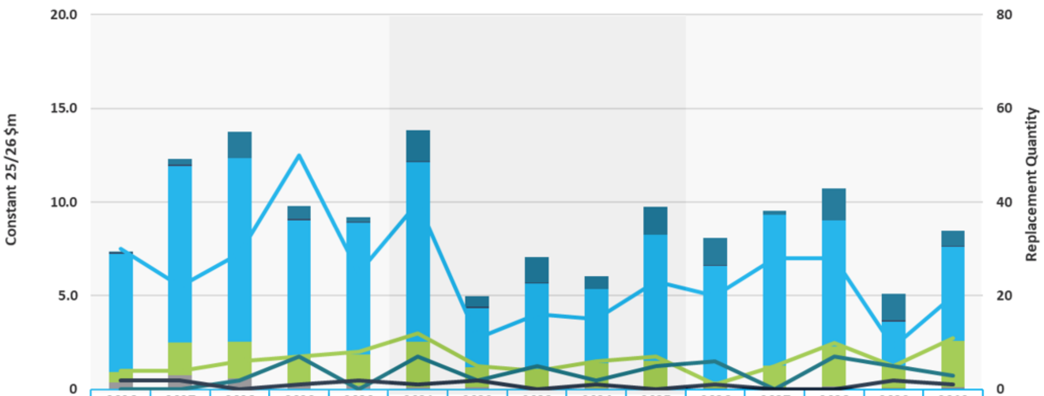
Opex: The forecast opex for outdoor instrument transformers covers the condition monitoring inspections and maintenance activities outlined in the lifecycle section of this AMP.

Capex: Our forecast through to the end of RCP6 is shown in **Figure 53**.

The forecast focuses on our strategic approach of replacement based on health subject to nominal life expectancy of 45 years and knowledge gained from forensic investigations on decommissioned assets.

The early retirement of assets with known issues will commence at the start of RCP4, which is highlighted by the high peak in the expenditure and deliverables quantities in years 2027 and 2028.

Figure 53: Outdoor instrument transformer forecast capex and quantities



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Capacitor Voltage Transformers	0.0	0.3	1.4	0.7	0.3	1.7	0.6	1.4	0.7	1.5	1.4	0.2	1.7	1.4	0.8
Neutral Current Transformers	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Current Transformers	6.3	9.4	9.8	7.2	7.0	9.6	3.2	4.6	3.9	6.7	6.2	8.0	6.7	2.3	5.0
Voltage Transformers	0.5	1.7	1.9	1.5	1.7	2.4	1.1	1.0	1.3	1.4	0.3	1.2	2.1	1.2	2.5
Other (asbestos, forensics, DGA testing, etc)	0.4	0.8	0.6	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1
Current Transformers Qty	30	22	29	50	25	40	11	16	15	23	20	28	28	9	20
Voltage Transformers Qty	4	4	6	7	8	12	5	4	6	7	1	5	10	5	11
Capacitor Voltage Transformers Qty	0	0	2	7	0	7	2	5	2	5	6	0	7	5	3
Neutral Current Transformers Qty	2	2	0	1	2	1	2	0	1	0	1	0	0	2	1

Power cables

Power cables transmit electricity from one point to another and are generally installed underground. HV cables provide transmission services in urban areas where the use of overhead lines is not practicable for a range of reasons. Our AC HV power cables have operating voltages from 66 kV to 220 kV. Since 2010, we have installed 76 km of HV cable circuits both buried underground and in tunnels. MV cables are generally used in short lengths (< 500 metres), inside substations, mainly to connect power transformers and indoor switchgear. MV cables have operating voltages between 11 kV and 33 kV. LV cables that operate at voltages lower than 11 kV are not included in this asset class.

The asset management of our HVDC cables are detailed in the HVDC asset class plan.

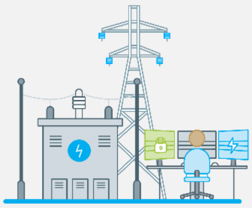
Asset class snapshot

Population

44 HV cable circuits <1km

13 HV cable circuits >1km

909 MV cable circuits <1km



Capex

RCP4 (forecast)

$63.6m

Asset health

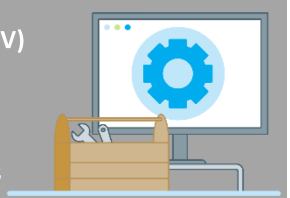
- 97.5% Good
- 2.5% Unscored

Work programme (RCP4)

3,695 meters (HV and MV)

48 Cable joints

108 HV Cable terminations



Asset class strategy

Objective

Safe and reliable operation, at least lifecycle cost.

Measure

Fewer than two unplanned outages per annum caused by defects or failures of HV power cables 66 kV and above power cables or supporting infrastructure.

Fewer than three unplanned outages per year for MV power cables below 66 kV.

Asset strategy

Asset replacement decisions are driven by risk assessment, with particular consideration given to the consequences of failure. This includes potential impacts on worker and public safety, load at risk, the availability of specialist skills and replacement parts, expected fault repair durations, and the potential for common-mode failures.

The primary investment driver is asset health and risk. Risk assessments incorporate cable and accessory performance, as well as international power cable failure data. Where intervention is required, options include refurbishment or replacement, with replacement being the more common solution. The preferred option is selected based on reliability outcomes and whole-of-life cost considerations.

Refurbishment opportunities for modern power cables are generally limited, as it is typically impractical to restore degraded cable insulation. As a preventative measure, the integrity of cable sheaths is closely monitored to avoid insulation damage. Where sheath degradation is identified but has not yet affected insulation condition, targeted repairs can be undertaken to prevent more costly cable section replacements. This is particularly important for HV cable circuits, where full cable replacement is significantly more expensive and time-consuming than sheath repair.

Replacement programmes are prioritised based on the likelihood and consequence of failure, incorporating factors such as load served and the physical impact of a failure event.

Since 2018, there has been one HV termination failure and two HV joint failures. In addition, several preventive repairs and replacements have been completed to mitigate imminent failure risks. Forensic investigations have been carried out, and replacements are underway for all joints assessed as having a high risk of failure.

Operational controls have been strengthened, including the introduction of a requirement for Asset Owner approval prior to switching HV cable circuits. This practice was previously permitted in certain circumstances to assist with voltage control; however, the restriction has been implemented to minimise operational stresses on these cables.

High-risk HV fluid-filled cable terminations are being retrofitted with modern click-fit designs to eliminate known failure mechanisms. In parallel, we are ensuring that cable jointers are appropriately trained and qualified, and that installation methodologies align with current industry best practice.

Lifecycle – deliver, operate, maintain, decommission, and disposal

Delivery times for power cables and associated accessories vary significantly by voltage level. Medium-voltage (MV) cable joints and terminations are generally readily available from local suppliers, enabling relatively short lead times for repairs and replacements. In contrast, high-voltage (HV) cable projects typically require a minimum delivery timeframe of approximately two years, with large or complex projects taking considerably longer. This extended timeframe reflects the need for detailed design, easement acquisition, planning approvals and consenting, procurement, installation, and commissioning.

We undertake regular patrols, inspections, condition assessments (CAs), and maintenance activities in accordance with our standard maintenance procedures. Specific inspection and condition assessment requirements for power cables and their accessories are detailed in **Table 16**

In addition to routine maintenance activities, we perform annual testing on a subset of 33 kV plug-in and heat shrink terminations with a known design issue. This targeted testing program is intended to monitor asset condition and deterioration, enabling timely intervention before failure occurs.

Decommissioned power cables are sold as scrap, allowing valuable recyclable metals to be recovered and reused, supporting both cost recovery and sustainability objectives.

Table 16: Power cable condition monitoring and inspections

Activities	Frequency
Power cables HV cable route patrol	Weekly
Cable tunnel, termination, strategic spares and tooling, external manhole and link box inspections, Power cables HV inspection – significant civil features	1-yearly
Power cables HV partial discharge and cable sheath insulation tests, Oil filled cable oil condition tests	2-yearly
Power cables HV integrity assessment – cable environment	4-yearly
Diagnostic inspection and service (MV cables)	5-yearly

We plan and manage outages to ensure a safe environment for the execution of required works, while minimising disruption to customers and end users. Cable-related works typically require significant coordination due to the complexity of outage planning and the potential impact on connected load.

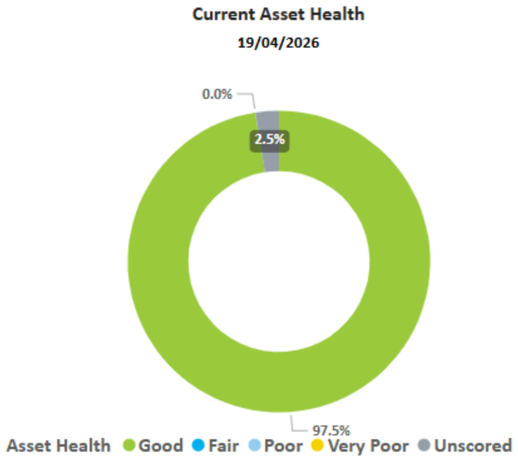
Wherever practicable, we coordinate multiple work activities within the same location to be completed during a single outage window. This approach maximises the efficient use of outages, reduces repeat interruptions for customers, and improves overall delivery efficiency.

Power cables are operated within their calculated current ratings and thermal limits to ensure insulation integrity is maintained and to prevent damage caused by overheating.

Asset risk, health, and performance

Figure 54 shows the health profile of our power cables.

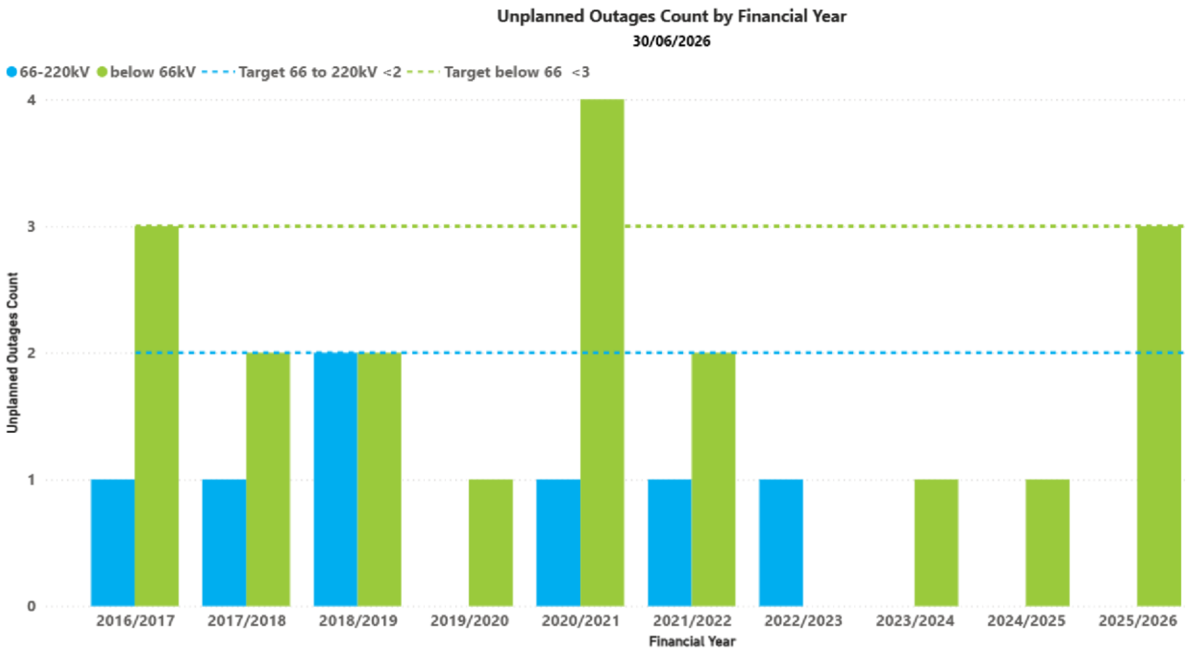
Figure 54: Power cable asset health



The asset health model includes data across both MV and HV cables. It presently excludes items such as the cable joints, terminations and bonding systems that make up the full cable system.

Figure 55 shows the unplanned power cable outages for the past 10 years by category.

Figure 55: Power cable asset performance



The predominant causes of power cable failure are insulation or termination degradation, exposure to external fire, and third-party activities such as uncontrolled excavation near cable routes. To reduce the likelihood of failures arising from these hazards, the following key preventive controls are in place:

- Competency management – ensuring cable jointers and installers are qualified, competent, trained, and use best industry practice methodologies.
- Stakeholder and third-party awareness – including warning and security signage, use of BeforeUdig registration of cables so that third parties intending to excavate are alerted to the presence of our assets and we are made aware of their intentions.
- The most critical and exposed cable assets have fire detection and/or passive or active fire suppression.

Although the majority of our HV XLPE cable assets are relatively new, several type-related and installation defects have been identified in recent years that resulted in unplanned outages. In response, a range of proactive interventions has been implemented, including increased inspection and monitoring, targeted maintenance, refurbishment, and, where necessary, replacement programmes aimed at preventing recurrence.

Some HV and MV cables have experienced termination failures associated with moisture ingress and poor installation quality. To address this, we have introduced inspection and repair programmes and, in higher-risk cases, replacement initiatives. These actions are supported by enhanced competency management and training programmes designed to address root causes, reduce failure risk, and minimise unplanned outages.

Forecast work and capex

Opex:

Forecast operating expenditure for power cables primarily relates to the condition-monitoring inspections and maintenance activities described in the lifecycle section of this ACP. These activities are essential to managing asset health, risk, and overall network reliability.

Following the 2018 failure of a 220 kV oil-filled cable termination, a programme has been implemented to replace all HV fluid-filled cable terminations with modern designs that remove the known failure mechanisms. Sufficient condition and forensic information has already been gathered to support this replacement programme. As a result, previously planned future condition-monitoring inspections for these oil-filled terminations are no longer required. The replacement programme itself is being delivered through capex.

Operating expenditure continues to provide for sheath inspection and repair programmes across both HV and MV cable circuits. Early intervention through sheath repairs is critical to preventing moisture ingress and insulation degradation, which would otherwise escalate into significantly more expensive full cable repairs or replacements.

Opex also includes the replacement of link box covers on selected HV circuits where poor-performing designs have allowed water ingress, increasing the risk of joint and cable deterioration.

There remain six legacy oil-filled, paper-insulated HV cable circuits in service across Bream Bay, Wilton, and Rangipo. The insulating oil condition in these cables is monitored through biennial testing to support ongoing risk management and to inform proactive replacement planning. In parallel, we are progressing the staged replacement of these oil-filled cable circuits, recognising their higher operational and environmental risk profile compared to modern cable technologies.

Capex:

The forecast focuses on managing asset health and risk.

HV joint and termination replacement programmes will continue through RCP4, targeting assets assessed as having the highest risk of failing in service. The HV termination retrofit programme is now being extended to include 220 kV terminations, following the availability of proven dry-type termination technology at this voltage. This programme will continue into RCP6.

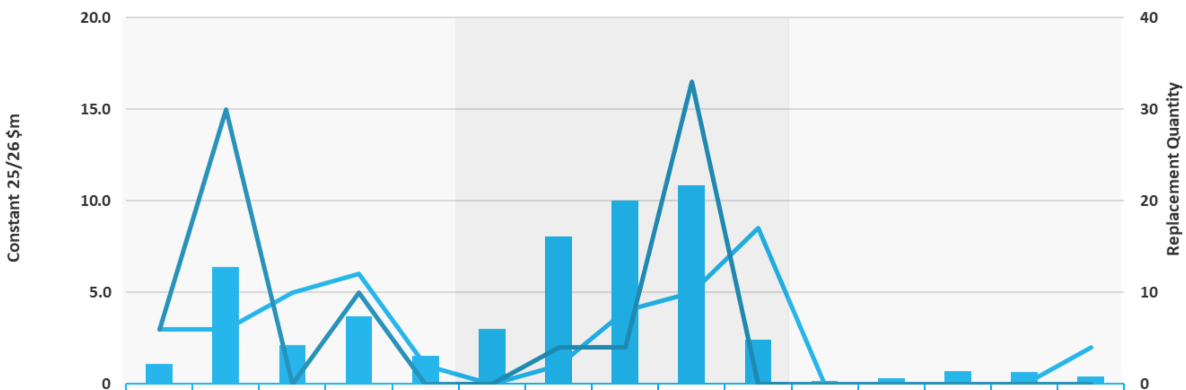
Refurbishment and life-extension projects for oil-filled cable systems have now been completed. These projects have provided improved understanding of the residual life of the six legacy HV oil-filled, paper-insulated cable circuits and their supporting assets. The outcomes indicate that the cable systems have no more than approximately 10–15 years of remaining operational life. Based on this improved asset knowledge, a proactive and coordinated replacement programme has now been established. Replacement timing is informed by asset condition, residual life expectations, and coordinated intervention planning for associated switchgear and transformers, recognising the strong interdependencies between these assets. The 220 kV oil-filled cables at Rangipo are planned for replacement in RCP4 due to deteriorating condition, age, and obsolescence.

Several MV cables and terminations have failed earlier than expected in their asset life. In addition, there is a backlog of MV cable circuits with poor sheath test results that have not yet been remediated. The forecast therefore includes targeted replacement of MV cables to reduce the risk of catastrophic in-service failures. This includes replacement of cables with known type-related issues, particularly legacy paper-insulated lead-covered (PILC) cables and early-generation XLPE cables that are of higher risk of failure. The significant increase in capex in RCP4 and RCP5 reflects the need to address these early-life, design, and installation-related failure mechanisms, which were not anticipated in earlier investment plans.

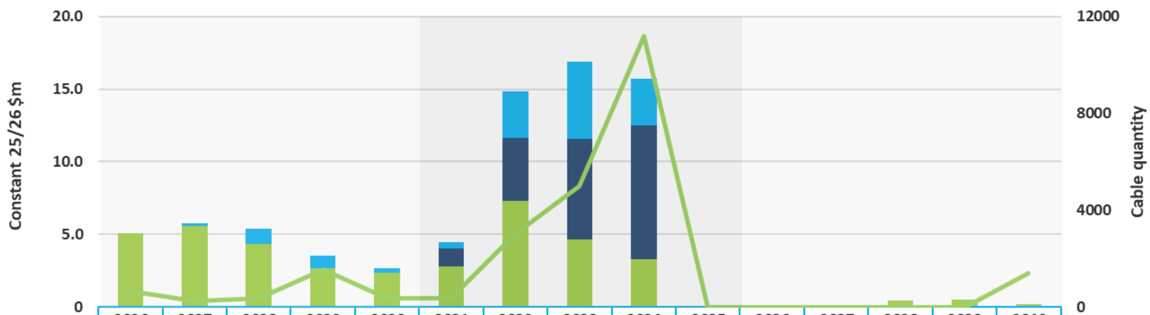
Funding is also included in RCP4 to purchase additional spare cable accessories. This follows a review of cable spares holdings undertaken to identify the most cost-effective assets to hold across the cable fleet, with the objective of reducing repair durations and minimising return-to-service times following faults

Our total volume of planned capex covering MV and HV cables and their accessories for RCP4–RCP6 is shown across the two graphs in **Figure 56**.

Figure 56: Power cable forecast capex and quantities



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Terminations	1.1	6.4	2.1	3.7	1.6	3.0	8.1	10.0	10.8	2.4	0.2	0.3	0.7	0.7	0.4
HV Terminations Qty	6	6	10	12	2	0	2	8	10	17	0	0	0	0	4
MV Terminations Qty	6	30	0	10	0	0	4	4	33	0	0	0	0	0	0



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
MV Cable trenching	0.0	0.2	1.0	0.9	0.4	0.4	3.2	5.3	3.2	0.0	0.0	0.0	0.0	0.0	0.0
HV Cable trenching	0.0	0.0	0.0	0.0	0.0	1.2	4.3	6.9	9.2	0.0	0.0	0.0	0.0	0.0	0.0
Cables	5.1	5.6	4.4	2.7	2.3	2.8	7.3	4.7	3.3	0.0	0.1	0.2	0.5	0.5	0.2
Cables Qty	645	250	360	1550	360	360	3020	4986	11200	0	0	0	0	0	1395

Outdoor disconnectors and earth switches

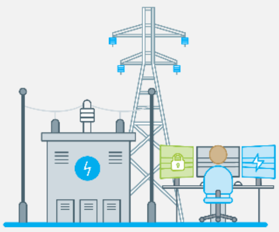
Disconnectors are mechanical switching devices used to provide a point of isolation. They provide isolation zones, which are typically used for maintenance purposes. Earth switches are mechanical devices used to ensure that isolated equipment is safe to work on, by protecting workers from accidental livening of the equipment and induced voltage hazards.

Asset class snapshot

Population

2,679 Disconnectors

999 Earth switches



Capex

RCP4 (forecast)

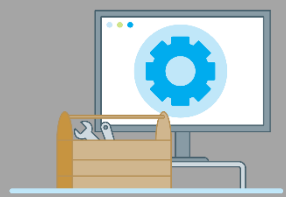
$29.5m

Disconnector asset health

- 65.3% Good
- 16.2% Fair
- 14.0% Poor
- 3.9% Very Poor
- 0.6% Unscored

Work programme

	RCP4
Disconnectors & Earth switches	42
Disconnector headgear	270



Asset class strategy

Objective
Minimise the safety risk to maintenance switchers associated with operating or maintaining our outdoor disconnectors and earth switches.

Measures
Fewer than 10 unplanned outages per year caused by outdoor disconnectors or earth switches at lowest whole-of-life cost.

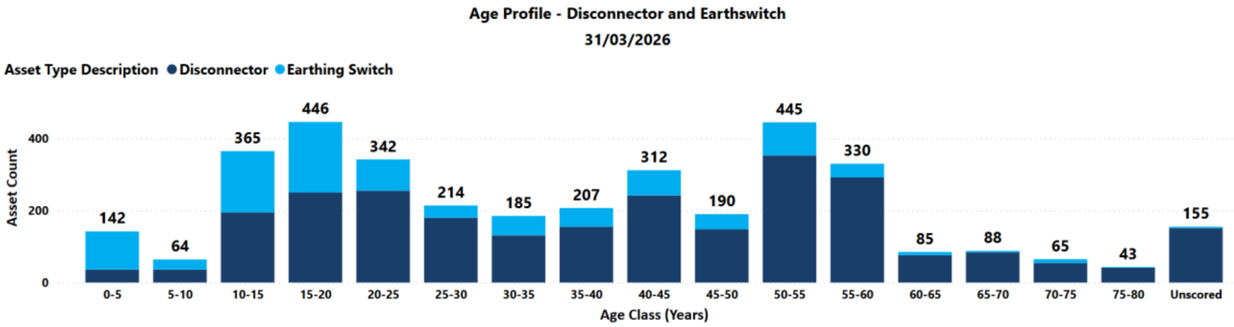
Asset strategy
Extend life using condition-based maintenance activities.

Investment need is based on asset health. Our primary approach is life extension through targeted refurbishment and component replacement. Ongoing maintenance or piece-wise replacement of components generally has a lower lifecycle cost than total replacement of the entire disconnector and earth switch and its support structure. Life expectancy is typically 50–90 years based on make and model. For the small subset of these assets where life extension is not possible, due to equipment quality or because they are part of a small population, we replace the entire unit.

Where technically and economically feasible, we will replace air-break disconnectors and earth switches by utilising disconnecting circuit breakers and earth switches or compact switchgear assemblies. We have begun retrofits where appropriate, to ensure sites are brought up to a standard ready to enable remote switching capability. Remote switching could deliver significant benefits and will reduce our carbon footprint and reduce the duration of planned outages and other operational efficiencies.

The age profile of the disconnectors and earth switches is shown in **Figure 57**.

Figure 57: Outdoor disconnectors and earth switches age profile



Lifecycle – deliver, operate, maintain, decommission, and disposal

Delivery timeframes for new disconnectors and earth switches is typically 24 months from business case approval to completion. This enables the design and procurement to be completed within the first 12 months, with the final year allocated for construction.

We plan outages to provide a safe environment for employees and service providers to undertake the work while minimising disruptions to customers and end-users. These works require significant coordination of outages. We align different types of work in the same location to happen at the same time whenever possible to make the most efficient use of our outage windows.

We undertake regular CAs and planned maintenance in accordance with our standard maintenance procedures. The specific tests and inspections for outdoor disconnectors and earth switches are outlined in **Table 17**.

Table 17: Outdoor disconnectors and earth switches condition monitoring and inspections

Activities	Frequency
An in-service level 1 inspection involving visual and audible noise observations during routine station inspection	2-Monthly
Contact alignment and re-greasing (problematic switches only)	1-yearly
Diagnostic inspection and service	5-yearly

Maintenance activities include checking alignment, inspecting HV contacts and transition plates, inspecting and cleaning the operating mechanism, inspecting insulators for damage, measuring contact resistances, inspection and operating checks, corrosion control, and external condition assessment.

Our decommissioned end-of-life disconnectors are typically scrapped, however where opportunities exist, we will recover critical components that can be reused and/or refurbished. A CA will be undertaken on those components to ensure the suitability to support our spares policy and life-extension strategy.

Asset risk – health and performance

Figure 58 shows the asset health of our disconnectors.

Figure 58: Disconnector current asset health

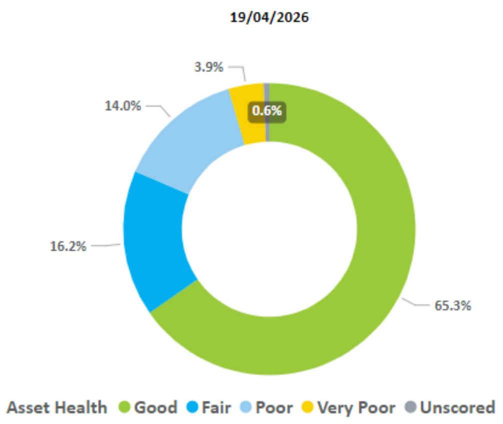


Figure 59 shows the asset health of our earth switches.

Figure 59: Earth switch current asset health

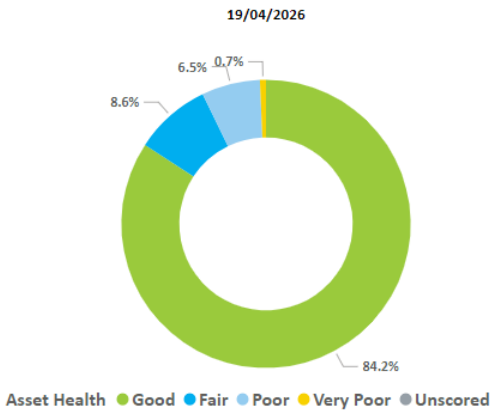
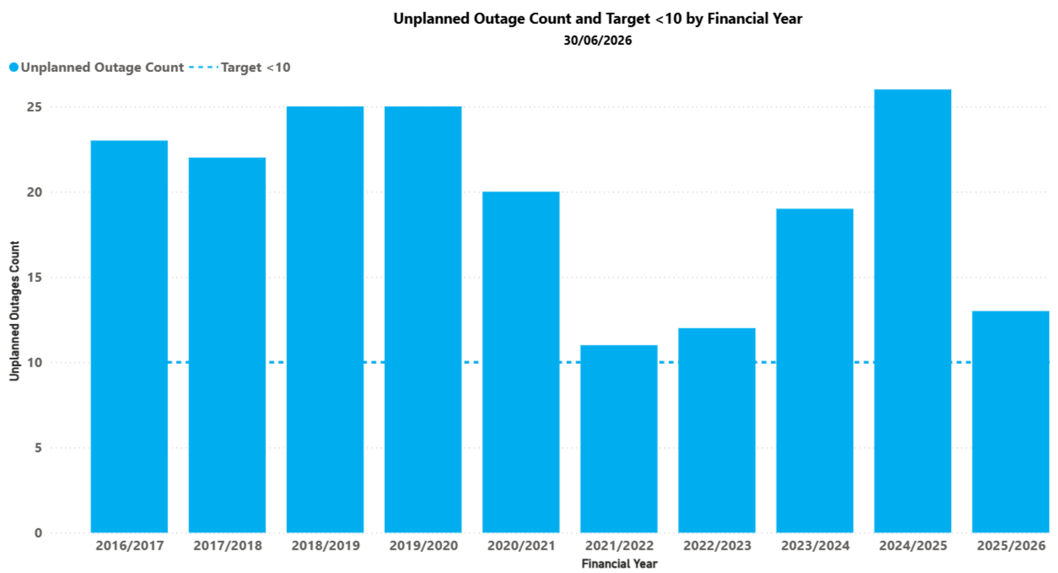


Figure 60 shows the unplanned outage performance for the disconnectors and earth switches by financial year.

Figure 60: Disconnector and earth switch performance



The predominant failure causes for our outdoor disconnectors and earth switches are incorrect alignment set up, driving mechanism failure, equipment failure, environmental factors such as geothermal and costal corrosion and bird nesting.

Birds, bird-nesting material and bird streaming cause repeated disconnectors and earth switch faults. Various trials are currently under way offering different solutions for different species at various problematic sites. An investigation is underway to provide a solution going forward in RCP5 and RCP6.

The key preventive controls that are critical to reducing the likelihood of failure are our inspections and maintenance programme, procurement specifications, and condition monitoring.

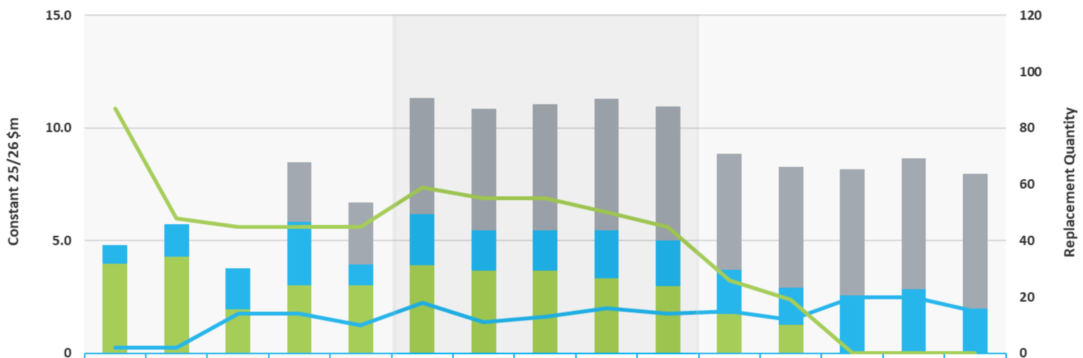
Forecast work and capex

Opex: The forecast opex for disconnectors and earth switches covers the condition-monitoring inspections and maintenance activities outlined in the lifecycle section of this AMP.

We continue to invest in life-extension activities, which covers the development of maintenance documentation, corrective procedures, and training with subject matter expert assistance in the field as part of the headgear restoration workstream. Further review of the maintenance and retrofitting of motorisation and an increased focus with improving competency requirements will continue in RCP4.

Capex: Our expenditure and deliverables forecast through to the end of RCP6 is shown in **Figure 61**.

Figure 61: Forecast capex and quantities



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Remote switching proposed	0.0	0.0	0.0	2.6	2.8	5.2	5.4	5.6	5.8	6.0	5.2	5.4	5.6	5.8	6.0
Disconnectors & Earthswitches	0.8	1.5	1.8	2.8	0.9	2.3	1.8	1.8	2.1	2.0	2.0	1.7	2.6	2.8	2.0
Disconnector headgear	4.0	4.3	2.0	3.0	3.0	3.9	3.7	3.7	3.3	3.0	1.7	1.3	0.0	0.0	0.0
Other DS/ES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Disconnectors & Earthswitches Qty	2	2	14	14	10	18	11	13	16	14	15	12	20	20	15
Disconnector headgear Qty	87	48	45	45	45	59	55	55	50	45	26	19	0	0	0

The forward investment plan is based on known and forecast asset health and condition issues for those disconnectors and earth switches where life extension is not appropriate. Investment in disconnector headgear life extension restorations commenced in 2024 and will continue to see the disconnector headgear restored to as-new condition having been calibrated and returned to the initial factory settings for the HV components during RCP4. We anticipate this programme to restore the full fleet, where applicable, over the next 3 RCP periods.

Investigating disconnector and earth switch remote switching capability development was anticipated for our RCP4 planning and beyond. Transpower will consider future implementation plans which may commence from late RCP4.

LVAC assets

LVAC assets provide a reliable source of standard LV electricity to operational equipment at our substations. Correct operation is important for limiting safety risk, ensuring reliability of supply, and maintaining operational equipment within normal operating parameters. This ACP covers:

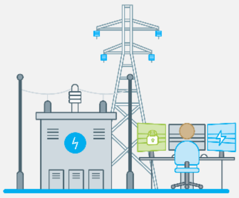
- main switchboards and LVAC source selection equipment
- distribution boards
- mains, submains, and LV distribution cabling.

Asset class snapshot

Population

511 LVAC distribution boards

159 Main LVAC switchboards



Capex

RCP4 (forecast)

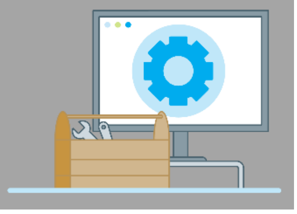
$11.6m

Asset health

- 92.7% Good
- 1.6% Fair
- 2.5% Poor
- 2.9% Very Poor

Work programme

	RCP4
LVAC replacement	26
LVAC refurbishment	14



Asset class strategy

Objective

Safe and reliable operation, at least lifecycle cost.

Measures

Zero unplanned outages of primary grid equipment caused by defects or failures of LV distribution systems.

Asset strategy

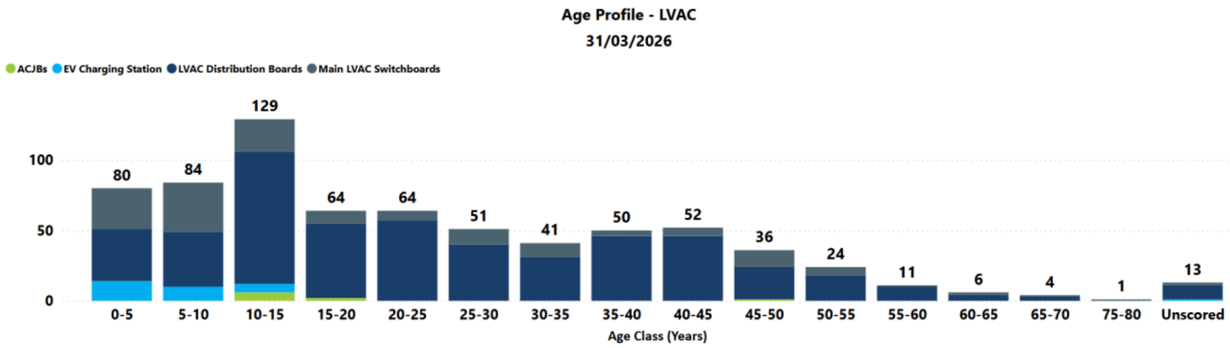
Replace LVAC local distribution boards based on condition. Where maintenance solutions are no longer effective or economic, replace LV switchboards or cabling based on electrical safety, condition, serviceability, and potential threat to transmission service and other assets.

Investment need is primarily based on risk and asset health. Factors accounted for are safety, obsolescence, risk of damage to other assets arising from failure of LVAC equipment, spare part availability or cost, and ongoing maintenance cost increases of in-service equipment. Replacement options consist of like-for-like replacement or establishing a new switchboard in either a more suitable position or similar position.

Our LVAC population and age profile is shown in **Figure 62**.

New LVAC systems are often installed as part of our 'ODID conversion' programme and power transformer replacements. This has resulted in a population with a low age profile.

Figure 62: LVAC age profile



Lifecycle – deliver, operate, maintain, decommission, and disposal

Delivery times for LVAC assets is typically 24 months. This accounts for site surveys, detailed design, procurement, outage planning and coordination with other major works at the site.

We undertake regular CAs and planned maintenance in accordance with our standard maintenance procedures. The specific tests and inspections for LVAC assets are outlined in Table 18.

Table 18: LVAC condition monitoring and inspections

Activities	Frequency
Appliance testing of portable equipment	1-yearly
Diagnostic test	4-yearly

Inspections focus on the visual identification of safety and operational risks. This includes rectifying damage caused by, or presence of vermin or other factors, external damage caused to distribution equipment that may compromise electrical safety, and material degradation of system components.

Maintenance activities include routine visual inspections, earthing continuity checks, insulation resistance tests, supply changeover control check, and CA.

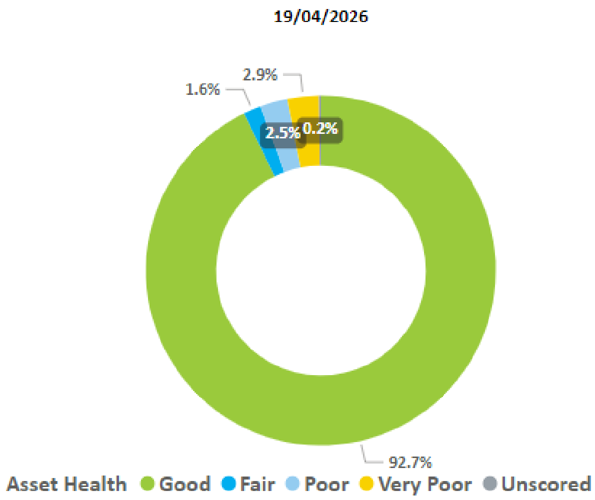
The intent of targeted investment in station LVAC systems is to ensure that connected equipment has the greatest degree of availibility and that isolations of connected equipment can be carried out safely. Outage planning is required when undertaking replacement of main switchboards. This is due to the need to isolate HV supplies to local service transformers and connected mains supplies. Primary outage planning will be instigated during the first 12 months of the 24-month project delivery.

Our decommissioning process includes safe work site management and responsible scrap disposal.

Asset risk - health and performance

Figure 63 shows the current asset health of our LVAC assets.

Figure 64: LVAC current asset health



The predominant failure causes are human element incidents, damage caused by vermin, external damage caused to distribution equipment, and material degradation of system components. The three key preventive controls critical to reducing the likelihood of a failure event are vermin management, the inspection and maintenance programme, and condition monitoring.

Our LVAC assets are reliable. It is uncommon for defects or failures to lead to unplanned outages of primary grid equipment. We have only identified one such instance in the past 20 years.

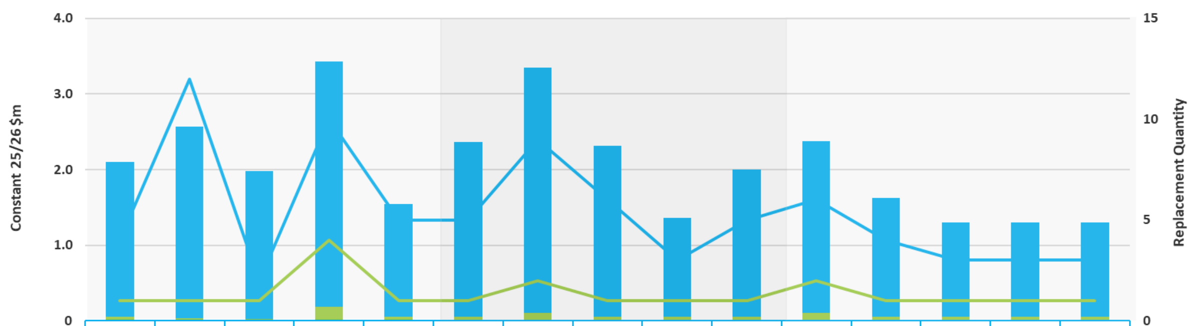
Forecast work and capex

Figure 65 shows LVAC expenditure by year and quantity.

Opex: The forecast for LVAC includes the condition-monitoring inspections and maintenance activities outlined in the lifecycle section of this ACP.

Capex: The forward investment plan focuses on managing risk and asset health. The investment driver for the RCP4 forecast is replacement and enhancement of main switchboards and distribution boards. As this programme of work continues, we expect the overall health of the asset class to be such that a more modest replacement programme is required. We are anticipating expenditure in RCP4 to cover multiple refurbishments to existing sites that have potential reliability issues. Minor remediation of lower capacity equipment is also planned to occur in each regional service area annually.

Figure 65: LVAC forecast capex and quantities



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
LVAC replacement	2.0	2.5	2.0	3.2	1.5	2.3	3.2	2.3	1.3	1.9	2.3	1.6	1.2	1.2	1.2
LVAC refurbishment	0.1	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
LVAC replace Qty	4	12	2	10	5	5	9	6	3	5	6	4	3	3	3
LVAC refurb Qty	1	1	1	4	1	1	2	1	1	1	2	1	1	1	1

Structures and buswork

Structures and buswork assets form a critical part of the transmission network, providing the connection between circuits and substation equipment. They include the bus, insulation, support structures and lightning protection.

This Asset Class Plan (ACP) sets out Transpower's approach to managing structures and buswork assets over the 15-year planning horizon. It defines the current state of the asset base, key performance risks, and the strategies and investment required to maintain safety, reliability, and cost performance at least lifecycle cost.

The portfolio is characterised by a diverse and ageing asset base subject to environmental exposure, structural degradation, and evolving service requirements. Effective management of these assets requires a coordinated approach to condition assessment, intervention planning, and integration with broader substation and network works.

This ACP covers:

- Outdoor switchyard structures, including switchyard gantries, bus supports, and concrete supports for disconnectors and earth switches
- Outdoor buswork, including associated conductors, fittings, insulators, and associated attachments
- Outdoor substation tie lines, including tie line structures, conductors, insulators and the associated fittings and attachments
- Substation earthwires, earthwire hardware and associated attachments.

Asset class snapshot

Population

5,946 Substation structures & girders

1,417 Outdoor bus section

1,346 Earthwires & hardware

Capex

RCP4 (forecast including $33.4m from one listed project)

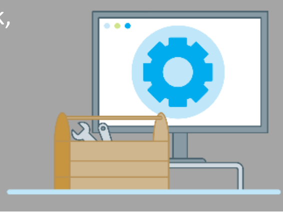
$83.1m

Asset condition

Wide range of condition from as new to requiring replacement.

Work programme (RCP4)

Condition based investments in line with strategy, resilience work, and listed project.



Asset class strategy

Objective

Safe and reliable operation, at least lifecycle cost.

Measure

Fewer than five unplanned outages per year arising from defects or failures of structures and buswork assets.

Asset Strategy

Plan major interventions based on forecast condition. Maintain assets to ensure acceptable safety and reliability performance.

Investment need is primarily based on condition and coordination with other works. Refurbishment and replacement are the two intervention options for the asset types in this asset class.

Replacement is the most viable option for insulators, conductor and bus hardware, substation earthwire, earthwire hardware and associated attachments.

Intervention options we consider for lattice gantries are protective coating of galvanised surfaces; recoating of previously painted surfaces; steel and bolt replacements; staged refurbishment including addition or bypass of structure bays; or total replacement. Site-specific constraints and condition characteristics of the structures have a significant influence on the preferred options. We have a standard approach to planning and managing painting works, consistent with our environmental stewardship objectives.

Options considered for concrete support structures are replacement (including foundations), minor repair only, and repair and coat with a protective coating system.

Our structures and buswork assets are an ageing population impacted by natural degradation and corrosion. Additional maintenance work is planned over the next 15 years to maintain asset condition.

Lifecycle – deliver, operate, maintain, decommission, and disposal

Work is scheduled according to need and resource availability while accounting for other work at the same location and outages. New installation or refurbishment works generally use standard off-the-shelf hardware and componentry items. Most of these are stored in and available from our warehouses. Sometimes specific hardware is produced, usually fabricated replacement steel, with minimal lead-time.

There are no specific operational or outage planning strategies specifically for structures and buswork.

We are undergoing a step change in asset management of structures and buswork with the implementation in 2024 of a nationwide condition assessment programme on a four-year cycle. Our routine condition monitoring tests and inspections are set out in

Table 19.

Table 19: Structures and buswork condition monitoring and inspections

Activities	Frequency
33kV insulator acoustic survey (selected sites only)	1-yearly
Condition assessment, utilising drones, for all station structures and buswork assets	4-yearly
Bus tie line condition assessment	4-yearly

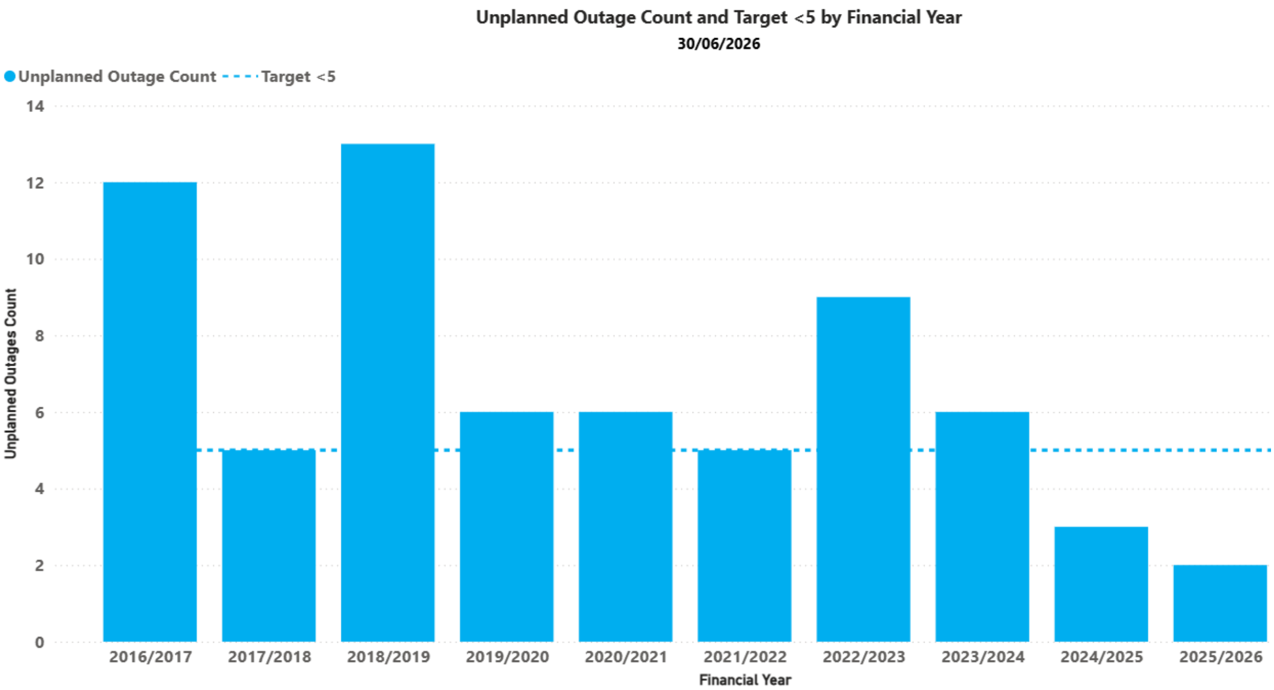
Maintenance activities on our structures and buswork include structure footing refurbishment and corrosion repair, steel and bolt replacement for lattice gantries, corrosion repair on structures, insulator cleaning, bird control, and replacement of bus hardware and components as per our service specifications or as required due to condition.

We maintain and follow an appropriate decommissioning process that includes safe worksite management and responsible scrap disposal.

Asset risk – health and performance

Structures and buswork assets are generally in fair condition. There is a range of newer assets in good condition, and a number in poorer condition that are planned for replacement or refurbishment over the next 15 years. This varies from asset to asset and is often a function of the assets age and the environment it is built in. Figure 66 shows the performance of structures and buswork assets. The main causes of unplanned outages are birds, asset health, and asset failure.

Figure 66: Structures and buswork performance



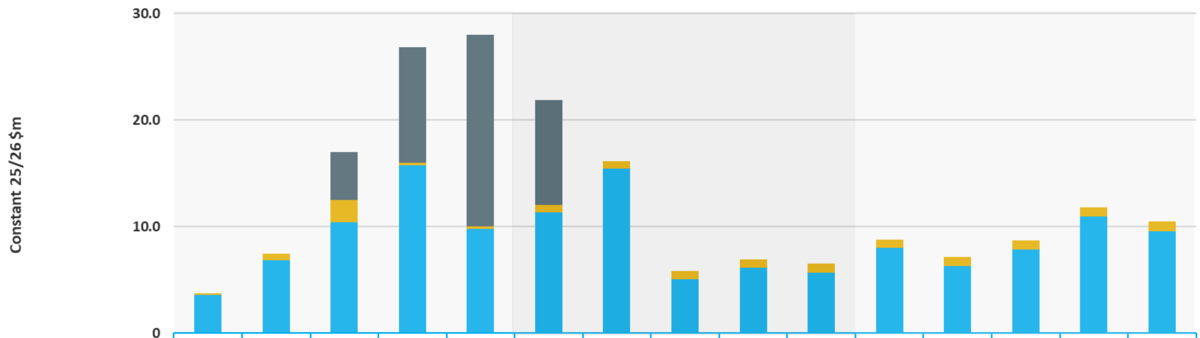
The key preventive controls to reduce unplanned outages are asset information and bird deterrents. This includes asset and condition data, asset maintenance, and asset implementation management such as ensuring the design, procurement, installation, and commissioning process meets local and international standards.

Overhead earthwires can cross multiple substation buses resulting in a high consequence if the earthwire drops onto an energised bus. A significant number of earthwires were removed after such a failure in 2006. Our resilience programme plans on further reducing this risk by replacing any remaining high risk earthwires with alternatives.

Forecast work and capex

Figure 67 shows structures and buswork forecast capex.

Figure 67: Structures and buswork forecast capex



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Listed structures & buswork	0.0	0.0	4.5	10.9	18.0	9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Resilience	0.1	0.6	2.0	0.2	0.2	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9
Structures & buswork	3.6	6.9	10.4	15.8	9.8	11.4	15.4	5.1	6.2	5.7	8.0	6.3	7.9	11.0	9.6

Opex: The forecast opex for structures and buswork covers the condition-monitoring inspections and maintenance activities outlined in the lifecycle section of this ACP. A large proportion of our operational spend within structures and buswork is on steel and bolt replacements and concrete post minor repairs, which both act to delay eventual capital replacement activities driven by corrosion-based degradation.

Capex: The forecast capex is primarily focused on the management of concrete posts, bus insulators and the life-extension activities for our steel lattice gantries. As we continue to improve our condition data through drone-based inspection, we will continually refine our investment to target the highest priority assets.

We have included a listed project related to the Haywards 110kV Bus reconfiguration that aims to reduce safety and operational risks.

Other substation equipment

Other station equipment assets are essential for supporting the operation of other primary assets, maintaining reliability of supply to customers, delivering environmental outcomes, and ensuring public and site safety. This ACP consists of a diverse range of assets which do not warrant an individual asset class or fit naturally within any of the existing ACPs. The asset types covered by this ACP are as follows.

- **Oil containment and interception systems**: Critical for minimising our impact on the environment and mitigating oil fire risk.
- **Cable trenches:** Protect high voltage HV cable routes at substations being contained in covered subsurface trenches.
- **Air compressor systems:** Supply compressed air for mechanical operation of HV switchgear.
- **Cranes and lift gear:** Required to lift equipment for maintenance and repairs on heavy grid critical assets such as transformers, circuit breakers, etc.
- **Earth grids:** Ensure safety for personnel and damage mitigation to other assets both in and around the switchyard by dissipating power system fault currents into the ground.
- **Neutral earthing resistors (NER):** Protect power transformers by limiting over voltages during a fault event.
- **Outdoor lighting:** Provides sufficient outdoor switchyard lighting for inspection and work when needed.
- **Outdoor fire hydrants:** Provide outdoor switchyard water supply access for firefighters in the event of a fire.
- **Roof and wall bushings:** Provide electrical insulation between conductor and building to pass safely through a conducting barrier.
- **Surge arresters (SAs):** Devices that supply protection to grid critical assets through limiting voltage by discharging the surge current.

Asset class snapshot

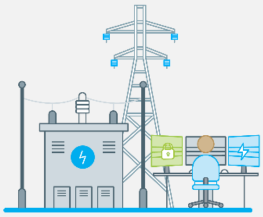
Population

2,901 Surge arrester

396 Neutral earthing resistor

330 Earth grid

176 Oil containment



Capex

RCP4 (forecast)

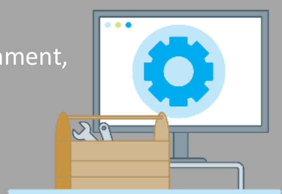
$16.6m

Asset health

Majority of assets are in good condition

Work programme

Focus on managing oil containment, safety hazards and condition management of other assets.



Asset class strategy

Asset class strategies are applicable only to oil containment and earth grids.

Objectives

- Minimise oil contaminants and discharges into the environment and restore the natural environment around our assets.
- No measured instance of water content exceeding the lower number of any resource consent or regional plan requirements, or 15ppm.

Asset strategy

- For oil containment assets, our asset strategy is to manage the potential environmental and safety hazards to personnel and the public associated with oil-filled equipment exceeding 1,000 litres. This includes oil storage, and oil processing and filling of our equipment. Work is planned to retrofit existing oil containment systems to minimise oil discharges into the environment while managing hot oil in an oil fire event.
- For earth grids, our asset strategy is to verify safety performance periodically, using remote injection testing and modelling. Also, to mitigate identified risks, including upgrading and extension of earth grid assets where these are in poor condition, or unacceptable step and touch or transferred potential hazards are identified.

The investment driver for the other asset types in this ACP is condition, with assets being either maintained or replaced with the objective(s) of ensuring public and site safety, maintaining reliability of supply to customers and/or delivering environmental outcomes.

Table 20 details the population and age data that is maintained for this group of assets, records are not maintained for some asset types.

Table 20: Other Substation Equipment age profile

Asset type description	Minimum age	Maximum age	Average age	Asset population
Bushing (wall/roof)	2	63	23.2	108
Cable Trench	N/a	N/a	N/a	2005
Centralised high pressure circuit breaker air compressor	3	45	29.94	19
Crane	2	83	38.36	30
Earth grid	1	41	17.20	330
Oil containment	2	53	18.47	176
Neutral resistor	12	73	18.56	396
Surge arrester	1	46	18.56	2,901
Washing system	36	36	36.0	3
Total				**5,968**

Lifecycle – deliver, operate, maintain, decommission, and disposal

Installations of new or replacement equipment are usually minor works and are often integrated into a wider programme schedule that accounts for other works at the same locations using common resources.

We undertake regular inspections and CAs to ensure these assets are maintained in an appropriate condition and operate as required as shown in **Table 21**.

Table 21: Other Substa

Activities	Frequency
Station compressed air system air compressor minor service	3-monthly
Oil containment, interception facilities, oil storage tanks and treatment areas, wall and roof bushings washing system maintenance, overhead crane diagnostic inspection and service including certificate of inspection, station compressed air system diagnostic inspection and service plus certificate of inspection [external] and dew point moisture content	1-yearly
Oil containment, interception facilities, oil storage tanks, and treatment areas discharge water testing, and station compressed air system air dryer desiccant replacement	2-yearly
Station air compressor – certificate of inspection for air storage receivers (internal)	3-yearly
Station oil services internal diagnostic inspection and service (drainage sumps and gravity interceptors), station compressed air system certificate of inspection (internal), and wall and roof bushings diagnostic inspection and service	4-yearly
Station earthing system inspection and testing, power system resistors (NERs), air-cored reactor and surge arrester diagnostic inspection and services	5-yearly
Station earthing system diagnostic tests, power system resistors (NERs) HV testing, and air-cored reactors impedance test	10-yearly

In addition to the routine inspections and CAs, we also obtain condition information for these assets from special surveys, the asset feedback register and maintenance activities.

Maintenance activities include cleaning of surfaces on SAs, bushings and NERs, replacement of outdoor switchyard lighting where needed, maintenance/replacement to sections of earth grid where required, bunded area sealing testing, oil / water containment tank inspection, and lubrication of moving parts on cranes and lift gear.

Outages are required for work on SAs, NERs, and roof and wall bushings. We plan and manage outages to safely maintain equipment while minimising the disruption for customers.

Decommissioning and disposal for the assets in this ACP is undertaken in accordance with our standard processes.

Asset risk – health and performance

We do not have operational asset health model outputs for the assets within this ACP. Overall, the majority of the assets in this ACP have performed well and are in good condition. A small number of asset-specific issues have been identified. These are set out below.

Cable trenches.
There have been occurrences of structural damage to our cable trenches caused from vehicles driving directly over them. To mitigate this, additional designated vehicle crossings will be installed where needed and existing ones that are not to standard will be brought up to standard. This expenditure is covered in the Buildings and Grounds ACP to be combined with existing trench lid work.

Outdoor lighting.
Lighting levels at some sites have been found to be inadequate, with installation of additional lighting needed. Lighting at all other sites will now be assessed and remedial work recommended.

Fire hydrants
We have a substation building fire resilience improvement programme in place to inform fire protection requirements. The outcome from this, along with site specific response plans developed with Fire and Emergency New Zealand, will determine fire protection upgrades.

Roof and wall bushings
Bushings need regular attention to monitor corrosion and deterioration. These are cleaned to remove environmental build-up. In general, this asset class is in good condition.

Some roof and wall bushings are connected to HVGIS installations, these are included in the ACS Indoor Switchgear portfolio which is currently undergoing a data quality review, adding these specific roof and wall bushings to the Asset Responsible portfolio, ACS Indoor Switchgear. These assets will align to the HVGIS lifecycle extension and any interventions throughout the lifecycle of the HVGIS.

An asset health model for roof and wall bushings has been recently developed; however, data is still being collected to populate it. This will provide performance data of the assets, allowing more targeted maintenance and/or replacement investment decisions.

Surge arrestors.
Current CA is visual only. A pilot investigation is currently under way to consider new condition-monitoring techniques available on the market. There have been model specific failures of surge arresters with a common mode of failure leading to their replacement.

Some surge arresters are also connected to and part of the HVGIS, these will also be included in the ACS Indoor switchgear portfolio, adding these through data quality asset responsible portfolio review.

Forecast work and capex

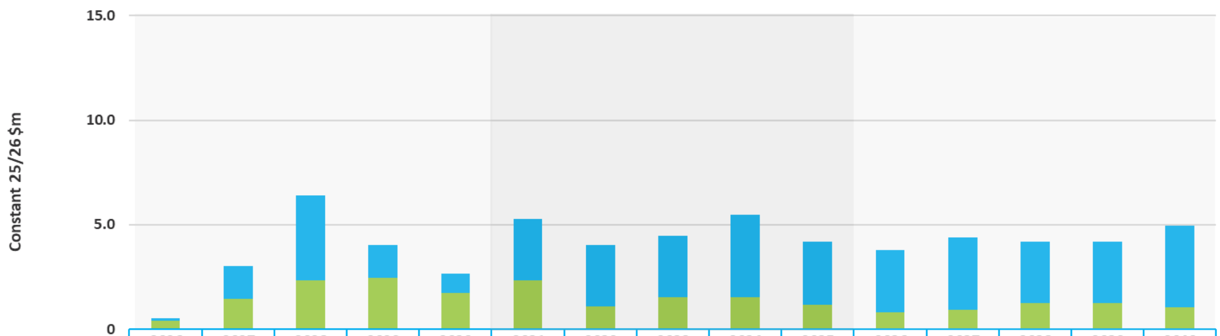
The forecast is shown in **Figure 68**.

Opex: The opex forecast covers the routine inspections, CAs, and maintenance activities outlined in the lifecycle section of this ACP.

Capex: The forecast investment plan focuses on managing the potential environmental and safety hazards associated with oil-containment assets, and condition management of the other asset types within this asset class. The investment timing may change as we bundle work into other projects for efficiency.

Oil-containment work was originally scoped to upgrade existing oil containment systems to minimise oil discharges into the environment while managing hot oil in an oil fire event. This included retrofitting existing bunds and other upgrades. Changes have been made to the oil containment design standard with greater tolerance of the very low risk of oil fire. Focus is now on mitigating the risk of oil discharges to the environment by installing new oil separator systems at a limited number of sites. There is a separate project for upgrading and refurbishing the Otahuhu oil-containment system. The forecast also includes wall and roof bushing replacements to avoid risk of failure due to manufacturing flaws and lack of spares and parts through obsolescence.

Figure 68: Other substation equipment forecast capex



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Oil containment	0.1	1.6	4.1	1.5	0.9	2.9	2.9	2.9	3.9	3.0	3.0	3.5	2.9	2.9	3.9
Other equipment	0.4	1.4	2.4	2.5	1.7	2.3	1.1	1.5	1.6	1.2	0.8	0.9	1.3	1.3	1.0

Outdoor 33 kV switchyards: ODID conversion

Outdoor 33 kV switchyards provide an interface point between our HV transmission network and MV distribution customers. All our outdoor 33 kV switchyards were constructed before 1985. Since then, there has been the availability of safer, more economical, and reliable alternatives, such as indoor switchgear or bus-less transformer feeder arrangements.

In 2008, we commenced a nationwide programme for the conversion of most of our outdoor 33 kV switchyards to indoor switchgear, to mitigate safety hazards, improve reliability, and achieve least lifecycle cost associated with outdoor 33 kV switchyards. This is known as our ODID programme. Our ODID programme is well advanced, and we expect to complete the few remaining sites by the end of RCP5, with possible carry over to the beginning of RCP6.

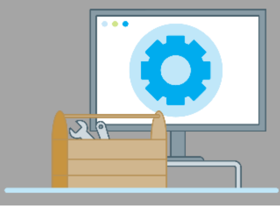
The remaining outdoor 33 kV switchyard sites are installations with appropriate clearances where the hazards of close approach to live equipment can be effectively managed or are N-security sites where safe access for maintenance is achieved during a total shutdown. As part of the programme, some outdoor switchyards are also planned for divestment to customers where they build and own the replacement indoor switchboard.

As there are only a few remaining sites, we have stopped managing ODID as a separate programme of work.

Asset class snapshot

Work programme

	RCP4
ODID conversions	4



Capex

RCP4 (forecast)

$15.2m

Asset class strategy

Objective
Safe and reliable operation, at least lifecycle cost.

Measure

Number of fault and forced outages caused by outdoor 33 kV equipment reduced to less than five per annum.

Asset strategy

- Convert outdoor 33 kV switchyards that do not meet current expectations for safety in design or reliability to modern equivalent indoor switchboards.
- Decommission all outdoor 33 kV structures that have inadequate safety clearances and reliability characteristics and replace with a modern equivalent indoor switchboard.
- Switchyards with small safety clearances, complicated structures and buswork, and aged bulk oil circuit breakers are priorities for conversion.

Investment planning for ODID is based on using a combination of asset health and site-specific consequence modelling to establish the total risk from each site. This is then compared with cost estimates to complete the ODID projects, which allows all sites to be ranked in terms of risk return on investment. This prioritised list is then reviewed to ensure other factors such as synergies with other work and customer plans have been considered in determining the final plan.

The asset health of outdoor circuit breakers in outdoor 33 kV switchyards is considered a starting proxy for the overall outdoor 33 kV switchyard condition and feeds directly into the ODID prioritisation model. However, sometimes the health of other equipment, such as concrete pole condition, will be a larger driver for prioritisation of ODID. The other main drivers for conversion are safety clearance and performance.

Lifecycle – deliver, operate, maintain, decommission, and disposal

An ODID conversion usually takes 36 months from inception to commissioning. This is a 12-month investigation phase followed by a 24-month delivery phase. The civil and electrical work is tendered on a project or site basis. We may bundle other minor works at the site with the ODID conversion, such as local service transformer replacement, or LVAC system upgrade.

Cutover of new indoor board can have a significant impact on customers and end-users. To ensure the safety of our workers and continuity of supply to customers, we negotiate long duration outage windows and use a staged cutover, including bypass cables and parallel supply.

As ODID is a capital programme of solutions, maintenance activities are not relevant to this ACP, as the maintenance requirements for each individual asset is planned for in the relevant asset class plan. Maintenance activities such as inspections, testing, and defect repairs undertaken on outdoor 33 kV switchyards provide key inputs into the ODID prioritisation process.

The outdoor 33 kV switchyards to be converted to indoor switchboards include a small number of 33 kV circuit breakers and other equipment that is of modern design, in good condition, and could provide many further years of useful service. This equipment is recovered for re-use or sale to distribution network companies. Where re-use or sale of the equipment is not appropriate, we ensure all demolition, recovery, recycling, and disposal work includes safe work- and site-management processes.

Remaining equipment is sold to scrap merchants who salvage and recycle all the metalwork, and the oil is recovered by an oil regeneration company. The SF_6 gas is recovered and re-used.

For sites where divestment is likely, the project forecast cost will be decreased to only cover the reduced scope. When existing outdoor 33 kV switchyards are divested or decommissioned, the asset status information is updated to reduce the risk of data anomalies in our asset information systems.

Asset risk – health and performance

There is no asset health model for the entire outdoor 33 kV switchyard system given it is a collection of many asset classes. The equipment in many of our outdoor 33 kV switchyards is nearing end of life with many assets beginning to show signs of poorer health.

The predominant causes for an outdoor 33 kV switchyard failure are insulation failure, including breach of MAD, mechanical failure, and material degradation. The key preventive controls critical to reducing the likelihood of a service failure event are lifecycle strategy, planning, and management; industry and Transpower safety standards and practices; and maintenance activities such as inspections, testing, and defect repairs. Condition and test information provide key inputs to the prioritisation process and help prevent major failures within the remaining outdoor 33 kV switchyards before conversion is completed.

Outdoor 33 kV switchyards have a much higher rate of planned and unplanned outages than equivalent indoor switchboards owing to environmental factors leading to corrosion, the effects of wind-blown debris, birds, and small insulation clearances leading to increased risk of electrical failure in the outdoor environment. Many of the existing circuit breakers are bulk oil types, with typically higher rates of unplanned outages than modern SF_6 circuit breakers, and many of the outdoor 33 kV switchyards do not have bus zone protection or bus section circuit breakers. This means that any insulation fault in any of the busbar equipment, or any individual 33 kV circuit breaker failure, will lead to a total loss of supply.

Circuit breakers are the leading cause of unplanned outages over the 10-year period. This supports the use of circuit breaker asset health as a proxy for the condition of the entire switchyard. Ageing disconnectors are the second most common cause and have been a significant cause of outages in recent years.

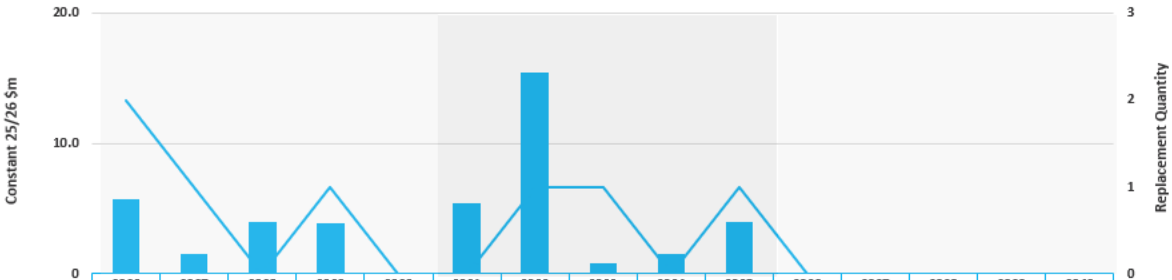
Forecast work and capex

Opex: As the ODID portfolio consists of solutions instead of assets there is no opex component, with all works being completed as capital projects.

Capex: Figure 69 shows the forecast capex and deliverable quantities through to the end of RCP6. The majority of our ODID projects will be completed by the end of RCP4.

There are three ODID projects planned for RCP5, which will bring the programme to a conclusion. ODID may be used in the future as a solution to address site specific constraints.

Figure 69: ODID forecast capex and quantities



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
ODID	5.7	1.5	4.0	3.9	0.0	5.4	15.4	0.8	1.5	4.0	0.0	0.0	0.0	0.0	0.0
ODID Qty	2	1	0	1	0	0	1	1	0	1	0	0	0	0	0

Buildings and grounds

Buildings and grounds assets provide the accommodation, services, and physical security for the critical grid equipment that facilitates the ongoing operation of the grid. Assets include buildings, fences site infrastructure, building services, and accessways to our sites. The asset class covers AC substations, warehouses, leased depots, and National Operating Centres.

Table 22 shows the asset types and population covered by this ACP.

Table 22: Buildings and grounds population

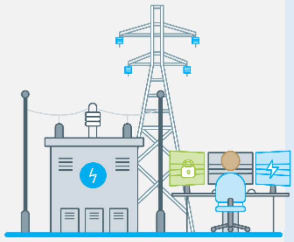
Type		Total
Site buildings	Number includes stores, communications, and other station site buildings	675
Substations	Number of substations, excluding the two HVDC substations	174
	Warehouses	3
	National Grid Operating Centres (NGOC'S)	2
	National Coordination Centre (NCC)	1[19]
Building services	Air-conditioning systems (HVAC)	848
	Fire alarm systems (not part of integrated security alarm systems)	232
	Fire suppression systems	38
	Electronic access control & security systems	173 sites
	Standby generators	20
	Uninterruptible power systems (UPS)	3 sites[20]
Site infrastructure	Roading	657,116m²
	Water supplies, storm water, and foul drainage systems	172 sites
	Switchyard metalling	1,425,907m²
Fencing	Switchyard and equipment fencing	247,30m²
	Boundary and non-security fencing	108,440m

[19] We operate two NCC. The Wellington NCC is contained in the Wellington leased office; therefore, it is not counted in the Buildings and Grounds asset population.
[20] Each NOCG and NCC have their own UPS. The Wellington UPS is accounted in the Wellington Office lease; therefore, it is not included in this count.

Asset class snapshot

Population

675 Site buildings
0.66km² Roading
0.25km² Switchyard fencing
108km Boundary fencing



Capex

RCP4 (forecast)

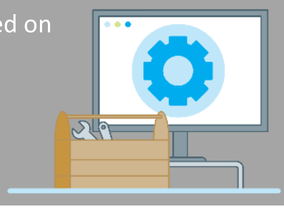
$130.9m

Overall asset condition

- 29% Excellent
- 53% Good
- 14% Average
- 3% Poor
- 1% Very poor

Work programme

Investment is primarily based on condition and is targeted to optimise lifecycle costs.



Asset class strategy

Objective

Our overarching objective for buildings and grounds assets is that they operate safely and reliably, at least lifecycle cost. To achieve this, our key objectives are outlined below.

Asset Performance

- Zero instances of transmission assets forced or fault outages, arising from failures of buildings and grounds assets.

Safety

- Zero fatalities or injuries causing permanent disability or harm to workers.

Our key strategies for achieving these key objectives are:

- Replace major asset types based on forecast condition. Operate a condition-forecasting model to predict when replacement will be required for major asset types within the buildings and grounds portfolio.
- Maintain buildings and grounds assets to ensure acceptable performance: Maintain buildings and grounds assets at a level that will ensure continuing acceptable levels of safety, reliability and performance.

There are also two focus areas for improving resilience related to the buildings and grounds assets.

- Seismic: Seismic assessment and strengthening programme for grid-critical and occupied buildings.
- Fire: Mitigation of building fire risk through standardised detection and suppression and development of site fire response plans.

Buildings and grounds assets may also be involved in improving site resilience to flood events, however the mitigations are site specific and will also impact assets outside of this portfolio.

Investment need is primarily based on condition and is targeted to optimise lifecycle costs. Options to address the identified needs are developed based on good industry practice in the buildings and grounds and facilities management sector. We address localised deterioration with repairs and minor replacements to enable deferral of major investment until maintenance is no longer an economic solution. In the case where specific hazards are identified, mitigation programmes are put in place.

Our approach is to maintain resilience in substation buildings and grounds to make outages less likely in the event of a major hazard event and improve restoration times when outages do occur.

Our oldest substation buildings and associated infrastructure were constructed in the 1930s. Most of our substation buildings were built in the 1950s to 1970s. From the early 1980s to more recently there were only a few new substation sites established, and these have generally only required a single building, including those required to replace outdoor 33 kV switchyards with indoor switchgear. We are now seeing an increased demand for new substations sites and expansion of capacity at existing sites, requiring new enabling facilities, because of increased generation and demand. Asbestos is a known risk in older buildings, equipment and surrounding areas. We manage this following our asbestos management plan, guided by the asbestos management strategy.

The earliest constructed fences with reinforced concrete structure posts were installed between the 1930s and 1950s. With a base life of 50 years, many of these are nearing the end of their useful life. Where these fences exist in benign and low corrosion zones, we can maintain the assets to address deterioration and extend life until it is no longer economic compared with replacement. Later designs in the 1980s and 1990s moved to steel structure posts, with a shorter base life of 25 years.

Many large air conditioning systems were installed during 2008/09 to improve the reliability of protection, SMS electronic equipment, TransGo panels, and batteries. These installations are now coming up for replacement.

The cardax building access systems are our first line of defence for physical and site operational security threats. The system is being updated to bring it in line with the latest specification to improve this defence. A total replacement of our cardax security system earlier in RCP3 has led to minimal funding requirements in RCP4, with only minor works required. There is a physical security strategy currently being written which will inform our future investments across RCP5 and beyond in power fences, CCTV and other substation defences.

Lifecycle – deliver, operate, maintain, decommission, and disposal

Replacements and refurbishments of complex building and grounds assets are individually scoped and priced, while more routine works is scoped and priced using condition data and Transpower specific unit rates. They are scheduled according to need and resource availability, while accounting for other work at the same location. The programme is managed internally to ensure our objectives are met, but the full end-to-end delivery of individual projects is outsourced to a specialist service provider. Transpower maintains assurance and oversight through our asset management framework.

There are no specific outage planning strategies for our buildings and grounds assets.

Assets are condition assessed based on International Infrastructure Management Manual assessment scale for building and infrastructure assets and detailed in TP.SS 02.40B.**Table 23** outlines the specific condition monitoring activities that we undertake.

Monitoring of our electronic access control and security systems, fire alarm systems, temperature and humidity monitoring systems, and emergency power supplies is undertaken in real time.

Table 23: Buildings and grounds condition monitoring and inspections

Activities	Frequency
Automatic gates – diagnostic inspection and test, fall arrest, fixed ladder, and guard rail inspection	6-monthly
Buildings, grounds, and facilities – maintenance activities and servicing	1-monthly
Pest control management	2-monthly
Maintenance of water, sanitation, and emergency water supply system at NGOC, forced air ventilation, and standby generator functional check (test run)	3-monthly
Performance, quality inspections, security/access system, air-conditioning system, roller doors, stock fencing, power fencing, automatic water backflow preventer, water servicing, emergency showers and burn kit diagnostic inspection, leased depot inspection, leased/non-leased land inspection, fall restraint anchor system certification, standby generator inspections and service, road and sealed area maintenance, bridge inspections, and building warrant of fitness process	1-yearly
Substation facilities CA, building exterior washdown, high/flat roof inspection, drainage sumps, and gravity interceptors' internal diagnostic inspection and service, waste-water servicing, and bridge engineering assessments	3-yearly
Fire alarm, extinguisher, sprinkler system, DSPA's, and gas flooding diagnostic inspection and services as per NZS4512	1,3 or 6 monthly or 1, 2, 4 or 10-yearly

Activities	Frequency
Transformer traverser track, trolley, and turntable inspection and standby generator prime mover minor service	4-yearly
Communication and repeater facilities condition Assessment and asbestos management survey	5-yearly

Asset risk - health and performance

Our buildings and grounds assets are in good condition overall. Condition is assessed over a rolling three-year period and is a key input to our expenditure forecast. Asset condition is collected at component level, but not all components are critical to the operation of the grid. Overall asset condition is illustrated below in **Table 24**.

Table 24: Buildings and ground asset condition

Condition	Percentage of assets
Excellent (C1) – As new condition (C1)	29%
Good (C2) – Asset still in good physical condition (C2)	53%
Average (C3) – Some signs of deterioration. No performance loss	14%
Poor (C4) – Severe deterioration. No performance loss.	3%
Very Poor (C5) – Deterioration to the point of performance loss	1%

The most critical data for assessing the overall condition of this asset class relates to fences (security of our sites) and roofs (prevention of water ingress). A summary of fence and roof condition from SPM Assets is shown in **Figure 70** and **Figure 71**. Investment is focused on the worst-condition assets (C4 and C5). Proactive inspection and maintenance of roofs helps to keep our buildings watertight and avoids more costly repairs. Roofs are replaced when maintenance is no longer adequate and where possible flat butynol roofs are replaced with pitched colour steel.

Figure 70: Fence condition by type

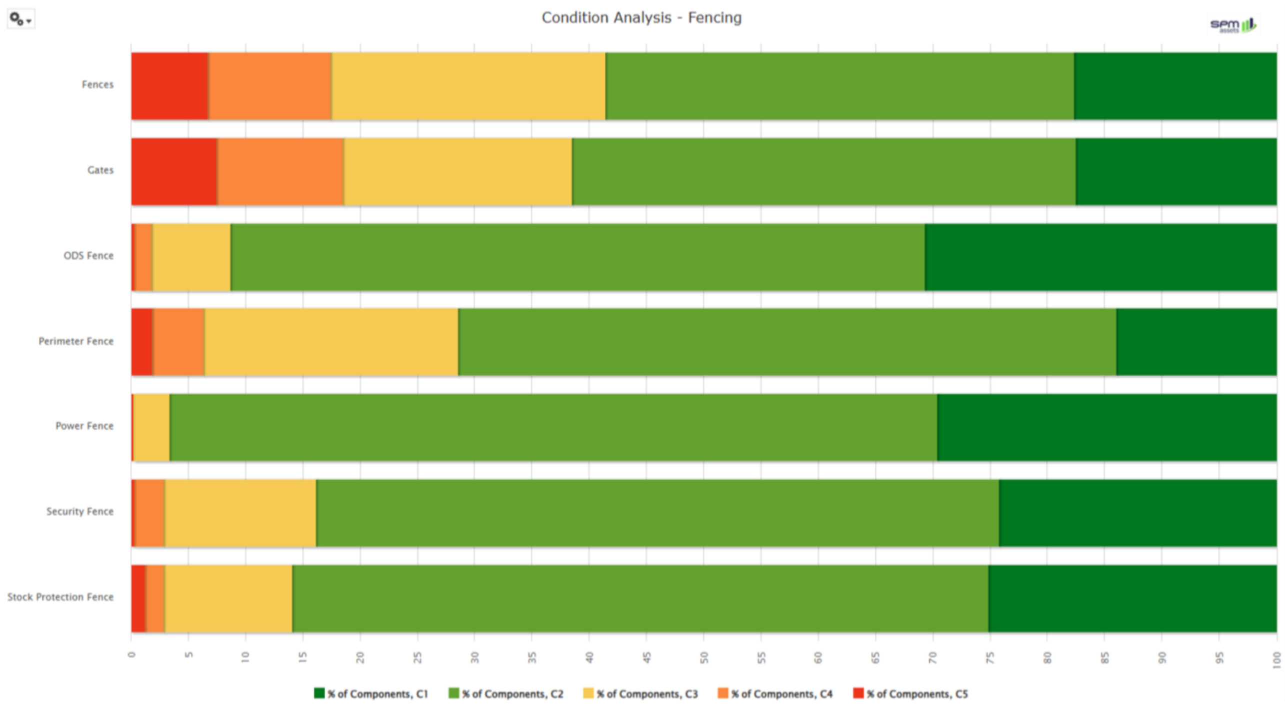
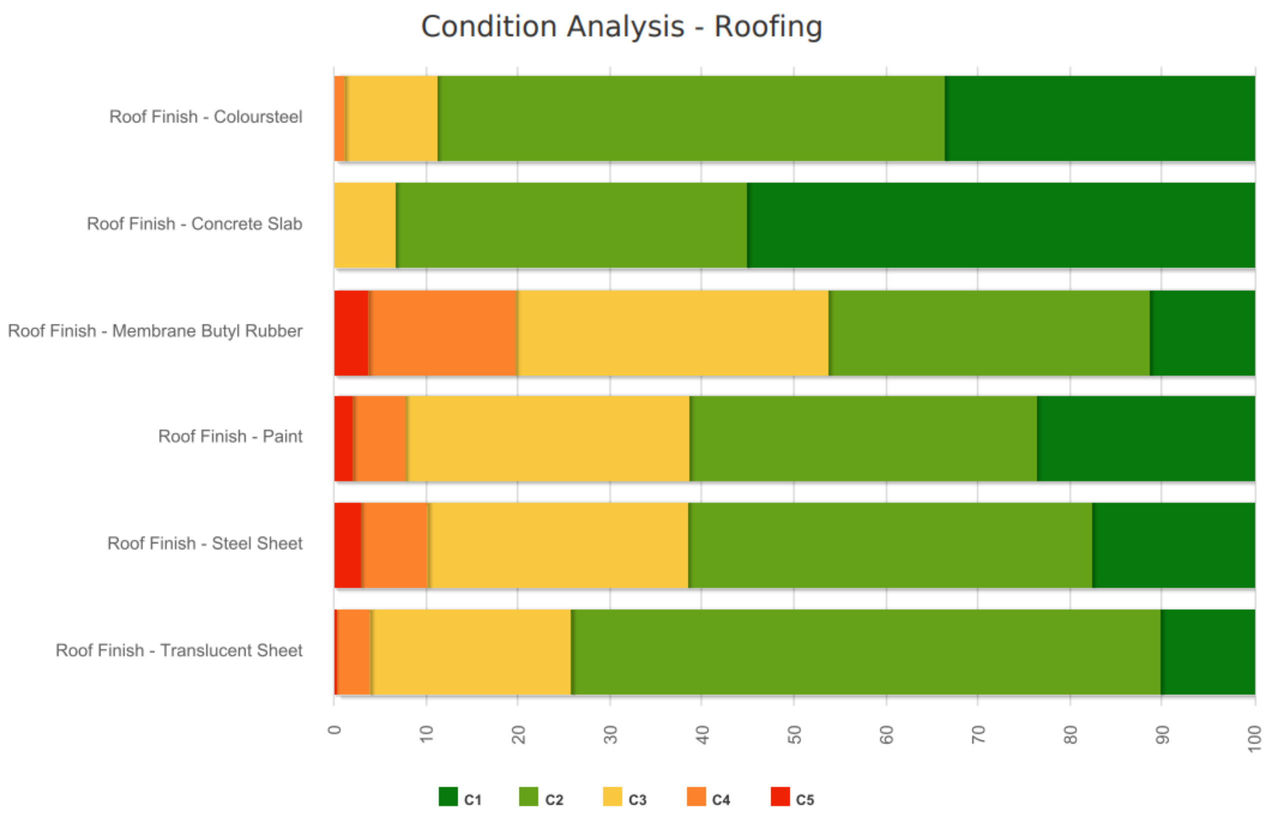


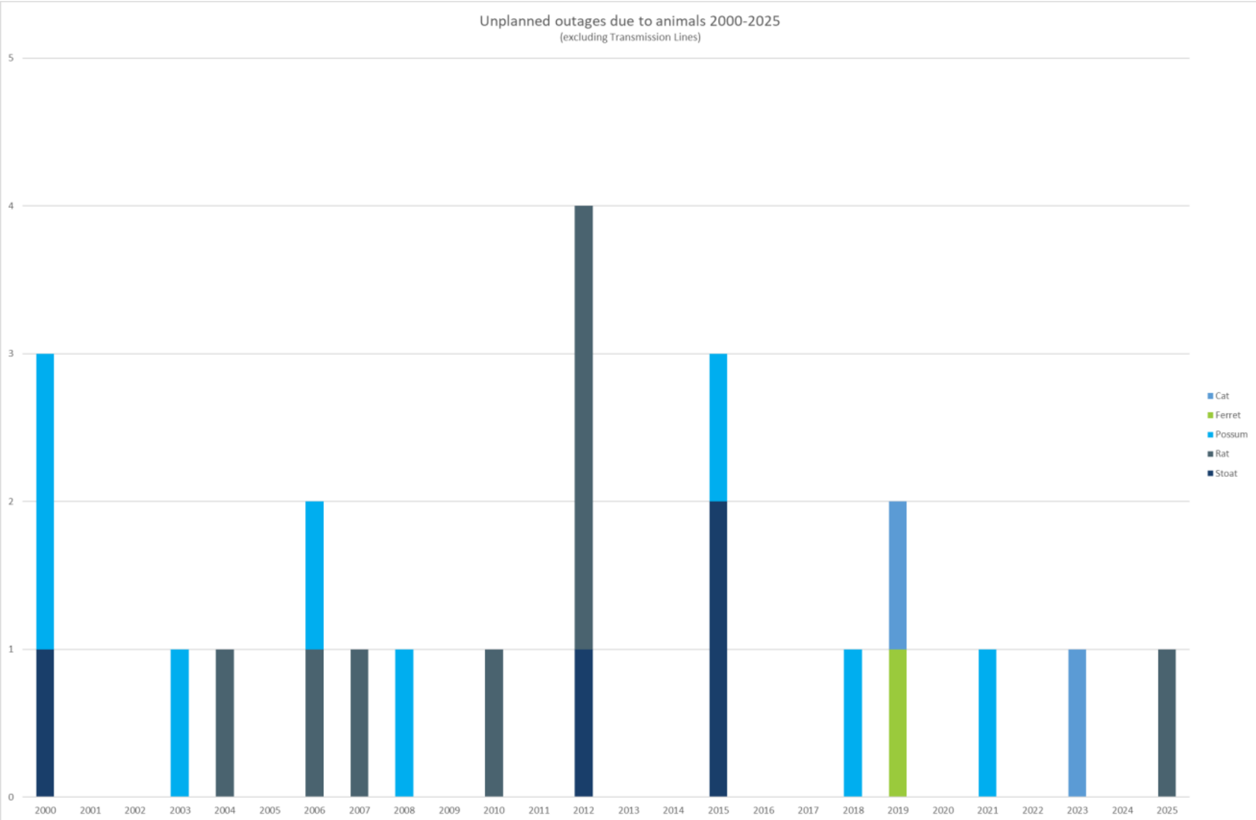
Figure 71: Roof condition by type



The probability of severe building failure is low. The predominant failure causes for buildings and grounds assets are unauthorised third-party interference, substandard construction, overloading of cable trench duct covers, and natural hazards. The key preventive controls critical to reducing the likelihood of a failure event are security access control and monitoring system, security fence and power fence alarms, procurement specifications in line with the Building Code and NZ Standards, cable trench duct cover specification and vehicle movement plan, seismic assessment programme and condition monitoring.

Figure 72 shows the number of unplanned outages caused by vermin related buildings and grounds asset failures over the last 25 years. It is not possible to directly correlate the failed asset element (eg. fence) with this data, however an increased focus on vermin prevention over the last few years is having an effect. In addition to the vermin related unplanned outages, there have also been three enviromental related unplanned outages over the last 10 years that directly or indirectly relate to buildings and grounds. Two of these were flooding related trippings related to Cyclone Gabrielle and one was a slip impacting the fence at the Kaiwharawhara cable termination site. Both events are being encoporated into planning approaches in the portfolio, to move closer towards the strategic objective of having zero instances of transmission assets forced or fault outages arising from failures of buildings and ground assets.

Figure 72: Building and grounds asset performance



Forecast work and capex

Opex: Maintenance activities have been grouped into programmes of work for efficient delivery. During RCP4, we are investigating flooding, stormwater issues and creating a plan to meet our drinking water supply requirements. The majority of opex expenditure within the portfolio is related to maintaining buildings in perpetuity through painting and building refurbishment works such as flooring and window replacements. This work increases in RCP4 as we undertake maintenance of assets delivered through the larger capital recladding and roofing projects previously completed. Some projects originally planned for capex replacement have been deferred through opex life-extension work. Likewise, projects originally planned for opex maintenance work have been capitalised due to increased scope, cost, and replacement.

We are forecasting an increase in overall opex expenditure across RCP4 and RCP5. The increase is related to leased building upgrades, remediation of water infrastructure defects and roof access compliance which is in addition to condition based opex interventions such as painting.

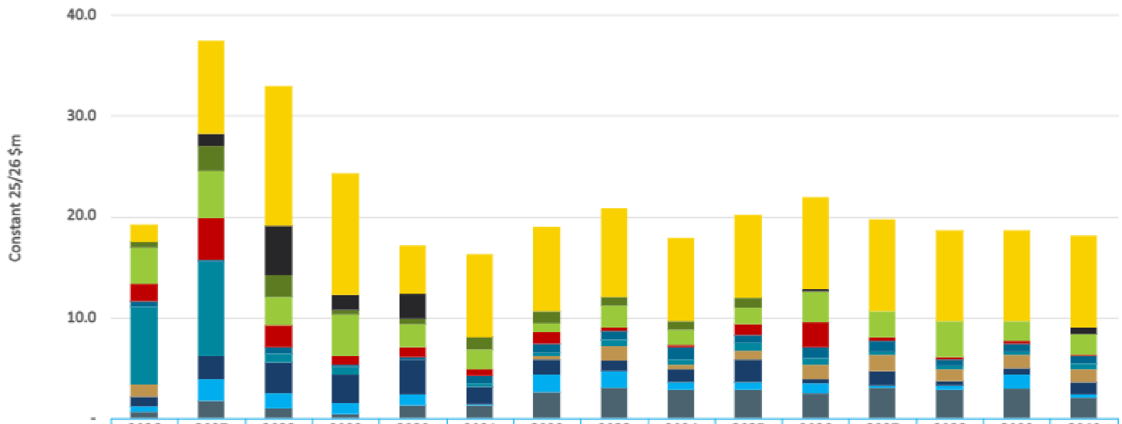
Capex: The investment drivers for buildings and grounds for the balance of RCP4 and into RCP5 are as follows.

- Resilience. Mitigation of seismic risk, building fire risks, and building flooding risks are the areas of focus of our resilience programme for our buildings and grounds assets and form part of our wider proactive resilience investment programme. We are continuing seismic assessments of select buildings across RCP4, resulting in strengthening required to meet our seismic policy. Prioritisation is guided by life safety considerations and the need to minimise risk to grid assets, however simple, straightforward solutions are being prioritised in RCP4 while the seismic policy is being updated.

- Warehousing. The acceleration of large capital investment within RCP3 was driven by an audit of our warehousing facilities. The majority of new the storage capacity is now complete with the commissioning of a new warehouse building at Bunnythorpe and a new facility at Rolleston to replace the Addington warehouse. A warehousing strategy is currently being created, which will inform long term investment for warehouses and enable a more effective whole of life cost approach to be taken.
- Fencing. A programme of work has been developed for the ongoing maintenance and replacement of fences including stock fencing upgrades in land subleased for grazing, update of the fencing standard to provide clearer guidance when implementing new site fencing and replacement of boundary fencing around Transpower owned properties along significant areas such as the Auckland transmission corridor.
- Prevention of building water ingress. A targeted programme to replace high-risk flat roofs has been delivered and will continue through RCP4 for remaining critical buildings, using low-pitched roof designs or modern membrane replacements where a pitched solution is uneconomical.
- Air-conditioning. Air conditioning expenditure increases through RCP4 and into RCP5 due to end-of-life replacement and growth in the asset base. Trench duct covers. Replacement of deteriorated cable trench lids was expected to remain at similar levels to RCP3; however, recent analysis of condition data has observed lids taking longer to reach their intervention point than expected leading to a reduction in forecast expenditure. Targeted maintenance will be undertaken up until this point.
- Water infrastructure. Investment is required at sites where three waters infrastructure needs to be upgraded due to age, capacity, condition, compliance requirements, and level of resilience. A programme of upgrades, and standard solutions, are being developed to meet our requirements under the Drinking Water Services Act. A further development of our three waters data collection processes is planned to be delivered following the Buildings and Grounds strategy update to provide standardisation to our data collection and condition assessment methods across all sites. This is to ensure these assets are being managed appropriately to maintain site functionality, resilience, and compliance with the relevant compliance requirements.
- Asbestos. The cost of removing asbestos associated with delivering capital projects was previously covered by separate funding and not included in forecasts. This option is no longer available, and these costs will need to be recognised in the projects, leading to an increase in forecast capex.

In the event that the forecast capital intervention is no longer the most cost effective whole of life solution, additional opex may be sought to extend the life of an asset. Figure 73 shows the forecast capex by year and asset type.

Figure 73: Buildings and grounds forecast



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Resilience	1.7	9.2	13.8	11.9	4.7	8.2	8.3	8.7	8.2	8.2	9.1	9.1	9.1	9.1	9.1
Seismic R&R	0.0	1.2	5.0	1.6	2.5	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.6
Fire protection	0.6	2.6	2.1	0.4	0.5	1.2	1.2	0.9	0.9	1.0	0.0	0.0	0.0	0.0	0.0
Buildings & Security	3.6	4.6	2.8	4.1	2.3	1.9	0.8	2.2	1.5	1.6	3.1	2.6	3.5	1.9	2.1
Roofing	1.7	4.1	2.2	0.8	1.0	0.7	1.2	0.3	0.2	1.1	2.5	0.3	0.2	0.3	0.2
Air conditioning	0.6	0.3	0.6	0.2	0.1	0.7	0.9	0.9	1.1	0.8	1.0	1.1	0.7	0.8	0.7
Warehouses	7.7	9.3	0.9	0.7	0.0	0.3	0.3	0.6	0.5	0.7	0.7	0.3	0.3	0.3	0.6
Cable duct/cover	1.2	0.0	0.0	0.0	0.0	0.0	0.3	1.4	0.5	0.8	1.4	1.6	1.2	1.3	1.2
Water infrastructure	0.9	2.3	3.1	2.9	3.5	1.8	1.6	1.2	1.3	2.2	0.4	1.5	0.4	0.6	1.2
Fencing	0.6	2.2	1.5	1.1	1.0	0.1	1.7	1.6	0.8	0.8	1.0	0.2	0.4	1.4	0.4
Roading	0.7	1.7	1.0	0.4	1.3	1.3	2.6	3.0	2.8	2.9	2.5	3.0	2.8	3.0	2.1
Total	19.2	37.4	32.9	24.3	17.1	16.3	18.9	20.8	17.9	20.2	21.9	19.7	18.7	18.7	18.1

Transmission lines

Transmission lines transport electricity from the sources of generation, across the country to where it is required. Our transmission lines include all assets on lattice tower and pole structures, the conductors and earthwires between structures, and associated hardware.

Our Transmission Lines portfolio incorporates six asset classes.

- Conductors
- Insulators
- Structures
- Paint
- Foundations
- Accessways

The largest portion of our transmission line assets were commissioned between the 1950s and 1980s and are spread across the country in varying environmental conditions, which can have significant influence on the condition and life expectancy of the assets.

Over time, the design and construction of our transmission line assets have changed, resulting in multiple designs and configurations to manage. For example, our towers consist of numerous designs, which include the original ones designed to support the 110 kV lines built in the 1920s, the flat-top structures designed to support the 220 kV lines built in the 1950s, through to the double-circuit 220 kV tower designs in use since the mid-1960s.

The primary driver for investment across this portfolio is asset health. Assets are planned for replacement considering their asset health score and the bundling of related or similar maintenance or replacement activities together where economic to do so. This enables us to minimise landowner interruption, prevent multiple planned outages, and reduce our carbon footprint by undertaking multiple works on a site at the same time. Factors such as the risk and criticality of assets are also considered in order to prioritise work as constraints arise.

We are constantly exploring innovative ways to improve our asset management. One of the main improvements we have implemented recently is the use of drones to provide superior condition assessment (CA) for our conductors which has allowed us to refine and optimise our expected future investment in our conductor assets.

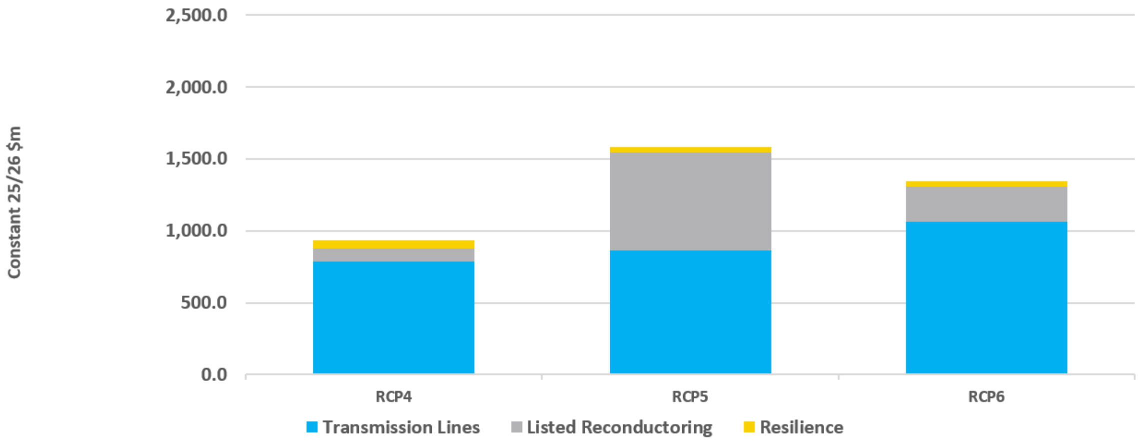
In preparation to meet the demands of New Zealand's energy future, we consider a range of options, such as thermal uprate of lines, building new lines, and line capacity reviews to improve the resiliency and capacity of our transmission lines assets. This includes specific consideration of the impact that natural hazard events have on our transmission line assets. These include volcanic ash deposits, ground slips and braided rivers. We are developing resilience plans together to address these risks.

The Data and Analytics and Asset Risk Modelling teams are supporting a review of our tower painting models. This includes a review of the corrosion degradation rates as well as an update to the economic intervention model. It is expected that the tower-to-pole model will also be affected with this review.

Opex is being used where appropriate through maintenance projects to extend asset life.

Figure 74 shows the capex investment profile over the RCPs. Overall, there is a steady increase in expenditure forecast for transmission line assets, primarily due to the increase in number of assets reaching end of life.

Figure 74: Transmission lines forecast capex incl resilience



The key investments relating to lines assets are described below.

Conductors

Our conductor portfolio represents a significant proportion of ongoing expenditure across, RCP4, RCP5, and RCP6. We have a long-term challenge to address transmission lines built between the 1950s to 1980s, that are approaching the end of their useful life.

Our improvements in CA using drone imagery have seen an enhancement in our asset health modelling. This has seen promising results during RCP3, allowed the safe deferral of some investment, and provided a more realistic reconductoring view for RCP4 and beyond. As we inspect more of the grid, we expect to further refine our forecasts and put forward a credible workplan that combines opex life extension and capex reconductoring.

Tower painting

As the network continues to age and degrade, the number of towers requiring painting and life extension increases. We see a need to gradually increase volumes based on the condition of the assets, towards a long-term steady state of regular recoating.

In 2019, we undertook a tower corrosion challenge, which identified an alternative approach from painting, to managing a portion of our towers that does not compromise long-term asset health or risk. We have now adopted a tower-to-pole strategy to manage a subset of our ageing towers rather than using painting as our sole maintenance method to address tower corrosion. We will continue to refine the designs, and the optimal intervention timing for this programme, during RCP4. In RCP4, we are also placing significant emphasis on addressing all MADs on towers that we paint.

Poles, insulators, and attachment points

Our pole portfolio includes untreated hardwood poles installed between 1920 and 1970. Subsequently, treated hardwood, concrete, and steel poles have been incorporated into the grid. Under RCP4, we are forecasting an uplift in pole replacement, as we systematically replace aging poles across the network, which will result in higher expenditure, compared to RCP3.

Our insulator sets in service across our transmission network are of various voltages and configuration types. Significant improvements in corrosion mapping from our Data and Analytics programme have been incorporated into our insulator health model. Results from this work show there will be an increase in insulator replacements for RCPs 5 & 6, compared to RCP4. The replacements are required to maintain the asset health of the asset class, due to an increasing number of insulators forecasted to be in poor condition. Replacements also includes the re-insulation on lines which are susceptible to volcanic ashfall, as part of the resilience programme, with suitable insulator types. Expenditure has also increased due to building block rate increases, consideration of opportunities to undertake live-line work which reduced outages on the grid, and stronger design and as-building processes.

Attachment points are present on all types of transmission line structures to support conductors, earth wires, and aerial communication cables, either directly or indirectly via insulators. Their size and complexity vary considerably depending on the specific structure configuration. An accounting treatment change of attachment replacements from opex to capex is now reflected as an increase in the capital forecast for RCPs 4, 5, and 6.

Transmission line major hazards, resilience, and sustainability

Our transmission line assets face many vulnerabilities and major hazards. To address this, our resilience programme includes specific strategic approaches to volcanic ash, seismic events, severe wind, land slips and washouts, and braided rivers. This approach considers both the vulnerability of the assets and their criticality to prioritise our resilience investment.

Consolidated simplified bow-ties

We have developed two transmission line consolidated simplified bow-ties (transmission line bow-ties). The transmission line bow-ties shown in **Figure 75** and **Figure 76** inform us of the most likely causes of failure across our transmission assets, along with the most likely resulting consequences of the failure.

Figure 75: Transmission line circuit consolidated simplified bow-tie

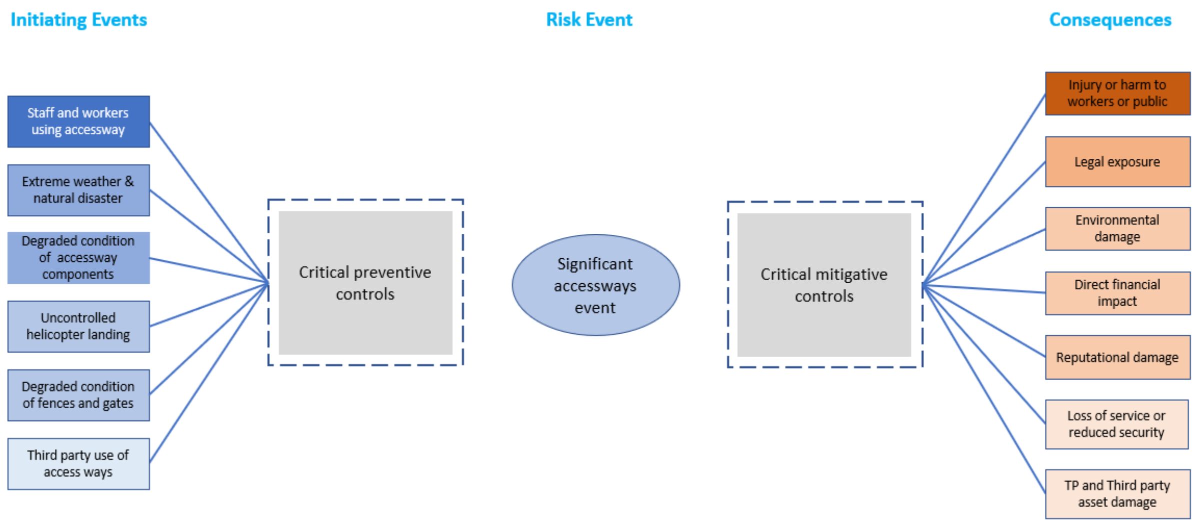
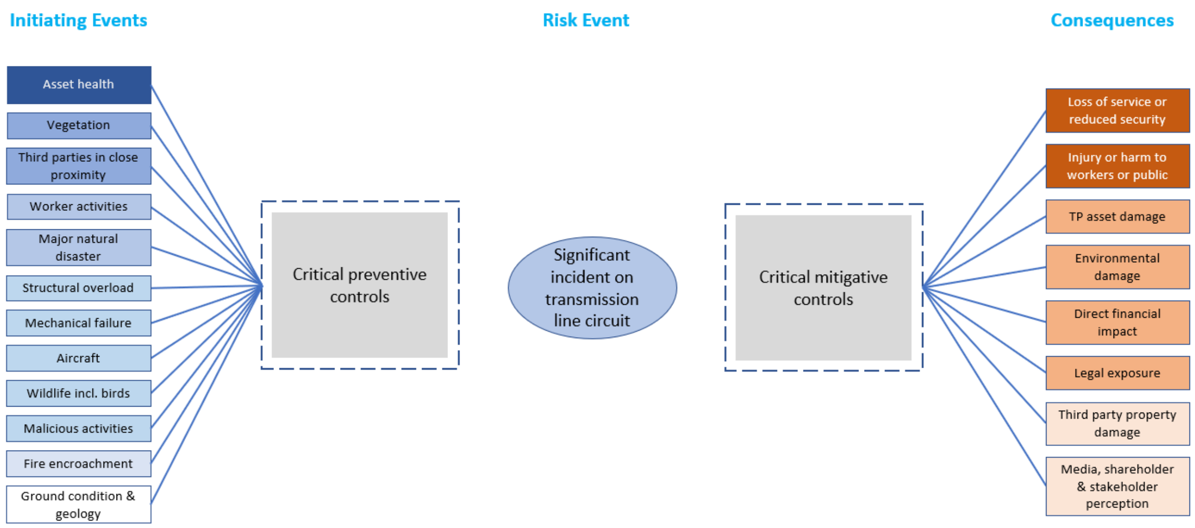


Figure 76: Transmission line accessway consolidated simplified bow-tie



We use the bow-tie analysis to inform our preventive and mitigative control activities.

Our preventive activities include our inspection and maintenance programme, workforce competency management, design, planning and procurement standards and specifications (including warranties and indemnities and the warning and security signage to be installed; and to ensure good condition records and defect reporting are held within our AMS. Additionally, we work with landowners and local councils, to improve management of third parties within our transmission corridors.

Our mitigative control activities include a range of approaches to ensure we respond well to unexpected events. This includes holding critical spares strategically located throughout the country which are condition monitored, maintained and ready for immediate installation and services. We also have incident and emergency management plans, specialist contracts for short notice emergency work, and undertake emergency exercises.

Each of our transmission line asset class plans advise the predominant likely causes of each asset class failure and the critical controls that we implement to reduce the likelihood and resulting impact of a failure.

Maintenance – patrols and inspections

We use a combination of patrols and CAs inspections to inspect our transmission lines. Regular CAs give a good indication of the condition of individual assets and the asset class, enabling the optimisation of maintenance and replacement works. Line patrols are performed annually to manage safety, structural integrity, and operational reliability risks. Patrols focus on identifying defects that are expected to deteriorate significantly within the next year and include observable structural damage, vegetation encroachment, animal interactions and incompatible corridor use.

The CA programme monitors and records the condition of transmission line structures, foundations, conductors, and hardware. The assessment produces a score for various components on a scale from 100 (new) to 20 (replacement or decommissioning criteria) to 1 (where failure is likely under everyday conditions). It applies a consistent approach to assessment of line components and allows extrapolation of the assessed condition into the future. We are also increasing the use of drones for tower and pole condition assessment, where a visual above ground indication is required.

The frequency of CA visits is based on the structure/span health and criticality. New assets will first be assessed prior to the end of any defect liability period. Thereafter, each tower and pole structure have assessments that are performed at 4-yearly intervals for tower lines that are in high wear/corrosion zones, 6-yearly for all wood poles that are in severe to extreme corrosion zones or have high public safety criticality, 8-yearly intervals for tower lines that have high public safety criticality, and 12-yearly intervals for tower lines that are in moderate to benign corrosion zones. In addition, partial assessments are undertaken every 4 years for tower lines and every 3 years for pole lines that are below CA50 and have a high degradation rate.

Table 25 shows our line patrols and condition monitoring undertaken.

Table 25: Line patrols and condition monitoring

Activity	Type / Criteria	Frequency	Description
Patrol	Security and right of Way	6 months/1 year	Security patrol and right-of-way assessment, special warning sign inspections, bridge and culvert annual inspection, slip/wash-out/ground movement inspections – aerial inspection, and temporary and emergency response structures - custodianship, emergency kits, storage, inspection, and maintenance
	Fault	As required	To investigate transient, permanent, or other fault events or unusual occurrences
	Pre-commissioning	As required	Inspects for safety or security hazards that may have arisen since the line/circuit(s) was constructed, last patrolled, or energised

Special purpose		As required		Scoped according to need. For example, after a storm or earthquake
CA inspection	CA 50 or above	Tower lines	4-yearly (high-wear/corrosion zones)	To verify the make-up and assess the condition of all components that make up a transmission line. CA information is used to support cost-effective long-term asset management decisions
			8-yearly (high public safety criticality)	
			12-yearly (moderate to benign corrosion zones)	
		Pole lines	6-yearly (all wood poles, severe to extreme corrosion zones or high public safety criticality)	
			12-yearly (moderate to benign corrosion zones)	
	CA below 50 and a high degradation rate	Tower lines 4-yearly		
		Pole lines 3-yearly		
Detailed CA inspection	Special	As required		To quantify condition in more detail as assets approach end of life, close aerial surveys, Cormon testing and sampling are carried out as required
Engineering inspection	Accessways – bridges and culverts	3-yearly		Engineering assessment to assess condition and ensure water crossings are compliant with regulatory requirements. The information is used to support cost-effective long-term asset management decisions

Risks and uncertainties

One of our expenditure risks relates to the future conductor replacement and repair work. As we collect more condition data for our conductors, this may allow us to refine the scope and timing of some of the planned reconductoring work.

In RCP4, we are planning to paint 100% of the MAD areas of the towers we paint, currently achieving approximately 90%. This is a significant step change from the approximately 60% of MADs that were painted in RCP3. A key risk in achieving this milestone is the ability to obtain outages that align with suitable painting weather windows, as this is work that has to be done de-energised.

Another uncertainty element across all transmission lines work considering the uplift from RCP4 into future years is the resource availability to deliver the work. This is further compounded by the fact that other major lines work in the Customer and Major Capital Projects space will also be reliant on the same resources to deliver the work. We are continually reviewing deliverability to manage this uplift in work and ensuring there is sufficient flexibility in the forward plan to maximise the utilisation of resource.

Asset class plans

The following sections describe in more detail our asset management approach for each of the asset classes. These ACPs describe the strategy, asset characteristics, management approach and expenditure profile for each asset class. The expenditure covers the capital requirements, along with any specific maintenance projects to be undertaken.

Conductors

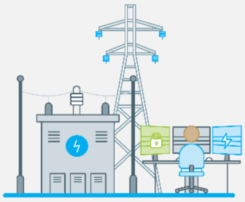
Conductors and their associated hardware enable electricity to flow from generators to consumers along transmission lines. This ACP covers conductors, earthwires, joints, spacers, and dampers.

Asset class snapshot

Population (circuit length km)

16,400 conductors

9,900 earth wires



Capex including listed projects

RCP4 (forecast)

$202.6m*

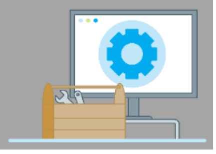
*including $89.7m for listed project

Asset health span status -

- 98.15% Good
- 1.85% Intervention required

Work programme, including Listed Project in RCP4

	RCP4
Conductor circuit kms	278
Earthwire circuit kms	65



Asset class strategy

Objective

Achieve a high level of reliability and mitigate safety hazards, at least lifecycle cost.

Asset strategy

- Plan and package work by considering site-specific factors that balance the competing interests of landowners, cost efficiency, resource availability, and outage constraints.
- Aims to ensure component failure does not cause significant environmental damage (such as bush fires) and/or third-party property damage.
- Extend the life of conductors by incorporating the learnings of the ICON project into our standard approach to managing conductors.
- Further enhance processes for investigation of circuit faults, asset failures and incidents, to improve consistency and usefulness of data.
- Continued improvement in consistency and reliability of CAs by using tools such as drones and laboratory testing.

Investment need is primarily based on asset health, under-clearance risk, and existing and future network requirements.

Most of our network was built between the 1950s and the 1980s, with more than 50% of conductors installed during this time. Twelve per cent of our conductors were installed before the 1950s. Our current estimates show that between 8%-10% of our network's conductors will require replacement in the next 15-20 years. Our replacement forecasts reflect significant investment in improving asset health models and condition assessment methods. These improvements are primarily supported byhigh-quality imagery from close aerial surveys using drones and extensive laboratory testing. While these refinements have significantly decreased our reconductoring forecast since previous RCP submissions, the results still indicate an increasing volume of reconductoring work across RCP4, RCP5 and RCP6. This growth is driven by the ageing profile of a large portion of the network. A reduction in peak workload is expected around the 2050 period.

The options considered for large conductor projects include like-for-like replacement, capacity upgrades and downgrades, dismantling, system reconfiguration, undergrounding, and continued repairs and maintenance. Like-for-like replacement options are typically selected for hardware, earthwire, and small sections of conductor replacement. Options to address under-clearances include work on structures and insulators, earthworks, and relocation of others utility's assets. We undertake extensive investigations and use economic analysis to determine the most cost-effective approach. Smaller scale hardware replacements are often integrated into a wider programme that accounts for other works at the same locations using common resources.

Figure 77 shows the population and age profile of our conductors and **Figure 78** the population and age profile of our earthwires.

Figure 77: Conductor circuit length km age profile

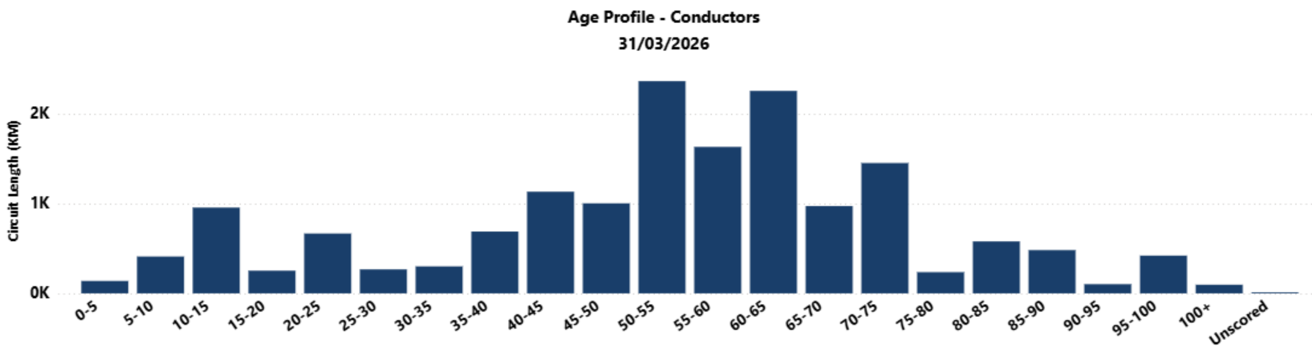
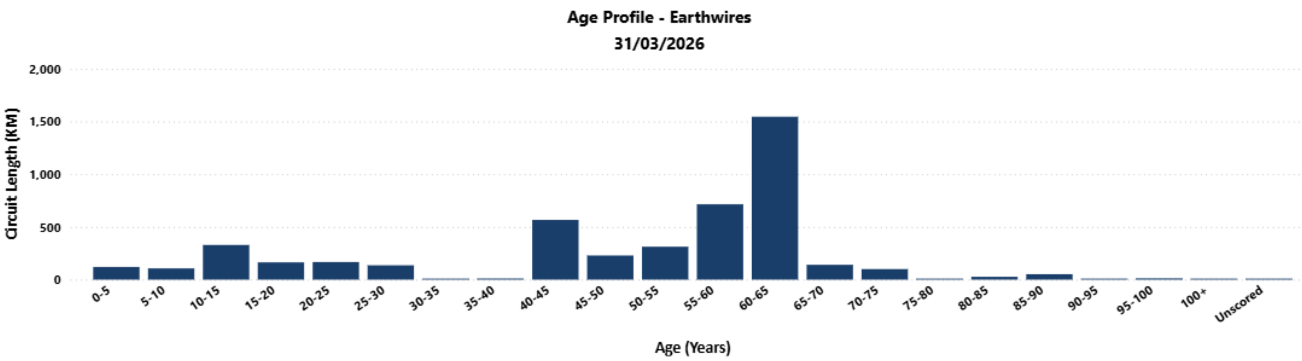


Figure 78: Earthwire circuit length km age profile



Lifecycle – deliver, operate, maintain, decommission, and disposal

Delivery times for reconductoring can take approximately 4 to 5 years from the start of the opex investigation through to works completion. This includes substantial investigation and design prior to the physical work on site. Other works within this ACP can generally be delivered at shorter notice, with timeframes of 24-36 months.

Conductor works require significant coordination of outages. We align different types of work in the same location to happen at the same time whenever possible, to make the most efficient use of our outage windows.

Our aerial laser survey (ALS) programme ensures we have up-to-date models of our lines as a key input to design and investment decision making. This enables us to analyse clearances beneath our lines and loading on structures, which subsequently informs our under-clearance rectification plan and replacement designs. Since the start of Covid, we have not undertaken ALS surveys as they were done by an international provider. We are continuing our efforts to restart the ALS program, with us currently working with Procurement to select a suitable provider to undertake this work, that meets our engineering requirements.

Minor condition issues identified during transmission line patrols and inspections are addressed through maintenance as required. Condition inspections of the conductors are undertaken using high-resolution images taken with drones. These are then analysed and used to inform repair options and long-term reconductoring needs. Maintenance activities include conductor testing and repairs, joint testing and repairs, and the installation of dampers and spacers. We expect our investment in maintenance to increase to extend conductor life and avoid a significant peak in expected reconductoring work.

When conductors reach end of life, we follow an appropriate decommissioning process. Requirements for recycling and disposal work include safe work and site management and environmental management processes. Conductors that are not recycled are sold as scrap.

Asset risk – health and performance

Figure 79 shows the health profile of our conductor population. We are currently forecasting approximately 2.6% of our conductors (431 cct km) requiring intervention at the end of RCP4. This is an indication of the forward work programme into RCP5 that will require reconductoring or targeted defect repairs. As we gather more condition information through close aerial surveys and sample tests, we will continue to refine our forecast of forward wiring work.

Figure 79: Conductor asset health

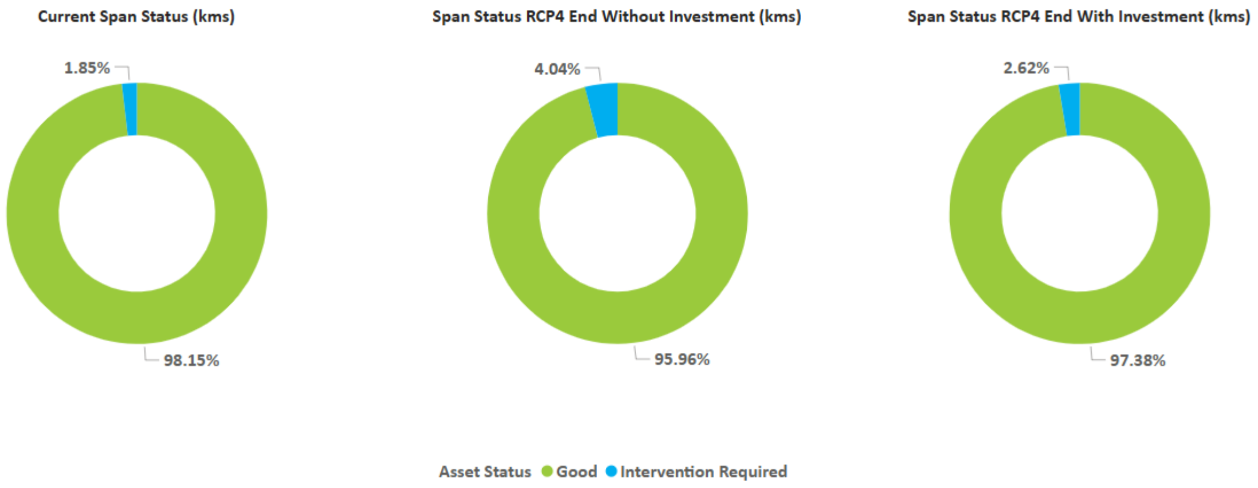
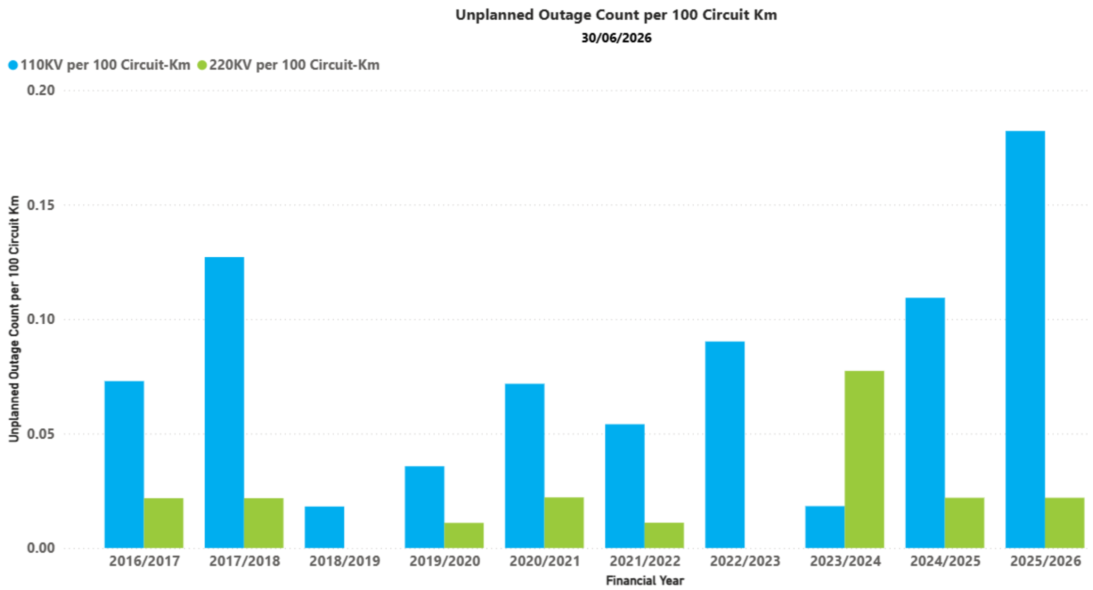


Figure 80 shows the count of conductor unplanned outage per 100 circuit kilometres. While the unplanned outage rate for 110 kV lines has increased in recent years, this increase is not attributed to deteriorating conductor asset health. Unplanned outages capture all causes, including third-party interference and weather events, many of which do not result in conductor drops. The conductor drop trend has remained stable, indicating that the condition-driven maintenance and replacement programmes continue to effectively manage asset-related failure risk. Despite the recent increase, the unplanned outage rate remains well within the strategic performance target of 4.0 events per 100 cct-km per year for 110 kV lines.

Figure 80: Conductor performance

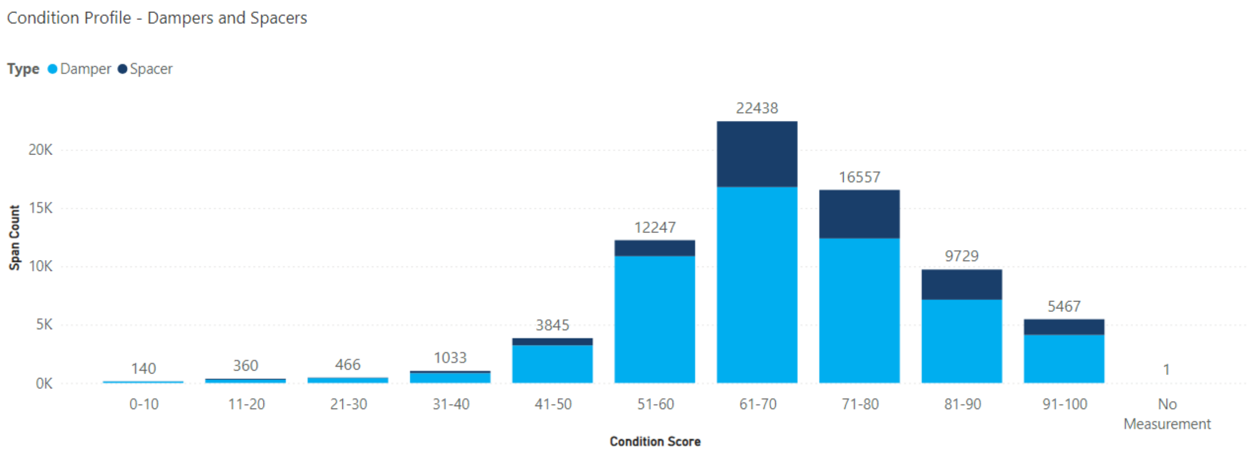


In the last 10 years, the predominant causes of conductor failure were adverse weather (including snow/ice, wind or lightning), contact with vegetation, and joint failure. Less common causes are birds or debris, conductor deterioration, mechanical failure, and damaged/deteriorated hardware.

The key preventive controls critical to reducing failures are good procurement specifications, condition monitoring, and vegetation management including inspections. We also work with local councils to improve management of third parties within our transmission corridors.

The inspected condition of spacers and dampers is shown in **Figure 81**.

Figure 81: Damper and spacer condition profile



CA score 100 is the as-new condition and CA20 is the condition score that triggers replacement. Joints are managed through an annual programme of joint testing and repairs, and the replacement of spacers and dampers is generally undertaken as part of our maintenance programme based on the CA information collected during routine condition inspections.

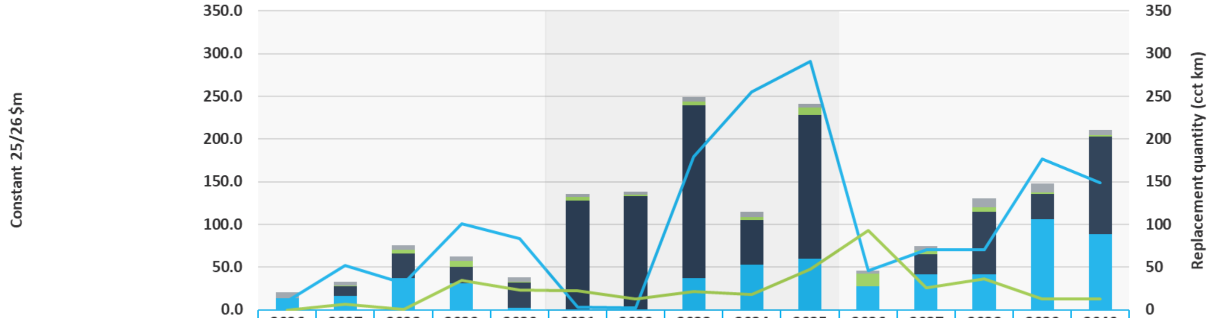
Forecast work and capex

Opex: The forecast covers joint testing, conductor inspections and repairs, conductor assessments, conductor hardware replacement, close aerial surveys, and some under-clearance rectification work. We forecast an increase in opex from the remaining years RCP4 through to RCP6, driven by an increase in inspection, testing and repairs to manage and inform the condition and operational risk associated with our ageing conductors, as explained in the previous section. The opex forecast is covered in the Maintenance ACP.

Capex: The forecast consists mostly of reconductoring. The reconductoring activities from RCP4 to RCP6 are summarised in **Figure 82**. The split between Base and Listed reconductoring projects for RCP5 and RCP6 will be refined and adjusted as more information on conductor condition, costs and uncertainties are known. Other capex activities include earthwire replacements, aerial laser surveys, and under-clearance rectifications.

We continue to identify opportunities to improve the tools and processes that support our asset management decision-making for conductors. We now have an improved conductor condition identification and defect management approach, which has improved our forecast confidence. With the resulting improved asset health model, and an increased investment in drone inspections and defect management, we can assess the need and timing of conductor replacements and consequently significantly reduce our planned volume of reconductoring. Although the forward workplan as shown in Figure 6, is currently peaky, we expect it to be smoothed into a more deliverable profile as we collect more condition data and finalsie our RCP5 planning.

Figure 82: Conductor forecast capex and quantities by year



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Under clearance and other	6.7	4.8	5.5	4.8	5.0	3.4	3.3	5.7	5.5	4.0	3.6	5.4	10.6	10.2	6.7
Earthwire	0.3	0.4	4.5	7.0	0.7	4.1	2.5	4.0	3.4	9.1	14.4	4.1	5.5	2.0	2.0
Listed Conductor	0.0	11.4	28.5	19.6	30.2	127.1	132.2	202.6	53.1	167.8	0.0	23.8	72.4	30.0	113.8
Base Conductor	13.2	16.5	37.4	31.0	2.0	0.7	0.4	36.9	52.5	60.1	27.6	41.6	41.9	105.6	88.6
Conductor Cct km (base & listed)	10	52	31	101	83	3	2	179	255	291	46	70	70	177	149
Earth Wire Cct km	0	7	1	34	23	22	13	21	18	48	93	26	36	13	13

Insulators

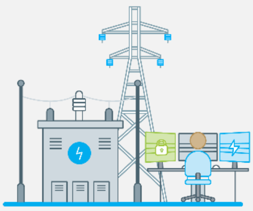
The primary function of insulators is to support and separate electrical conductors from the supporting structure, without allowing current through themselves. This ACP covers:

- Insulators of different material types (glass, composite and porcelain) used on our overhead transmission lines.
- Phase conductor and earthwire clamps and associated hardware.

Asset class snapshot

Population – insulator sets

11,192 Composite
33,627 Glass
7,173 Porcelain
10,171 Earthwire hardware



Capex

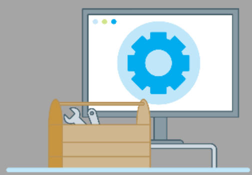
RCP4 (forecast)
$46.2m

Asset health 2025

- 81.1% Good
- 16.1% Fair
- 1.9% Poor
- 0.7% Very Poor

Work programme

	RCP4
Insulator sets	4,890



Asset class strategy

Objective
Achieve a high level of reliability and mitigate safety hazards, at least lifecycle cost.

Measure
Average annual unplanned outage rate (expressed in events for each 100-cct km each year) less than 4.0 for 110 kV lines and 1.5 for 220 kV lines.

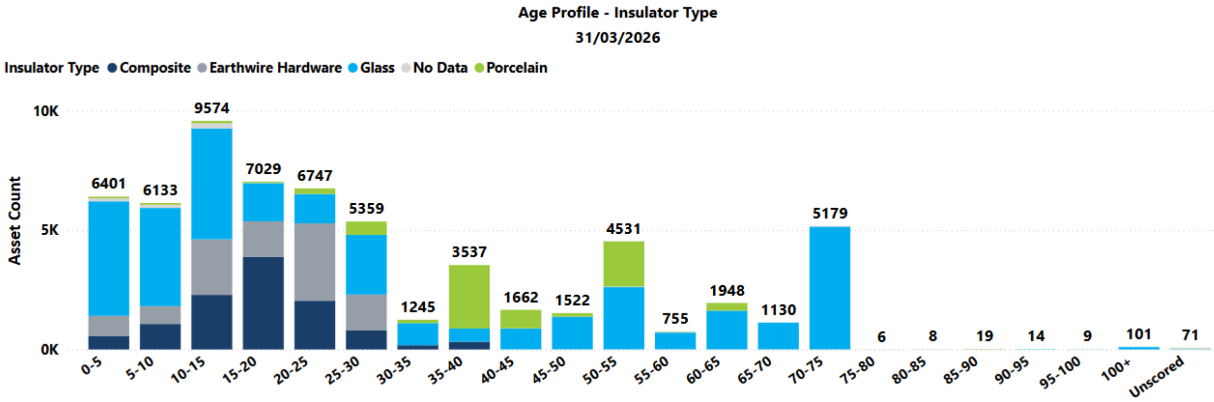
Asset Strategy

- Replace glass and porcelain insulators and fittings when their condition reaches replacement criteria (CA 20).
- Replace composite insulators and fittings based on life expectancy, which varies between corrosion codes, or sooner where condition dictates.
- Install composite insulators in extreme and very severe corrosion areas, and in sensitive areas where audible noise is an issue. Install glass cap and pin insulators in all other areas due to longer reliable life and electrical and mechanical performance.

Investment need is primarily based on asset health. However, when it is deemed cost effective to do so, re-insulation work is bundled with any works where conductor lifting is done, e.g. reconductoring, pole/cross-arm replacement, or attachment point replacement. While this results in some insulators being replaced before end of life, this is an approach consistent with our strategy and removes future costs associated with re-accessing the site, design, and project management. It also minimises landowner interruption and provides greatest economic benefit. Additionally, if defects are identified during line patrols, e.g. gunshot damage to the insulator skirts, this is done as maintenance works as required. System growth projects also drive the need for further investment.

Figure 83 shows the population and age profile of our insulators.

Figure 83: Insulator age profile



Insulator health is influenced by the corrosiveness of the environment and, as such, their life expectancy can vary greatly. While annual re-insulation numbers are currently stable, this is expected to change over the next few RCPs as we undergo continuous calibration of our health model and make improvements to our corrosion zone mapping, which will enable improved asset health forecasting.

In accordance with the strategy, insulators do not have a refurbishment option. Once the replacement criteria are reached, the insulator is replaced. This work is undertaken as volumetric capex work.

Lifecycle – deliver, operate, maintain, decommission, and disposal

Delivery times for insulator replacements are typically 12-24 months with the detailed design and planning occurring in the year preceding the work delivery, where possible. At times, due to poor condition, some aspects of this process are accelerated to ensure components are replaced within suitable timeframes.

The outage requirements for insulators are dependent on the specific tasks involved. These can be, for example, the number of insulators to be changed on a line, whether it is a strain set or suspension that needs replacement, whether the structure type is a pole or tower, and whether it is a HVDC/HVAC re-insulation. We also have the option of reinsulating structures (220kV and HVDC) under live-line conditions where this is required.

We have programmes of work that address asset condition issues identified during transmission line patrols, inspections, and CAs. Examples of such works are insulator washing or replacing insulator hardware in bulk. Both are not routine and not forecasted but completed as required. Where part of an insulator set requires replacement, this will be undertaken through maintenance as required. This can be, for example, when only the hot- or cold-end hardware requires replacement but not the insulator itself. Insulator fittings, such as armour rod repair/replacement, is done as maintenance when not replaced with the full insulator set. In cases where only the jumper insulator of a strain set requires replacement; this too is done as maintenance.

Requirements for recycling and disposal work include safe work and site management, and environmental management processes. Insulators that are not recycled are sold as scrap.

Asset risk – health and performance

The overall health of the insulator asset class is good due to the volume of re-insulation work that takes place annually. Insulators not yet at replacement criteria are also replaced with other workstreams such as under-clearance fixes or pole replacements. In the interest of economic efficiency, insulators requiring replacement within the same RCP are also brought forward to align with attachment point replacement where viable to do so. We use the asset health model to forecast future work.

Figure 82 shows the current asset health of our insulators and the health at the end of RCP4 with and without the current level of planned investment.

Figure 84: Insulator asset health

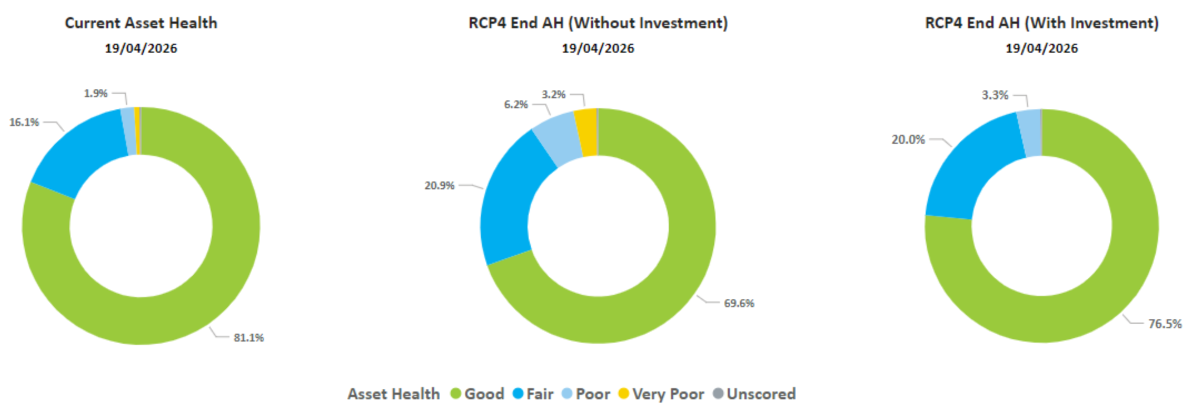
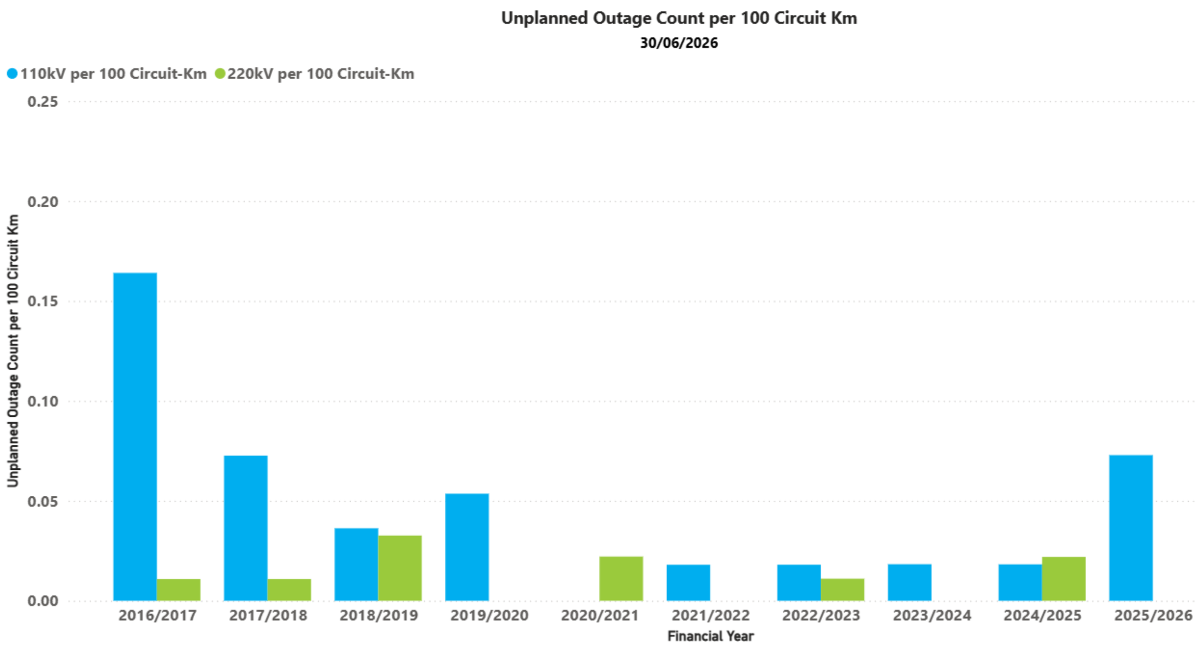


Figure 85 shows the unplanned outages for the last 10 years. It shows how unplanned outages have decreased over time, following improved asset management efforts. Note in FY25/26 there were 2 out of 4 events were attributed to wilful damage by a third party and are not reflective of our asset health management.

Figure 85: Insulator performance



The predominant causes of failures for insulators are corrosion to metal pins of the insulators, third-party acts causing interference or damage, (e.g. gunshot damage), contamination and pollution that result in flashover, and adverse weather events such as lightning strikes (particularly on composite insulators).

The three key preventive controls that we have implemented to reduce the likelihood of a failure include routine condition inspections including contamination checks, bird proofing, and predictive modelling. The quality of CAs has improved over time, which has enabled better health modelling. More recently we have completed an exercise to recalibrate asset health models using historic data sets compared against actual delivery, an exercise known as back-casting. We have also undertaken corrosion zone mapping improvements which have further improved the confidence in our health modelling.

Insulator failure can be either mechanical or electrical. Mechanical failure is largely attributable to steel pin corrosion and will generally drop the conductor unless the insulator set comprises some redundancy (multiple strings). Electrical failure of insulators is typically caused by pollution, from bird droppings, salts, or other contaminants, which can lead to flashover. Non-technical failures include issues such as vandalism, bird strikes, or extreme weather.

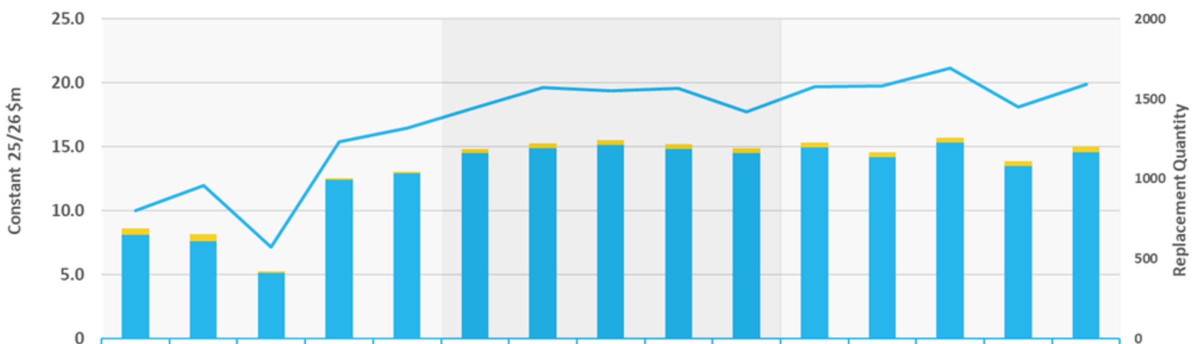
Forecast work and capex

Health modelling is used to forecast the quantity of strain and suspension insulators of the various voltage levels that would require intervention in subsequent years. The exact scope of work is determined closer to the time based on the latest available condition data. The TEES building block rates are then applied to these quantities to determine an uninflated expenditure forecast. To date, the volumes scoped for replacement have been less than originally forecast for RCP4, due to better than forecast asset condition and changes in scoping aligned insulator replacements.

Opex: Re-insulation is funded through capex, and no associated work is done through opex work other than replacement of components. Replacement of any component portions of an insulator set, such as hot- or cold-end hardware, only jumper (including jumper hardware) or part of the insulator string will be funded through predictive maintenance work.

Capex: The forecast capex and volumes for RCP4 to RCP6 are shown in **Figure 86**. Significant recalibration of the health models and corrosion zone updates have been done over the past years, which resulted in an increase in volumes from the RCP4 period. To maintain the asset health of the fleet due to an increasing number of insulators forecasted to be in poor condition in the future, more replacements are planned. This includes the re-insulation to harden the insulators, which are susceptible to volcanic ashfall, as part of the resilience programme.

Figure 86: Insulator forecast capex and quantities by year



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Resilience	0.5	0.6	0.2	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Insulators	8.1	7.6	5.1	12.4	12.9	14.5	14.9	15.1	14.8	14.5	15.0	14.2	15.3	13.5	14.6
Insulators Qty	804	958	575	1235	1318	1446	1570	1554	1568	1419	1577	1583	1695	1450	1592

Paint

Our approach to maintaining the structural integrity and performance of our steel transmission towers is primarily through our paint programme, with the alternative tower-to-pole replacement programme emerging during RCP4. Paint coatings help protect steel from the corrosive environment. The alternative approach is to replace small towers with poles when practical and cost effective. This section discusses the tower paint programme.

Asset class snapshot

Work programme

	RCP4
Towers painted	2,884
MAD areas painted (Minimum Approach Distance)	4,307

Capex

RCP4 (forecast)

$360.7m

Asset class strategy

Objective

Our overarching objective for towers and poles is to maintain them in perpetuity, with a high level of safety, resilience and reliability, at the least lifecycle cost.

Asset strategy:

- First paint towers based on the economically optimal point.
- Repaint structures when the undercoat shows through the topcoat.
- Use the asset health model to plan interventions. Complete all actions required to implement the widespread use of poles to replace towers.

We have a well-established tower painting programme. Towers are identified for painting primarily by asset health. Delivery considerations such as landowners, property boundaries, site access, seasonal constraints and maximum resource availability are also accounted for in the investment planning.

To ensure the structural integrity and performance of towers are not adversely impacted we focus on completing full tower painting, recoating previously painted structures, and the painting of the backlog of now due towers. Full tower painting includes painting the MAD areas of the tower. Our strategy is to recoat painting prior to any coating system failure, and new paint to be completed prior to the onset of significant rusting of steel members.

Figure 87 shows the population and age profile of our painted and unpainted towers.

Figure 87: Tower age profile

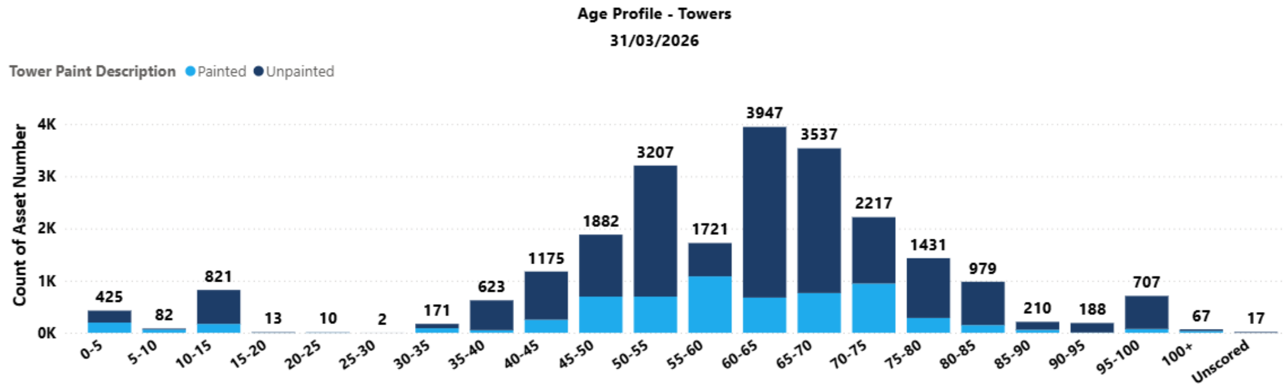


Table 26 shows the percentage of towers painted in each corrosion zone.

Table 26: Tower paint profile by corrosion zone

Corrosion Zone	Tower Painted	Tower Unpainted	% Painted in Zone
Extreme	154	55	73.68
Very Severe	1588	174	90.12
Severe	2679	924	74.35
Moderate	1846	10751	14.65
Low	13	3592	0.36
Benign	1	1655	0.06
Total	**6281**	**17151**	**26.81**

Lifecycle – deliver, operate, maintain, decommission, and disposal

Painting utilises specialist resources and work is delivered through a mixture of selective source and open tender to maintain and develop suitable service provider resources and competencies, while maintaining a competitive pressure on prices. We scope a programme of projects 12-36 months ahead of delivery, ensuring time for finalising delivery scope details. This enables efficiency opportunities aligning resources, land use and system operational requirements, while maintaining a continuous year-round painting programme. This also ensures changes can be effectively managed without compromising safety, asset health, structural integrity, or performance objectives.

During delivery stages, all practicable steps are taken to minimise impact on the surrounding environment, with sustainability considerations under ongoing review.

Most tower painting work does not require an outage, but some of the work cannot be undertaken with lines in service. Painting within the MAD on all structures requires an outage. As such, our approach is to seek outages (including additional ones), where possible, and use these periods to prepare and paint the area within the MAD on as many of the structures as possible within the outage period. Where an outage is required, we plan them to provide a safe environment for employees and service providers to undertake the work while minimising disruptions to customers and end-users.

All inspection requirements for our towers are covered in the Transmission Lines Structures ACP. There are no specific maintenance activities associated with the paint programme.

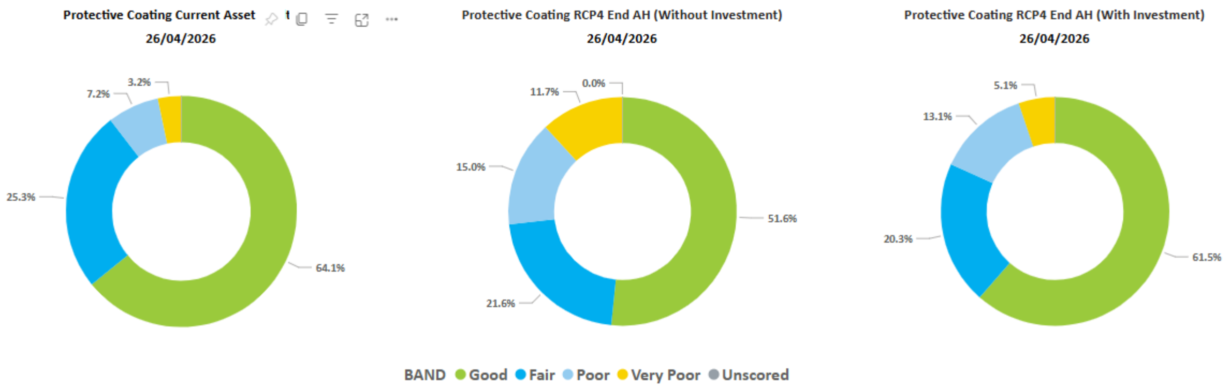
However, painting of towers does have significant benefits in addressing minor structure maintenance tasks such as steel and bolt replacements, earth plate installations, signage replacements, and addressing any identified or emerging defects.

Decommissioning and disposal do not apply to our paint programme.

Asset risk – health and performance

Figure 88 shows the current asset health of our total tower population's protective coating and also forecast asset health at the end of RCP4 with and without investment.

Figure 88: Tower protective coating asset health



Asset health scores reflect the expected remaining life of the tower steel protective coating for unpainted structures, or the remaining life of the paint coating for painted structures. Application of the paint strategy ensures painted towers are maintained prior to coating system failure and ensures unpainted structures do not deteriorate beyond paintable condition thus requiring a more costly replacement strategy. The increasing percentage of the protective coating in the fair to poor asset health bands is reflective of the tower-to-pole strategy, as these towers are managed through to replacement with a pole as per the Transmission Line Structures ACP.

This portfolio workstream is an intervention programme before degradation has reached a point where failure is possible.

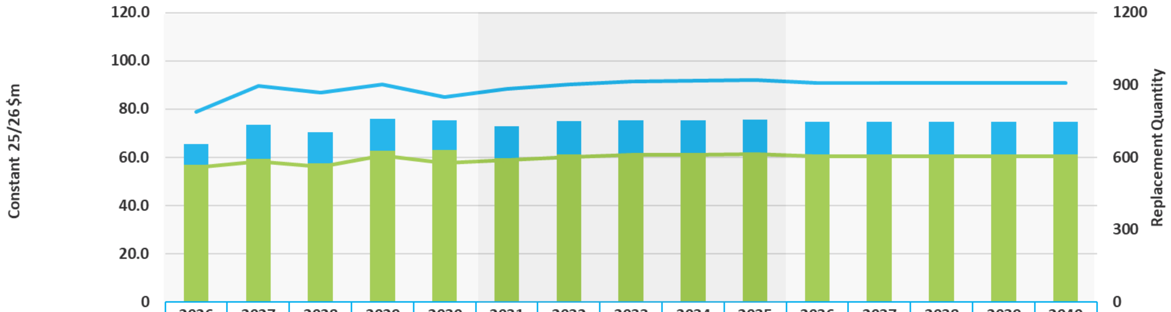
Performance of tower structures is historically good with very few failures. No failures are attributable to protective coating condition. We have not identified any specific asset performance measures applicable to this programme of works.

Forecast work and capex

Work volumes increase as we recoat an increasing quantity of painted structures and undertake painting of new towers each RCP. Coupled with the growth in MAD paint completion, the forecast expenditure increases into RCP5 and remains broadly consistent into RCP6. This is despite the reduction in painting from future replacement of older, smaller towers structures with poles. The Transmission Line Structures ACP outlines the expected expenditure on the tower to pole replacement programme over the next three RCPs.

Figure 89 shows the forecast work volumes and expenditure until RCP6.

Figure 89: Paint forecast capex and quantities



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
MAD painting	8.5	14.1	12.9	13.2	12.2	13.4	13.6	13.8	13.8	13.9	13.7	13.7	13.7	13.7	13.7
Tower painting	56.9	59.3	57.6	62.9	63.2	59.6	61.3	61.5	61.3	61.7	61.1	61.1	61.1	61.1	61.1
Towers painted Qty	557	582	560	608	577	590	602	609	611	614	605	605	605	605	605
MAD painted Qty	789	896	869	903	850	884	903	913	916	920	907	907	907	907	907

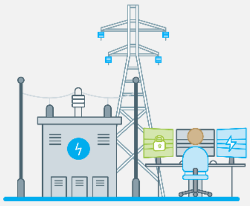
Structures

Transmission line structures consist of steel lattice towers; concrete, wooden and steel poles; and components including attachment points. They are used to physically support conductors, earthwires, and aerial communications cables. Painting of towers is covered in the tower paint ACP.

Asset class snapshot

Population

13,176 Poles
23,432 Towers
64,278 Attachment points



Capex

RCP4 (forecast)

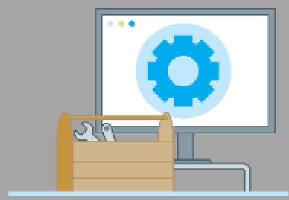
$158.2m

Pole asset health

- 86.9% Good
- 12.1% Fair
- 0.5% Poor
- 0.5% Very Poor

Work programme

	RCP4
Poles	1,369
Towers	2
Tower to pole	61
Attachment points	1,878



Asset class strategy

Objective

Our overarching objective for towers and poles is to maintain them in perpetuity, with a high level of safety, resilience and reliability, at the least lifecycle cost.

Measure

- Number of storm events resulting in a major tower failure of ≤ 0.1 per annum, and major pole failure of ≤ 0.75 per annum, on a 10-year rolling average
- Zero major tower or pole failures directly attributable to loads imposed that are less than their design criteria

Asset strategy

- Repair or replace structures that have degraded to a point where they can no longer support their structural loads.
- Replace attachment points at the onset of section loss (CA 20) or before the fastener threads seize up (CA 30).
- Replace steel components where deemed necessary and cost-effective.

Investment need for poles is primarily based on asset health. Life expectancy of poles is typically 50-80 years, depending on the construction material. These structures are managed through to replacement. They are replaced with steel or concrete poles and steel cross-arms subject to design, location, and sustainability considerations. Individual pole or cross-arm replacements are only completed where this is a least lifecycle cost solution for the structure.

Investment need for maintaining towers includes tower painting, tower replacement in full or in part, conversion to poles, attachment point replacement, and steel and bolt replacement. Options analysis considers the overall tower condition, the corrosion zone, and plans for the line or specific towers in determining which option is most appropriate.

Figure 90 and **Figure 91** shows the population of our poles and towers. Life expectancy for unpainted towers ranges from 18 to 120 years depending on the corrosion zone.

Figure 90: Pole age profile

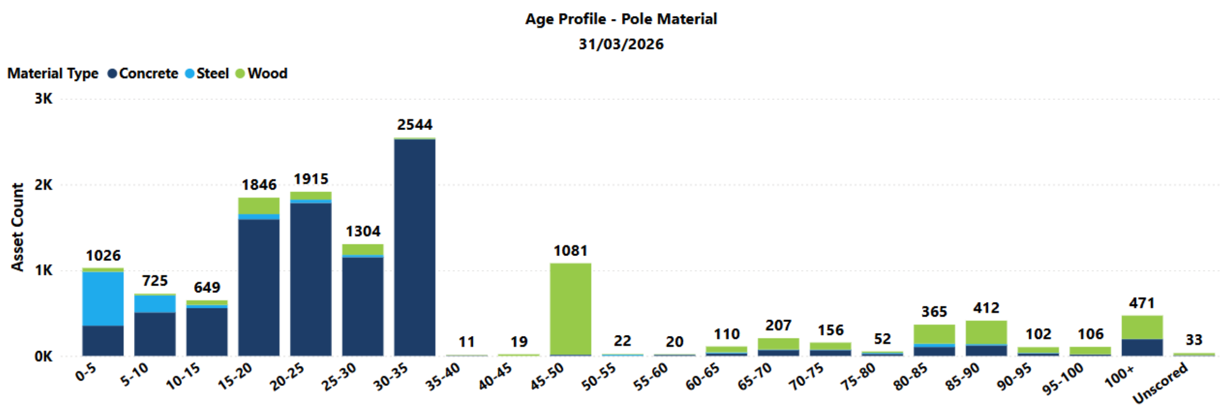
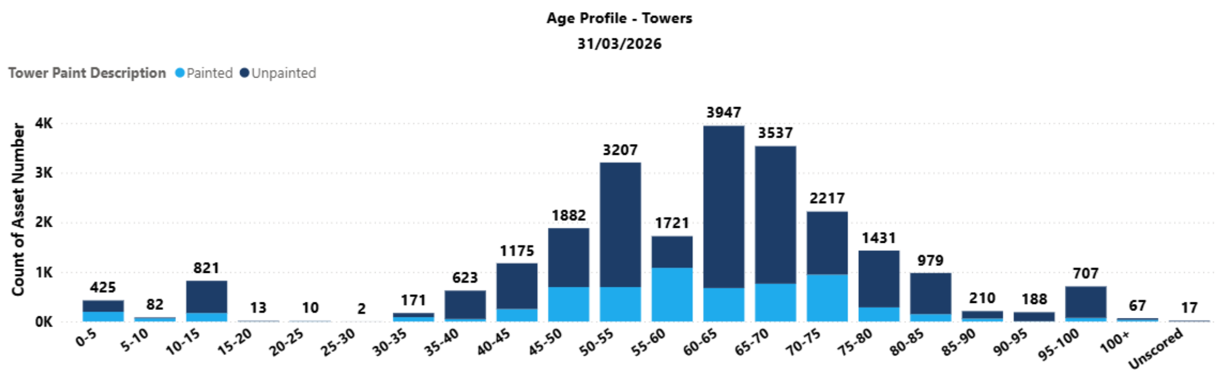


Figure 91: Tower age profile



Our tower-to-pole initiative is an emerging solution for managing the future replacement needs of many of the smaller/lightly loaded older towers. In many locations new steel poles can be cost-effectively installed to meet all design and operational requirements for these smaller towers at an overall lower lifecycle cost to maintaining through paint. Planned intervention with steel and bolt replacements will ensure towers remain fit for purpose through to replacement with a pole.

Unplanned tower replacements typically result from major hazard events, such as environmental events or third-party interaction.

Attachment points supporting the insulation assemblies and phase and earthwire conductors are subject to corrosion and wind-related degradation. These components are managed by replacement with interventions completed prior to major degradation of the items and before unacceptable risk of failure under design loads are exceeded.

Lifecycle – deliver, operate, maintain, decommission, and disposal

Delivery times for pole replacements and attachment point projects are typically planned on a 12-24-month horizon with the detailed design and planning occurring in the year preceding the work delivery, where possible. At times, due to poor condition, some aspects of this process are accelerated to ensure components are replaced within suitable timeframes.

In addition to the transmission line patrols, inspections and CAs, we undertake defect rectification, fault response, attachment point component replacement, steel and bolt replacement and EPR mitigations.

We rarely decommission a tower or pole site. However, where it does occur, consistent with our environmental objectives, our decommissioned sites are reinstated to integrate with their surrounding environment, and in some cases, to their original natural forms to allow the land to recover.

All decommissioned items are removed from the site, condition assessed, reused where appropriate and recyclable components are sustainably disposed of.

Asset risk – health and performance

Figure 92 and **Figure 93** show the asset health of our poles, and attachment points.

Figure 92: Pole current asset health

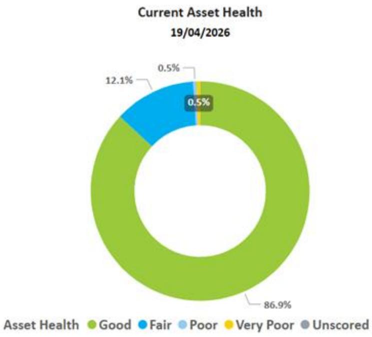


Figure 93: Attachment point asset health

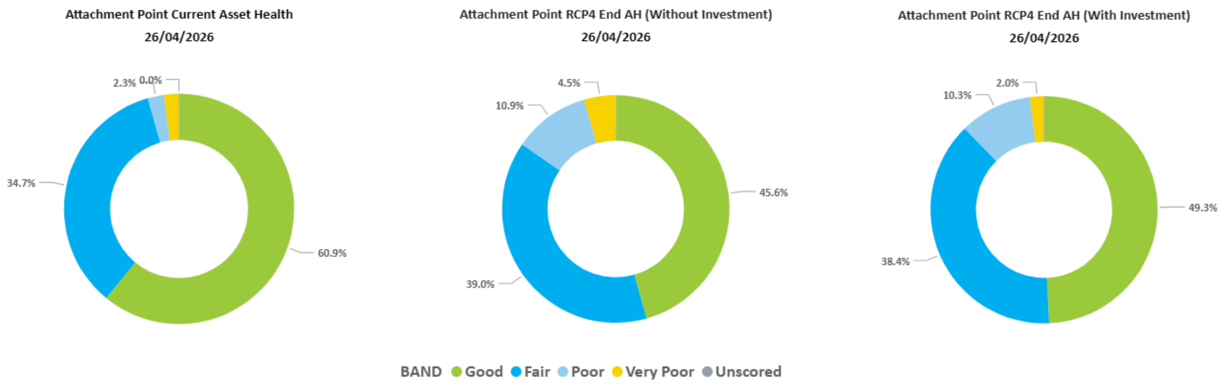


Figure 94 and **Figure 95** respectively, show our pole structure and tower failure performance against the strategy objectives.

Figure 94: Pole performance

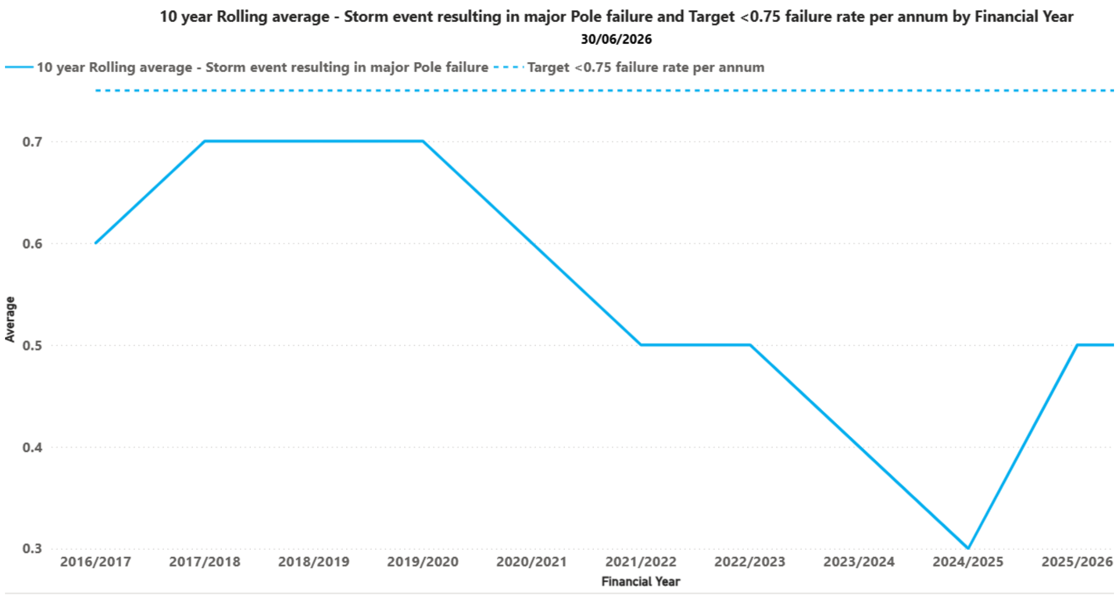
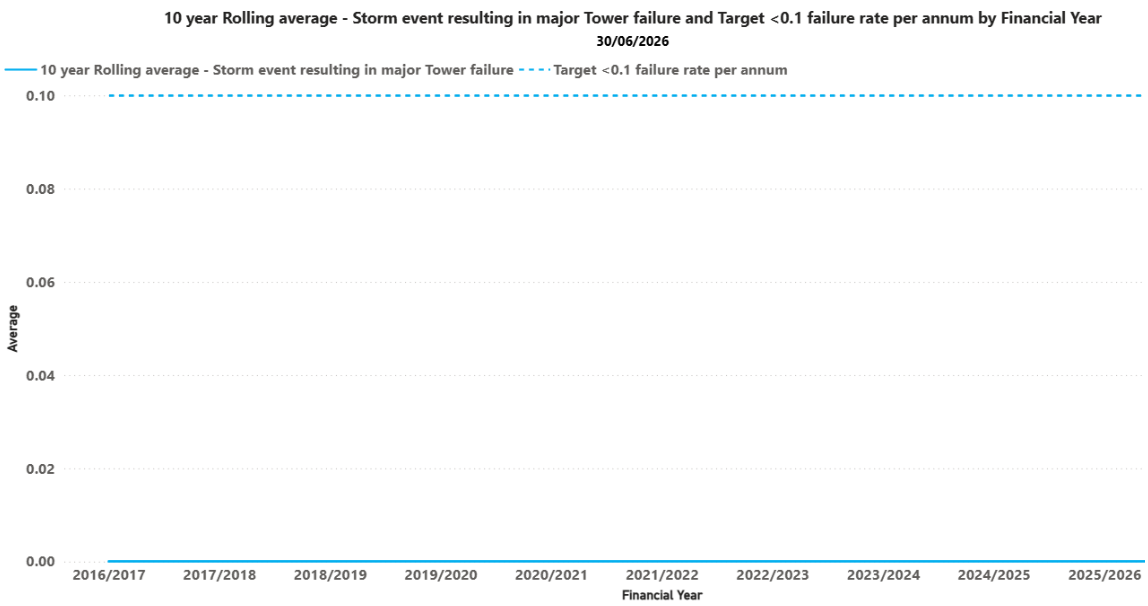


Figure 95: Tower performance



Forecast work and capex

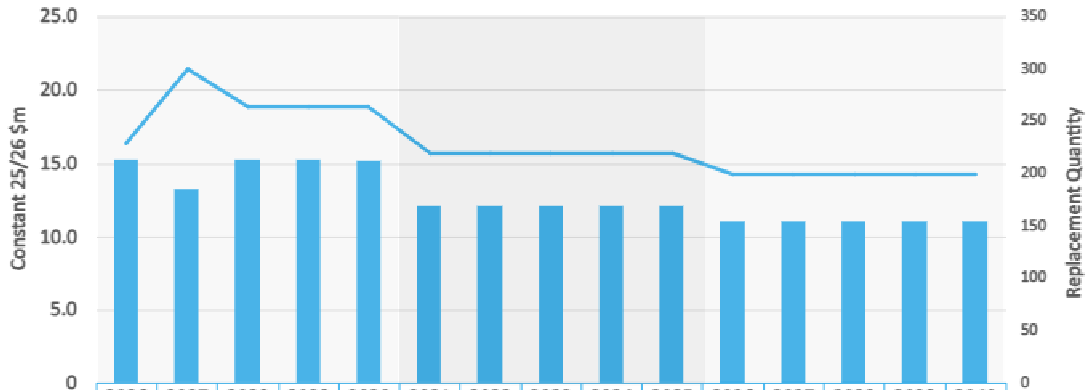
Opex: The forecast includes steel and bolt replacement, attachment point component replacement, signage, earth potential rise mitigations, bird deterrent installation and climb deterrent installation.

Capex: Figure 96 shows that pole replacements are forecast to continue at or slightly above the historical volumes for RCP4 and then drop back for RCP5 and RCP6.

Figure 97 shows the tower forecast. Historically, we have replaced two towers per year under this workstream. We have continued forecasting unplanned tower replacements at this quantity, ensuring visibility of this workstream remains.

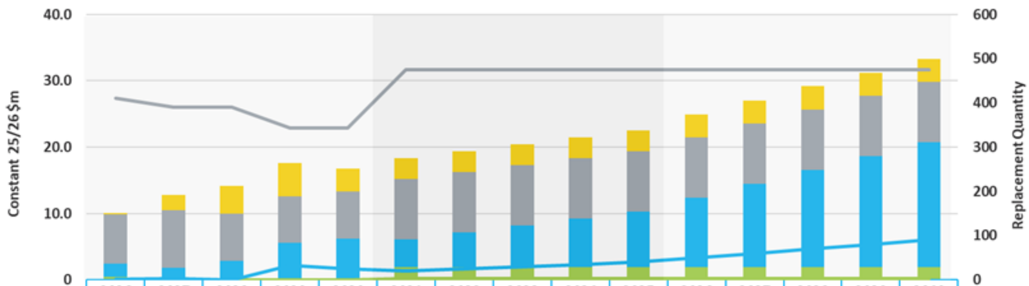
Following proof of concept. the tower-to-pole programme commences in RCP4 and increases over the following RCPs. We expect this will continue beyond RCP6.

Figure 96: Pole forecast capex and quantities



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Poles	15.2	13.2	15.2	15.2	15.2	12.1	12.1	12.1	12.1	12.1	11.0	11.0	11.0	11.0	11.0
Poles Qty	229	301	265	265	265	220	220	220	220	220	200	200	200	200	200

Figure 97: Tower forecast capex and quantities



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Resilience	0.2	2.3	4.2	5.0	3.5	3.2	3.2	3.2	3.2	3.2	3.5	3.5	3.5	3.5	3.5
Attachment points	7.5	8.6	7.1	7.0	7.0	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1
Tower to Pole	2.0	1.9	2.8	5.6	6.3	4.2	5.2	6.3	7.3	8.4	10.4	12.5	14.7	16.7	18.8
Tower replacement	0.4	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Towers Qty	2	0	0	0	0	3	3	3	3	3	3	3	3	3	3
Tower to Pole Qty	1	3	0	32	25	20	25	30	35	40	50	60	70	80	90
Attachment points Qty	411	390	391	343	343	475	475	475	475	475	475	475	475	475	475

Foundations

The performance of foundations is critical to ensure the structural integrity, reliability, and public safety of the overhead structures and conductors they support. Most of our foundations are used to support steel lattice towers, but we also have a small number of larger steel pole (monopole) foundations. This ACP also includes the foundation interface, which is the connection between the buried foundation and the above-ground structure.

The type of foundation and interface used varies depending on design loads, soil type, and the preferred construction practices of the time in which they were installed.

Asset class snapshot

Population

8,323 Steel grillage
5,193 Concrete over grillage (CoG)
9,392 Concrete plug
526 Other tower foundations
129 Pole foundations

Capex

RCP4 (forecast)
$123.5m

Grillage asset health

- 68.4% Good
- 24.6% Fair
- 5.8% Poor
- 0.6% Very Poor

Work programme

	RCP4
Concrete over grillage	831
Cathodic protection	612
New foundations	4
Slope stability & river piling	36
Marine foundation strengthening	9

Asset class strategy

Objective
Maintain our transmission line foundations in perpetuity at least lifecycle cost to ensure the integrity resilience and reliability of the overhead structures and conductors they support.

Measure
No more than one major foundation failure every 5 years and none on highly critical foundation assets.

Asset strategy

- Strengthen, refurbish, and disassemble foundations with a focus on sustainability and minimal impact on the environment.
- Develop our whole-of-life asset information for the foundations fleet.

Investment need is primarily based on asset health. Timely refurbishment of grillages is required to avoid deterioration to a point where higher-cost tower propping and major steel replacement is required. Other key drivers are replacing poor condition foundations, undertaking waterway protection work on foundations in or adjacent to riverbeds, and remediating slope stability issues.

Options considered are refurbishment or replacement. To determine the preferred option, inputs such as foundation loads, constructability, and plans for the line are considered along with an economic assessment to ensure least lifecycle cost.

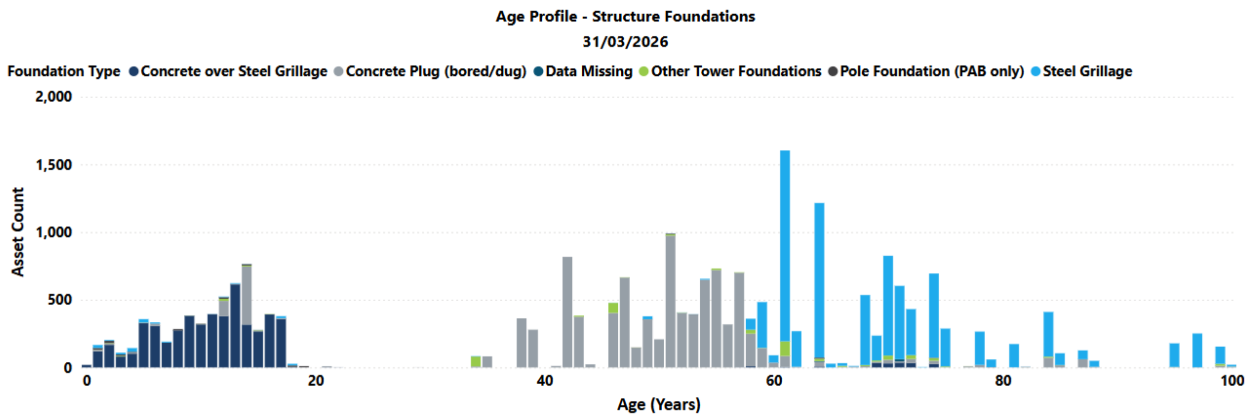
Concrete encasement of buried steel foundations (CoG) and Cathodic protection (CP) are now the preferred grillage intervention options. Where an asset is forecast to remain in perpetuity, we will consider CoG as the preferred option, with CP as an alternative where CoG cannot be delivered in a cost-effective manner. CP is considered as the primary intervention where the structure is to be decommissioned. In these finite-life considerations, CP can maintain the foundation through to the end of its required life. However, CP is not a viable option in some locations due to soil resistivity, proximity to substations, and proximity of buried services. In these situations, CoG is most likely to be the intervention option selected.

Grillage foundation refurbishments are based on the condition of the interface; this is when the grillage is at CA 40 for all structures except low- to medium-level criticality suspension structures, where the intervention point shall be CA 30.

Concrete foundations are long-life assets with the objective to ensure they remain fit for purpose. Interface maintenance interventions are asset health driven with proactive refurbishment prior to the onset of significant rusting. Complete replacement of a concrete foundation is rare and is managed individually when the need arises.

Figure 98 shows the population of transmission line foundations by age and type.

Figure 98: Foundations age profile



Lifecycle – deliver, operate, maintain, decommission, and disposal

Delivery times for foundation work is typically 24 months with the detailed design and planning occurring in the year preceding the work delivery, where possible.

There are no specific outage planning requirements for foundation works, and work can often be undertaken without an outage. The only exception is significant foundation strengthening activities where outages are generally required to enable the large construction equipment to operate beneath the line.

We complete planned maintenance on our foundation interfaces in accordance with our standard maintenance procedures. For our interface maintenance, this involves a combination of cleaning, painting, and grouting.

Decommissioned foundation sites are reinstated to integrate into their surrounding environment and, in some cases, to their original natural forms to allow the land to recover.

Asset risk, health and performance

Figure 99 shows the health profile of our grillage foundations. The forecast asset health aligns with our strategy of intervening prior to major steel deterioration but with slight differentiation by asset criticality. Assets in 'Very Poor' health and approaching intervention in 'Poor' health will be significantly reduced at the end of RCP4, with an increase in percentage of assets in 'Fair' condition. This results in a well-managed risk profile, as shown in **Figure 100** due to the application of criticality in our investment planning.

Figure 99: Grillage Foundation asset health

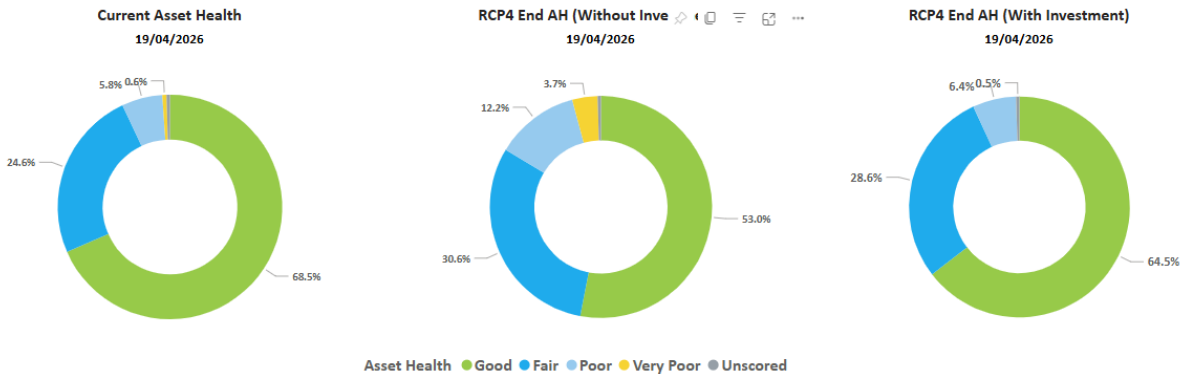
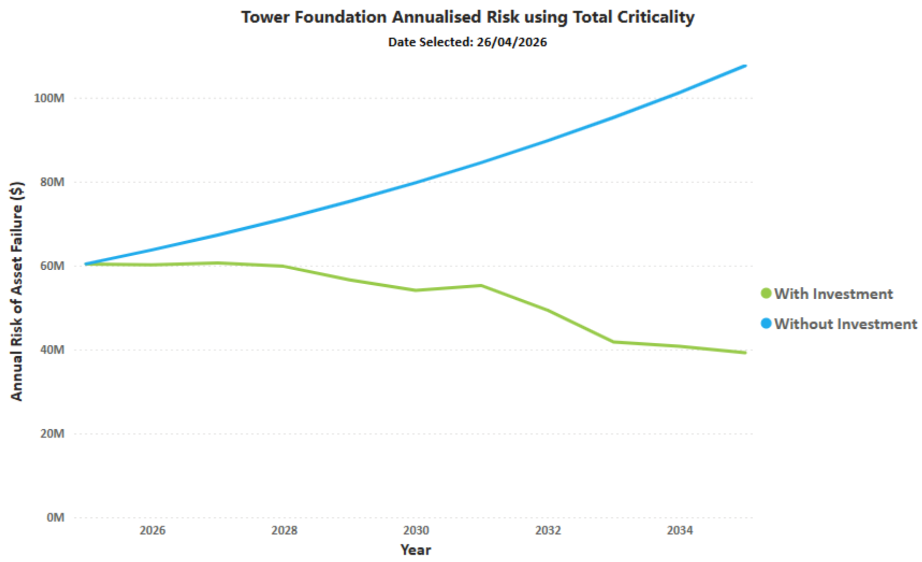


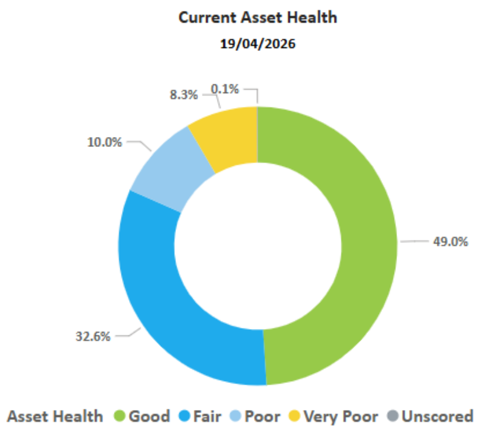
Figure 100: Grillage foundations annualised risk



Structural failures of foundations are rare. Predominant causes for foundation failures are deteriorating foundation condition, deteriorating interface condition, and overloaded foundations.

Figure 101 shows the health profile of our foundation interfaces for all foundation types.

Figure 101: Foundation interface asset health



Failures can also be as a result of erosion, landslides and flooding. The three key preventive controls critical to reducing the likelihood of a service failure event are operational and maintenance procedures and standards, foundation integrity and remediation review, and appropriate foundation design based on geotechnical analysis. Other areas of focus for continued risk management include monitoring after environmental events for foundations with known issues, regular monitoring of critical foundations and proactive hardening of foundation assets at risk. There are two separate resilience workstreams addressing these risks being (1) land stability for towers and poles, and (2) hardening critical and vulnerable HVAC and HVDC towers in braided rivers.

There have been three major foundation failure events since 2012. This was due to river scour in the 2019 Rangitata River flood event, a landslide causing an unplanned outage in Northland and erosion around a pole in Coleridge.

Forecast work and capex

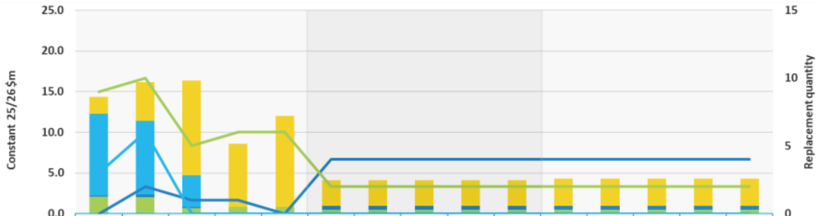
Opex: The forecast opex for foundations covers, interface refurbishments, CP maintenance (commencing in RCP5), river protection and slope stability maintenance.

Interface refurbishments are forecast to ramp up in RCP4, RCP5, and RCP6 respectively. This is due to asset health and emerging needs from CoG interface refurbishments and grillage with CP all requiring refurbishment.

Slope stability maintenance includes risk assessments, retaining wall repairs or slope protection works. This is forecast to continue in a steady state in RCP4.

Capex: Figure 102 shows the foundation capex forecast (excluding grillage). The predominant expenditure in RCP4 for foundations comprises two resilience workstreams and marine foundation strengthening. The resilience workstreams are for land stability and proactive hardening of towers in braided rivers. The other expenditure consists of new foundations, slope stability, and river piling to mitigate at-risk sites.

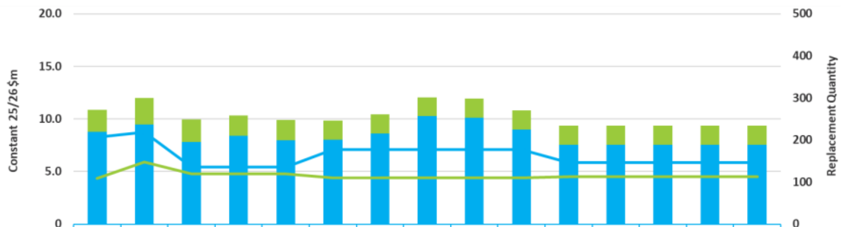
Figure 102: Foundation forecast capex and quantities



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Resilience	2.1	4.7	11.7	7.8	11.2	3.2	3.2	3.2	3.2	3.2	3.3	3.3	3.3	3.3	3.3
Marine foundation strengthening	10.0	9.1	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
New foundations	0.1	0.3	0.1	0.0	0.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Slope Stability and River Piling	2.1	2.0	0.7	0.8	0.8	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
New foundations qty	0	2	1	1	0	4	4	4	4	4	4	4	4	4	4
Slope Stability and River Piling qty	9	10	5	6	6	2	2	2	2	2	2	2	2	2	2
Marine foundation strengthen qty	3	6	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 103 shows the grillage foundation forecast. This consists of CoG refurbishments and CP installations. Overall, the grillage refurbishment profile remains stable, with a similar mix of CP and CoG each year, which is expected to maintain the asset health and risk profile for these assets.

Figure 103: Grillage forecast capex and quantities



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Cathodic protection	2.1	2.5	2.1	1.9	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Concrete over grillage	8.8	9.5	7.8	8.4	8.0	8.0	8.6	10.3	10.1	9.0	7.5	7.5	7.5	7.5	7.5
Concrete over grillage qty	207	219	135	135	135	177	177	177	177	177	146	146	146	146	146
Cathodic protection qty	108	147	119	119	119	110	110	110	110	110	112	112	112	112	112

Accessways

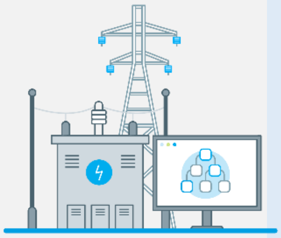
Access ways provide routes to our transmission lines and structures from readily accessible areas such as local roads to more remote locations via private or public land. They are critical in enabling us to quickly and safely respond to faults or events and undertake maintenance work on our transmission lines.

They consist of sealed and unsealed roads, spur tracks, walking tracks and unformed tracks (eg pasture). Access ways are typically owned by landowners and not Transpower. They often include watercrossing structures such as bridges, culverts, and fords, many of which were designed and built by private landowners.

Asset class snapshot

Population

15,960km Access tracks
620 Bridges
4,858 Culverts
607 Fords



Capex

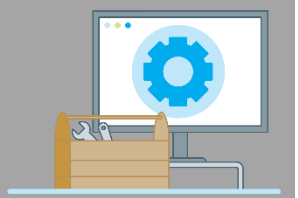
RCP4 (forecast)
$12.8m

Condition

Pre-work inspections of access ways are undertaken to identify any immediate safety concerns and suitability for use.

Work programme (RCP4)

Management of access tracks, bridges, culverts, and fords.



Asset class strategy

Objective

Our objective for access ways is to enable reliable access to our network while minimising safety risks, optimising whole-of-life costs, and maintaining positive biodiversity outcomes

Measure

Rolling average 0.5 of high potential incidents for workers over 10 years on access ways.

Asset strategy

- Eliminate or minimise, so far as is reasonably practicable, public and worker safety risks due from access ways
- Maintain access to our network assets at least whole life cost
- Maintain positive biodiversity levels when undertaking work on water crossings

Investment need is primarily based on bridges and large culverts where the water-crossing has been identified as requiring safety enhancements or upgrades to meet requirement use. Prudent investment is necessary to ensure that safe access is available to all of our transmission structures for maintenance and emergency work. Options considered for access ways are either repair, refurbishment, or replacement. Options are evaluated based on expert engineering advice, economic assessment, any alternative access that might be available, future works, pre-existing agreements with landowners, and the transmission structures to which the water-crossing provides access.

Table 27 shows our access ways population.

Table 27: Access way Population

Asset type	Population
Access track length (km)	15,960
Total number of bridges	620
Total number of culverts	4,858
Total number of fords	607

Lifecycle – deliver, operate, maintain, decommission and disposal

Delivery time for access way projects is typically 2 years, with the first year being used for scoping, optioneering, design, archaeological assessment and consenting. The second year is for the construction. This 2-year approach reduces delivery risk, increases cost certainty at time of construction and ensures sufficient time is allowed for design and consenting.

In addition to the regular transmission line patrols, inspections, and CAs, we undertake special earthquake or flood inspections of our access ways immediately following a significant earthquake or flood. Typical maintenance activities triggered from regular or special inspections include clearance of slips, water table maintenance, and grading of tracks.

As the majority of access ways are not owned by Transpower, it is rare for an access way asset to be decommissioned. In most cases where the access way is no longer required, with the landowner's agreement it will be left for their use and for them to maintain in the future.

Asset risk – health and performance

We do not have an asset health model for access ways. Asset health and remaining life for our water-crossings are based on inspections from chartered professional engineers with bridge experience.

Access ways deteriorate through use, the climatic conditions, and the varying environmental factors in which they are situated, and because of natural hazard events.

Pre-work inspections of access ways are undertaken to identify any immediate safety concerns and suitability for use. Our service provider contacts the landowner to confirm the most appropriate access on the day and will inspect the access way that the landowner has suggested to confirm suitability or advise any remediation that is required.

The predominant causes of failure relate to access track wear over time, extreme weather, environmental factors, and natural disaster. The three critical preventive controls that are critical to reducing the likelihood of a failure event are conducting routine patrols and inspections, pre-works walkovers, and planning.

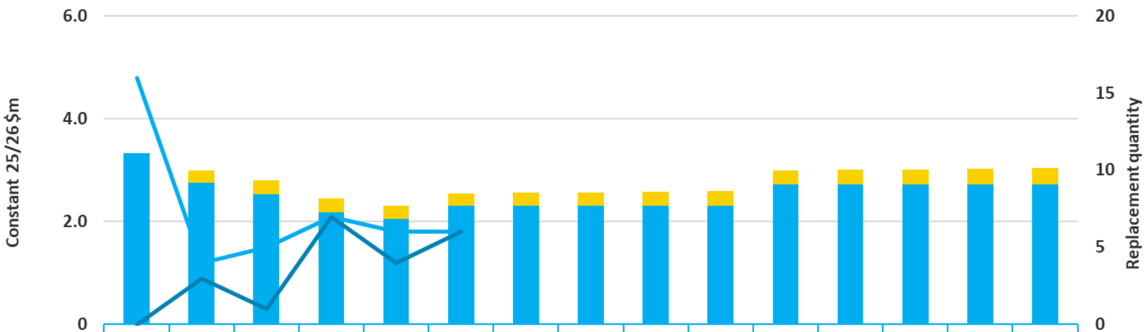
Forecast work and capex

Opex: The total opex forecast is an increase from the current expenditure levels as current expenditure levels are not meeting the general maintenance requirements and we are seeing an increase in access way defects. An increased frequency and intensity of weather events is also resulting in the need for more access way maintenance.

Capex: We are planning an increase in expenditure when compared with historical volumes of work. This change is based on cost and inspections, in particular the recommendations from the 3-yearly water-crossing inspections undertaken by chartered engineers. The forecasted expenditure for RCP4, RCP5, and RCP6 is shown in Figure 104.

The actual costs for bridge refurbishment or replacement are highly variable and depends on the span, the soil type, the height above the waterway, how remote the water-crossing is, etc. Typically, if the watercrossing or access way upgrade is required for a major project, then the replacement or refurbishment will be undertaken as part of the project.

Figure 104: Access ways forecast capex and quantities by year



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Resilience	0.0	0.2	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Accessways	3.3	2.8	2.5	2.2	2.1	2.3	2.3	2.3	2.3	2.3	2.7	2.7	2.7	2.7	2.7
Bridge replacements	16	4	5	7	6	6									
New Tracks	0	3	1	7	4	6									

HVDC

The HVDC system provides a high-capacity connection between the North Island and South Island electricity systems, providing energy security through the ability to access South Island renewable generation as well as enabling the operation of an efficient national electricity market. It also provides dynamic energy transfer response and frequency-keeping services that benefit the electricity market through considerably reduced frequency keeping and reserve costs. The HVDC system is expected to play a key role in compensating for intermittent renewable generation and load patterns going forward. As such the role and service criticality it plays in connecting New Zealanders will evolve along with electrification.

The HVDC system comprises of Pole 2 commissioned in 1992 and Pole 3 commissioned in 2013 with both based on thyristor valve technology. There are converter stations at Haywards and Benmore, cable stations at Fighting Bay and Oteranga Bay, electrode stations at Te Hikowhenua and Bog Roy, three submarine cables that cross the Cook Strait (38km per cable), and an overhead transmission line that connects Hayward to Oteranga Bay and Fighting Bay to Benmore. HVDC converters are used for converting alternating current (AC) to direct current (DC) which is then transmitted through HVDC overhead lines and cables into the other station, where the current is converted back to AC from DC.

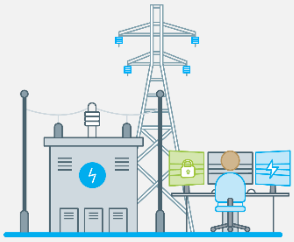
Electrode stations are used to inject or extract DC current between two poles to remote earth/sea electrodes. They facilitate the operation of Pole 2 and Pole 3 with unbalanced currents, or with one pole out of service. Earth return removes the need for another set of conductors between Haywards and Benmore, thus reducing the initial capital cost of the system, maintenance costs, as well as system losses by providing a low resistance current path.

Each converter station consists of many AC and DC assets with some that are unique to the HVDC systems. There are circuit breakers, voltage and current transformers, power transformers including HVDC converter transformers, thyristor valves, valve cooling systems, redundant control systems, backup battery banks, chargers & UPS's, fire protection systems, mechanical ventilation systems, LVAC and DC distribution systems, HVDC harmonic filter banks, other reactive plant such as synchronous condensers, STATCOM, and many other common AC substation assets within HVDC boundaries

The TransGO telecommunications network supports the HVDC protection and SCADA communications service. The in progress TransGO upgrade considers the requirements of these services and is incorporate their modernisation as part of the network refresh. The local IP Network equipment used by HVDC and other Power Electronic systems will be lifecycle managed as part of the wider recurring lifecycle investment.

Asset class snapshot

Population
2 Converter stations
2 Electrode stations
2 Cable stations
3 Subsea cables



Capex
RCP4 (Forecast)
$85.3m

Asset health

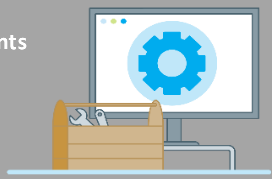
Converter Transformer - 100% Good
Thyristor Valve Hall - 100% Good
Subsea Cable - 100% Good

Work programme (RCP4 and RCP5)

Complete Pole 2 era mid-life refurbishment

HVDC cables & cable station replacements

Control system replacements



Asset Class Strategy

Objective

Our HVDC system is operated safely and reliably, at least lifecycle cost.

Measure:
Annual bi-pole availability greater than 98% for RCP4¸ excluding allowances and exclusions agreed by the Commerce Commission.

Asset Strategy

- Operate the HVDC link safely and minimise environmental impacts
- Maintain high availability and performance of a nationally critical asset
- Enable electrification and renewable generation through sufficient transfer capability
- Optimise asset lifecycle decisions using risk, condition, and whole-of-life cost information.
- Strengthen long-term resilience through capability upgrades, renewals, and diversification.
- Support the transition to more renewables and increased resilience requirements.

The HVDC system forms a critical part of the Aotearoa New Zealand transmission system. The asset components that collectively make up the HVDC system are diverse, experience different environmental operating conditions and redundancy levels, and have different expected lives. Compared with their AC counterparts, the majority of our HVDC assets have been specifically customised and designed for our operating conditions and environment. The specialist nature of the HVDC requires specialist international expertise, specifically designed assets to meet local requirements, type testing, and early supplier engagement.

Our 2024 HVDC Link Upgrade Programme consultation scenarios demonstrated a continuing need for HVDC capacity [21]between the North and South Islands, with increasing use of South Island hydro to firm North Island intermittent generation.

[21] https://www.transpower.co.nz/hvdc-upgrade

Our expectation is that with higher demands on HVDC capacity, the availability of outage windows for lifecycle and life extension work on the HVDC system will be materially reduced. Similarly, HVDC reliability expectations will continue to increase. Our asset management accounts for these effects, including the phasing and packaging of the proposed work.

Our investment planning is based on achieving a 50-year operational life from each HVDC pole by undertaking necessary interventions at the correct times. Our life extension programmes will reduce the whole of-life costs by deferring expensive pole replacement by 20 years or more. Compared with reactive interventions, the life extension work reduces the risks associated with ageing assets in poorer condition and ensures the continued service levels expected by our customers. A Pole 2 and associated AC and HVDC assets (commissioned in 1992) life-extension programme is now under way, with a significant portion that has been delivered in RCP3 and now across RCP4. Our regular maintenance and other interventions supplement the life-extension plans.

Lifecycle – deliver, operate, maintain, decommission and disposal

Interventions for HVDC assets are individually scoped and priced based on asset health and other factors such as safety risks and obsolescence. They are scheduled according to need and resource, availability, while accounting for other work across all six sites. Many HVDC assets and systems have long lead times and can only be replaced during annual HVDC outages. The work requiring HVDC outages are planned to be delivered during the annual HVDC outage to ensure that the annual HVDC availability requirements can be met. Delivery times for larger HVDC projects account for detailed design, procurement, availability of specialised resources, outage planning, electricity market impacts, and coordination with other major works across the HVDC link. This is typically two to three years in duration. Some projects require highly skilled specialised engineering and service provider resources which are obtained through consultants, manufacturers, and service providers from other regions. Engineering support is normally provided internally by HVDC engineers. Due to the unique nature of our HVDC assets, active participation of HVDC engineers during delivery is necessary along with good documentation and training as part of close outs. It is important to ensure that our staffs are well trained to operate and maintain the new assets delivered through the project

We generally plan HVDC outages in summer when the HVDC demand is lowest. Good planning and preparation is required and is undertaken with the industry to ensure HVDC work can be completed without major system impacts.

Regular condition assessments of our HVDC assets are undertaken in accordance with technical specifications. There are online-monitoring systems which enable us to monitor the condition of HVDC assets in near real time. There are several interval-based visual inspections. The PI suite of systems provides condition monitoring, trend analysis, and operational data for the HVDC rotating assets. It is a key input to asset health assessment and forward work planning.

Table 28 outlines the condition assessments we undertake for HVDC equipment.

Table 28: HVDC condition monitoring and tests

Asset type	Measured condition parameters
Majority of HVDC assets	Visual inspections
	Unscheduled UV/Corona camera inspections
	Thermographic checks
Transformers including converter transformers	Dissolved Gas Analysis (DGA) – continuous online monitors and laboratory tests
	Tap changer operations count readings
	Electrical testing such as insulation resistance, power factor, polarisation index and capacitance test
	Unscheduled furans testing
Pole 2 & 3 Buildings	Pole 3 has seismic event and deflection monitoring at Haywards. Both Pole buildings are checked after significant seismic events
Converter stations	Thyristor diagnostic inspections in line with manufacturers requirements + continuous monitoring by the control system
	Monitoring of water conductivity, electrode inspections, flow rates and pressure in valve cooling systems
	Secondary and auxiliary equipment monitoring such as self-check systems
Thyristor stack	Visual inspection of thyristor stacks
	Use of Level Tester for individual Thyristor and TCU checks
Filter bank circuit breakers	Circuit breaker operations count readings

Asset type	Measured condition parameters
	SF_6 gas pressure and quality – readings, quality checks, and low-pressure alarms
	Electrical testing such as insulation resistance and contact resistance tests
	Velocity plot – includes measuring timing of main contacts, closing/opening speeds and closing/opening damping tests
Cable stations	Bushing gas analysis
	Hydrophobicity testing of bushings
	Internal bushing gas pressure readings
Submarine cables	Line Resonance Analysis (LIRA)
	Dive spot checks and surveys
	Remotely operated vehicle surveys and checks
Cable Terminations	Oil Sampling to assess nitrogen contamination
Shore electrodes (THW)	Current sharing tests and resistance measurements
	Lift and clean electrodes of salt deposits
Land electrodes (BGR)	Current sharing tests and resistance measurements
	Resistance measurements
HVDC overhead lines	The maintenance of the HVDC and Earth electrode overhead lines are managed by the Transmission Lines portfolios

Most HVDC assets require special maintenance tasks prescribed by original equipment manufacturers. We also seek feedback from the international HVDC operator community. This information is reflected in our standard maintenance procedures. The majority of the HVDC maintenance work is carried out during the annual maintenance outage.

The maintenance of the HVDC line is covered under Transmission Lines portfolios. In general, HVDC assets require less opex, other than routine maintenance and some predictive maintenance works

The system criticality of the HVDC system demands a highly reliable HVDC system. Replacements, refurbishments and more frequent routine maintenance generally address these requirements which are tightly aligned with annual outage windows.

Our maintenance activities for the HVDC system include activities such as:

- corrosion and defect repairs on primary equipment (i.e. maintenance of converter transformer tap changers, cooling fans, motors, etc.)
- land and shore electrode maintenance
- building maintenance activities such as roof, air conditioning and guttering repairs
- replacement or refurbishment of consumables and high-wear components and parts
- cleaning and water blasting of insulating material.

Where possible and useful, we donate retired equipment to education institutions and we recycle as much of the equipment as possible.

Table 29 provides a view of remaining life by major system component below.

Table 29: HVDC major component life expectancy

Major system component HVDC	Year commissioned	Life expectancy	Planned refurbishment & Cable Replacement	Expected end of life
HVDC Pole 2 converter stations	1992	50	~ RCP 3 & 4(underway)	2042
HVDC Pole 3 converter stations	2013	50	~ RCP 5 & 6	2063
Subsea Cable 4	1992	40	HVDC Link Upgrade Programme	2032
Subsea Cable 5	1992	40	HVDC Link Upgrade Programme	2032
Subsea Cable 6	1992	40	HVDC Link Upgrade Programme	2032
HVDC Control System	2013	20	HVDC Link Upgrade Programme	2032

Asset risk – health and performance

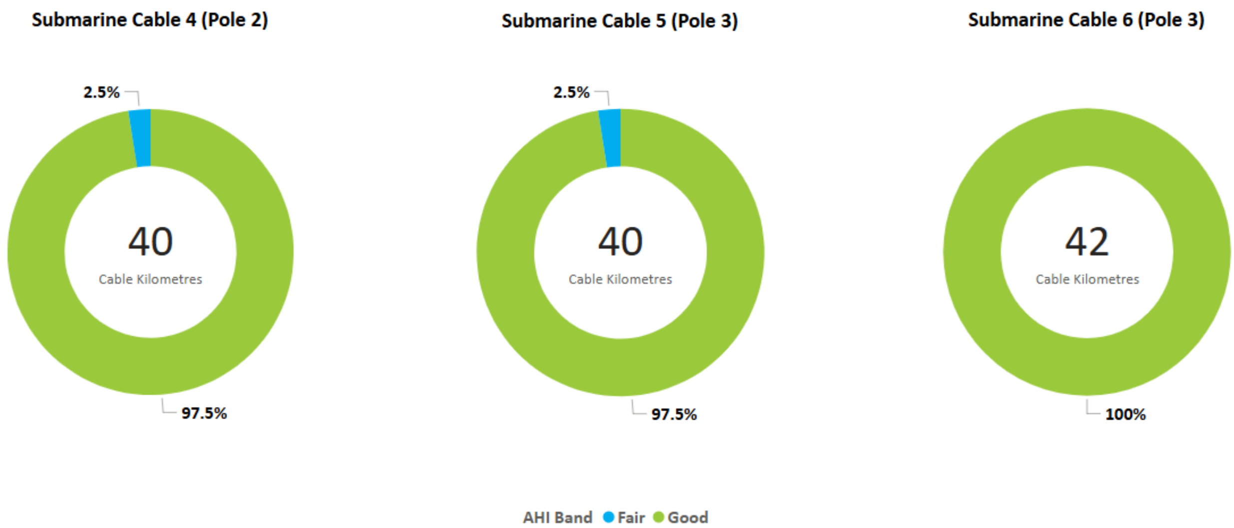
HVDC assets that fit within our wider asset classes such as the HVDC line, circuit breakers, instrument transformers, power transformers and filter banks are included within those existing asset health models. For example, health modelling for HVDC circuit breakers is included within the health model for AC outdoor circuit breakers.

At 13 years into their operational life, most Pole 3 assets are still in relatively good condition and can be reliably maintained with preventive and corrective maintenance.

We have developed an asset health model for HVDC cables that we update regularly when new data is available, which incorporates ageing calculations, annual inspection results and test results to estimate the remaining life of the submarine cables. The current output of the asset health model is in alignment with the 40 year expected operational life of the cables.

Figure 105 shows our asset health modelling indicates that the cables are currently in good condition. However, according to our inspections and asset health data, these cables will reach the end of their operational life around 2032. (this aligns with their design life). Extending their life beyond this date significantly raises the risk of failure, which could disrupt HVDC operations and compromise electricity supply, particularly during dry years when South Island hydro generation supports North Island demand.

Figure 105: HVDC cable current asset health

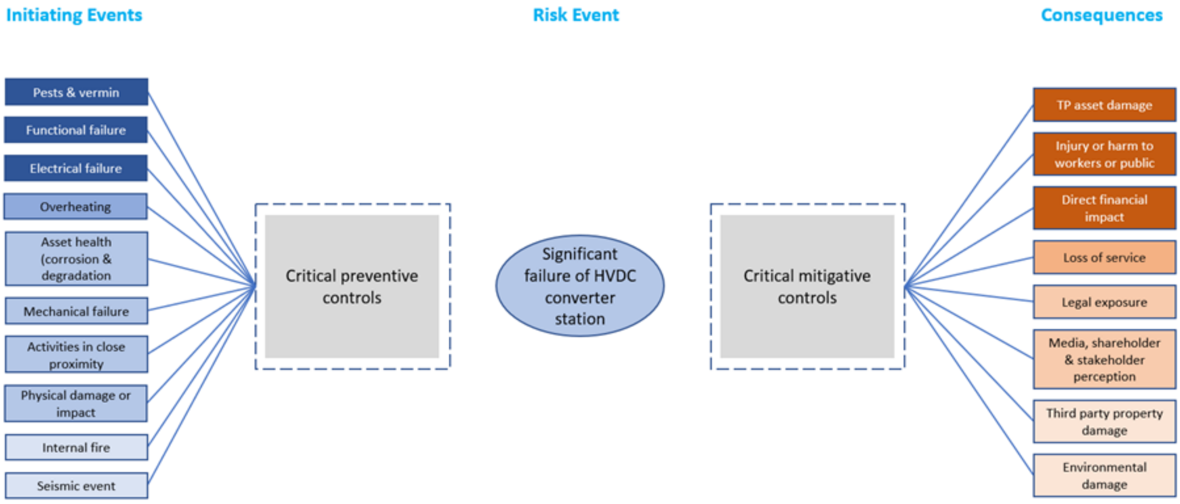


There are also significant synergies in replacing/upgrading the cables as a single campaign due to manufacturing, transport, and installation costs., this is the approach with our planned HVDC Link Upgrade Programme.

Electrode stations and related assets are in good condition. Due to their dynamic operating environment, asset health modelling is not practical for HVDC electrodes. Factors such as electrode line current, direction of the HVDC flow, resistivity of the surrounding area, and weather events affect the degradation of electrodes.

Our HVDC Converter Station consolidated simplified bow-tie as shown in **Figure 106** informs us of the most likely causes of failure, along with the most likely resulting consequences of the failure.

Figure 106: HVDC Risk Bowtie



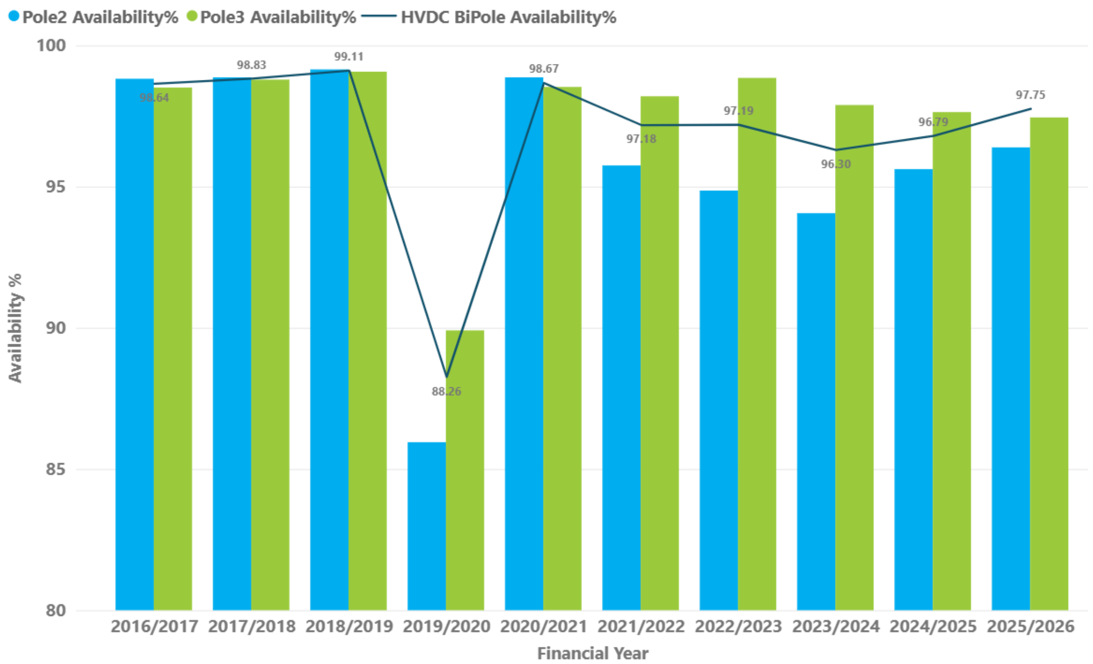
The predominant causes for HVDC system failures are functional failures such as control system issues or auxiliary system failures, overheating, corrosion and material degradation, electrical failures such as insulation failures, mechanical failures, third-party activity close to assets, pests and vermin damage, and natural causes.

The critical preventative controls implemented to reduce the likelihood of failure event includes redundancy, lifecycle planning, monitoring, inspections and testing, quality assurance during the original installation, procurement specifications, maintenance activities, and staff and contractor competency management. Media and stakeholder engagement and regular patrolling of the cable protection zone are critical controls for managing the risk to Cook Strait submarine cables.

Our mitigative control activities include a range of approaches to ensure we respond well to unexpected events. Our readiness plans for HVDC ensures we have an adequate level of emergency preparedness. This includes holding of emergency spares, tool and equipment, support agreements, and maintaining specialist contracts for short notice emergency work.

Cable stations require ongoing refurbishment work to ensure their reliable operation with the associated cable seal ends housed within these stations, until they are replaced with the proposed HVDC Link Upgrade Programme.

Figure 107: HVDC performance



Maintenance requirements associated with AC assets also apply to inspections and testing, quality assurance during the original installation, procurement specifications, maintenance activities and staff and contractor competency management. Media and stakeholder engagement and regular patrolling of the cable protection zone are critical controls for managing the risk to Cook Strait submarine cables. The availability of the HVDC link varies from year to year, due to the number and length of planned and forced outages. Overall, the HVDC link has achieved world-class levels of availability since it was commissioned. shows the annual availability of the HVDC link since 2015. The reduced availability across a)2019/20 is due to HVDC line reconductoring during February 2020 and b) 2021/24 is due to Pole 2 life extension work, extended outages.

Pole 2 life extension work was planned to maintain the high availability target of 98% going forward. Without this life extension work, the probability of forced outages per annum exceeding the 0.25% target would increase significantly with the ageing of Pole 2 era assets. This life extension work will also defer the more costly replacement of Pole 2.

Forecast work and capex expenditure

Opex: The majority of the opex forecast covers HVDC cable surveillance and operational support. Cable station assets also require frequent corrective intervention due to harsh coastal conditions. General testing and maintenance requirements associated with AC assets also apply to many HVDC assets. Refurbishments and major interventions on most HVDC assets are not feasible or cost effective. A failure of the HVDC system will affect the entire network rather than a small region or a site. Similarly, there is only one annual outage which is used for maintenance and capex work. Therefore, replacements are often necessary to maintain the required level of availability and reliability.

Opex projects such as investigation projects, condition assessments, major refurbishment of tap changers, reactors and circuit breakers are planned for condition improvement of assets. The opex expenditure is covered in detail in the Maintenance Asset Class Plan.

Capex: RCP4 expenditure covers the continuation of Pole 2 mid-life refurbishment programme after the refurbishment of the more significant assets in RCP3. We anticipate that the increased cost of procuring specialist HVDC plant due to increased worldwide demand, will lead to additional expenditure beyond what we have estimated in RCP4. To manage overall expenditure, we will prioritise our RCP4 workplan following detailed condition assessment and defer less urgent interventions into RCP5.

A significant portion of the Pole 2 life extension programme has been delivered in RCP3. The replacement of the remainder of Pole 2 era primary AC assets such as interventions to reactive support plant, addressing obsolescence issues, refurbishment of remaining auxiliary systems, interventions to some Pole 3 era assets and systems such as the communication and fire systems are planned for RCP4.

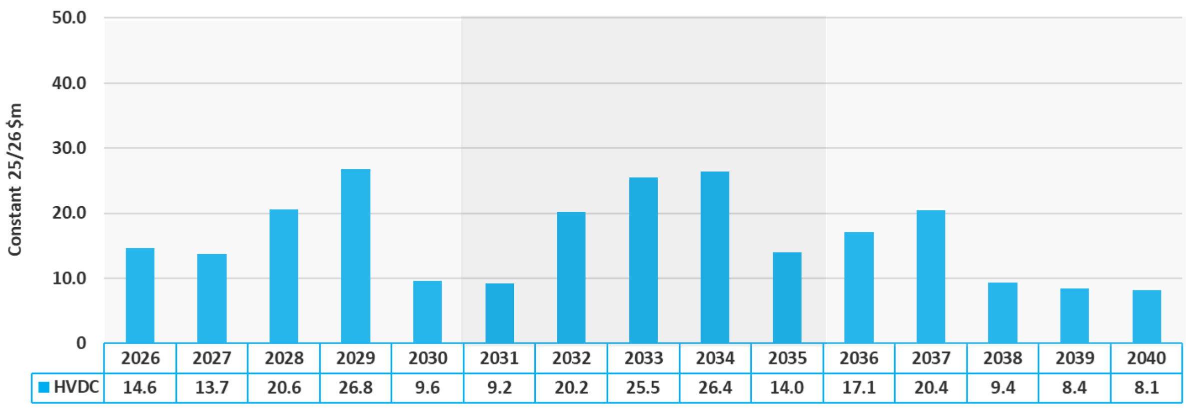
As Pole 2 interventions revert to routine minor work following the life extension programme, major interventions to Pole 3 era assets and secondary systems will commence in RCP5 and will continue across RCP6. Planning is commencing to identify and assess options for the anticipated Pole 2 end of life replacement, expected within the RCP7 period.

The HVDC Link Upgrade Programme was submitted to the Commerce Commission as a major capex proposal and received approval in 2026, with a total approved value of $1.1 billion. The programme is planned for delivery in RCP5 and includes:

- Undersea cable supply and install (1400MW)
- Cable Termination station upgrades
- HVDC control system replacement
- Benmore filter bank upgrade
- Pole 2 overload scheme
- Cable storage facility
- Recovery of decommissioned cables

Figure 108 shows the HVDC capex forecast until RCP6, excluding MCP funded HVDC link upgrade programme expenditure.

Figure 108: HVDC forecast capex, excluding any HVDC link upgrade programme expenditure



Reactive assets

Our reactive assets incorporate:

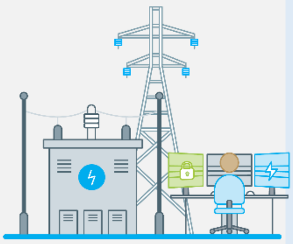
- Synchronous condensers
- SVCs and STATCOMs
- Capacitor banks and reactors

We use switched capacitor banks and reactors to provide most of the reactive power support required for the network. To ensure stability under transient or abnormal conditions, the system also requires fast-acting sources of dynamic reactive power. This is provided by the synchronous condensers, SVCs, and STATCOMs.

Asset class snapshot

Population

395 Reactors
65 Capacitor banks
8 Synchronous condensers
9 STATCOMs
3 SVCs



Capex

RCP4 (Forecast)

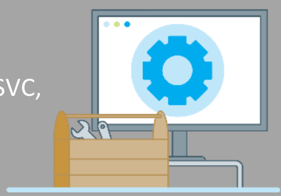
$118.0m

Reactor asset health 2025

- 81.8% Good
- 14.4% Fair
- 2% Poor
- 1.2% Very Poor

Work programme (RCP4)

Capacitor bank replacements, SVC, STATCOMs and synchronous condensers 'refurbishments.



Asset class strategy

Objective

Safe and reliable operation, at least whole-of-life cost.

Measures

- Fewer than 10 unplanned outages per year caused by capacitor banks and their components at lowest lifecycle cost.
- 98 percent or better availability of SVCs and STATCOMs and fewer than three forced and fault outages each year from each SVC or STATCOM.
- Five-year average annual availability greater than 91.0 per cent for each Haywards synchronous condenser, including planned unavailability of 5.7 per cent or less and unplanned unavailability of 3.5 per cent or less.

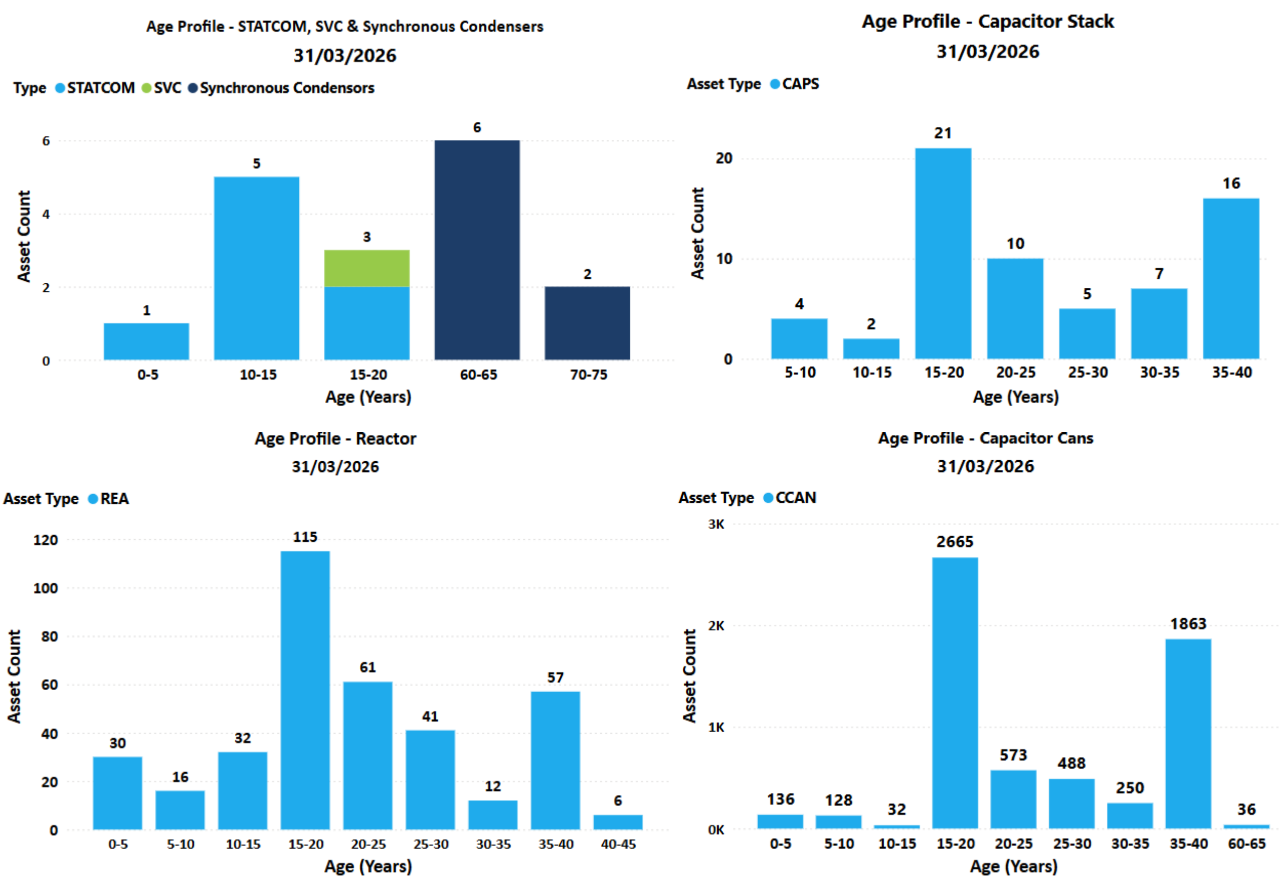
Asset strategy

- Replace capacitor banks and reactors when they satisfy replacement criteria and refurbish capacitor banks and reactors to extend their lives where they are not replaced.
- Undertake half-life refurbishments on SVCs and STATCOMs (typically 20 years) to ensure that the main plant can achieve reliable operation until the end of its engineering life.
- Undertake major overhauls to extend the life of the synchronous condenser main units, typically at 15- to 20-year intervals, or based on condition.

- Investment need is primarily based on addressing capacitor can failures on ageing and deteriorating capacitor banks, addressing obsolescence and high risk of failure due to ageing of control systems, and improving synchronous condenser availability as well as minimising the risk of failures, addressing control and auxiliary system assets reaching end of life, and undertaking life-extension work on reactors.
- The portfolio is arranged round the provision of reactive support to the network rather than a single asset type. As well as the portfolio-specific assets (e.g. synchronous condenser machines), there are many other components within the reactive device that are the same as those in other portfolios (e.g. protection relays, batteries). For these items, we follow the strategies and maintenance methods of the main portfolio.
- We consider the replacement of whole reactive devices when planning major works on individual assets to ensure that we balance the overall continuing need for the plant. This includes costs for partial replacement and the increased maintenance costs towards end of life with the capital cost for a complete replacement of the whole plant.
- The forecast greater reliance on grid infrastructure with electrification increases the need for reliable reactive equipment. To support voltage stability, reactive power controllers are needed to manage these assets, power quality monitoring and maintaining voltage within the Electricity Industry Participation Code requirements. SCADA ensures this equipment can be monitored and data retrieved, controlled, and managed by the System Operator.
- The PI suite of systems is used for monitoring the assets, including the health of the capacitor banks and our telecommunications equipment such as switches and terminal servers for the SVCs and STATCOM assets.

The population and age profiles of our reactive assets are shown in **Figure 109**.

Figure 109: Reactive assets population and age profiles



Lifecycle – deliver, operate, maintain, decommission, and disposal

Delivery times for reactive power assets include allowance for detailed design, procurement, outage planning, and coordination with other major works at the site. It typically takes 1-2 years to

complete this work and can be much longer (>5 years) for larger programmes.

We plan and manage outages in a way that creates a safe environment for employees while minimising the disruption for customers.

Dynamic reactive power assets require specialised maintenance to be carried out during the warranty period. These requirements along with operation experience during the warranty period form the basis of standard maintenance practices following the warranty period.

We have online monitoring systems that monitor the condition of key assets in real time. We also undertake visual inspections and thermo-vision inspections for early detection of potential issues.

Synchronous condenser can include visual and thermal inspections as well as electrical, mechanical, bearing oil, and gas tests, at 3-monthly, yearly, 2-yearly and 4-yearly equipment service intervals. We have installed several smart monitoring systems to continuously monitor the condition of the synchronous condensers. We carry out internal inspections of the synchronous condensers 4-yearly to ensure reliable operation by identifying issues in advance.

Capacitors and reactors have 4-yearly (HVDC assets) or 5-yearly (HVAC assets) electrical testing and inspections to monitor signs of corrosion, paint peeling, leaks, loose terminations, or physical deformation. These issues are addressed as part of our maintenance activities.

For most of our STATCOM installations, CA is still carried out as part of the warranty reporting process. Detailed service specifications and standard maintenance procedures have been developed for for SVCs and STATCOMs, and more are planned to reflect what we have learned about these relatively new assets during the inspections completed to date.

Disposal of used capacitor cans and other oil-filled assets follow our standard protocols.

Asset risk – health and performance

Figure 110 and **Figure 111** show the current health of our synchronous condensers and reactive capacitors.

Figure 110: Synchronous condenser current asset health

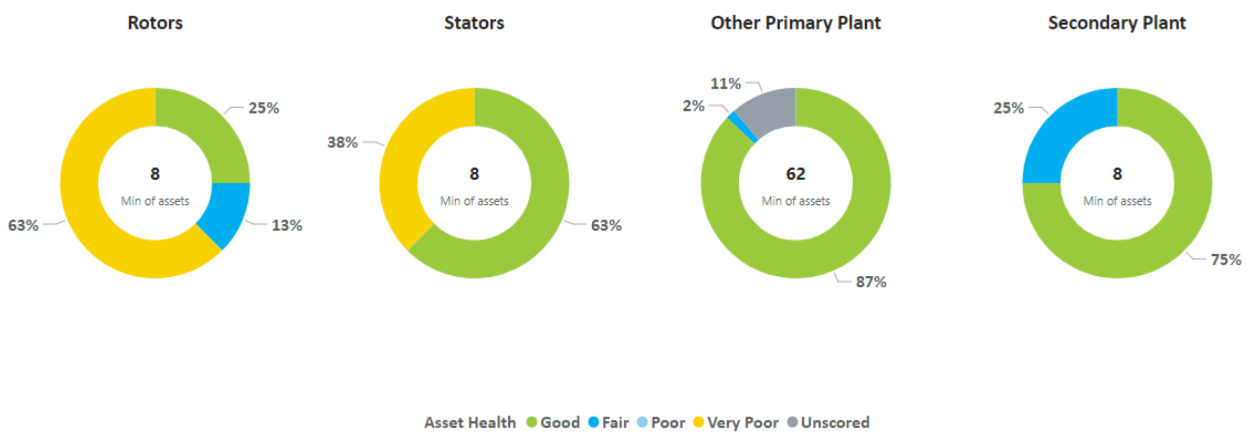
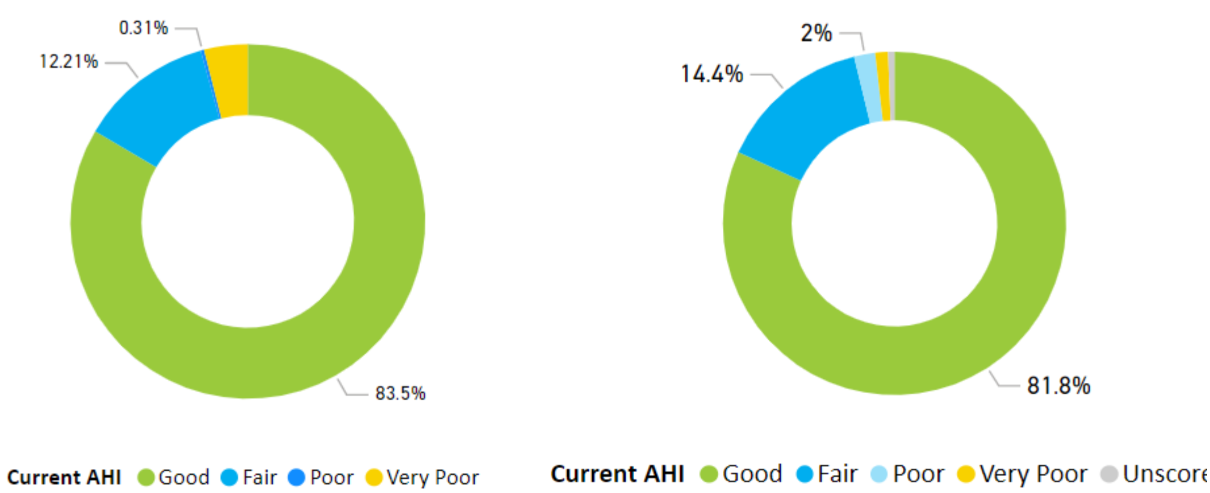


Figure 111: Capacitor(left) and Reactor (right) current asset health



The predominant causes for reactive and synchronous condenser asset failure are:

- Corrosion and degradation of electrical insulation, protective paintwork, hydrogen pipe work, hydraulic systems, auxiliary system components, seals, and connections leading to a loss of service Mechanical failures of components such as rotors, motors, cooling systems, racks, reactors, switches, etc., causing loss of service
- Electrical failures such as insulation degradation due to ageing or overloading, failure of electrical components, or electrical faults leading to loss of service
- Functional failure such as software failure, malfunctioning, configuration issues of control system software and/or auxiliary systems that could lead to major failures depending on the failure mode.

The combined likelihood of electrical, mechanical, and functional failure increases relative to the age and condition of the asset.

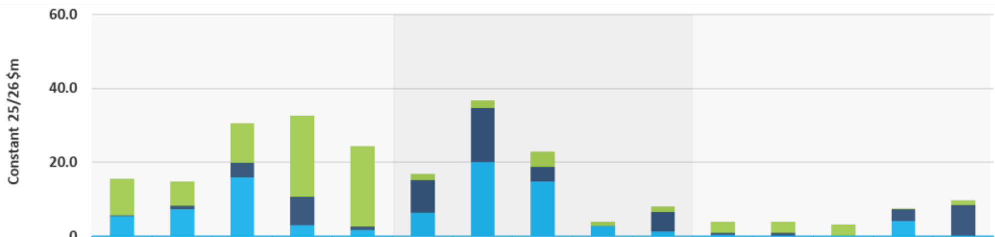
The key preventive controls critical to reducing the likelihood of a failure event are:

- routine inspection, maintenance, testing, and treatment
- operating environment and temperature control
- alarms and monitoring.

Forecast work and capex

Figure 112 shows the capex forecast.

Figure 112: Reactive assets forecast capex and quantities



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
HVDC Synch Condensers	10.0	6.6	10.7	21.9	21.7	1.8	1.9	4.3	1.2	1.4	3.0	2.9	3.0	0.2	1.4
ACS Capacitors & Reactors	0.2	0.8	4.0	7.7	0.9	8.8	14.7	3.8	0.0	5.3	0.6	0.9	0.0	3.1	8.2
ACS Dynamic Reactive Power	5.4	7.4	15.9	3.0	1.7	6.4	20.0	14.9	2.8	1.4	0.4	0.1	0.2	4.2	0.2

Several of the oldest capacitor banks are at end of life and will be replaced in RCP4.

To support the current 1200MW HVDC capacity requires all eight existing synchronous condensers and the STATCOM at Haywards in service. A reduction in the available synchronous condensers can have an impact on the HVDC transfer and the operation of the electricity market. Our recent Net Zero Grid Pathway scenarios demonstrate a continuing and growing need for HVDC capacity between the North and South Islands. This requires the associated availability of the synchronous condensers to support higher HVDC transfer levels to firm North Island intermittent generation. As part of the Net Zero Grid Pathway 1.1 programme, a new second STATCOM is to be installed at Haywards, to increase the availability of reactive equipment. This installation supports both the current maximum HVDC transfer level of 1,200 MW and the future 1,400 MW transfer capability following replacement of the existing three cables and installation of a fourth.

We are carrying out major refurbishments on the synchronous condensers and their auxiliary systems between 2025 and 2030. It has been approximately 20 years since the last major refurbishment occurred. This work is supported by the associated health model and is to ensure they have a high availability and that these units remain operational until at least 2042 when Pole 2 is forecast for replacement at which point, we will review the need to retain all of them.

The scope of these interventions is difficult to fully assess while the synchronous condensers remain in operation. To manage this risk, we have performed an invasive scoping investigation to better understand the scope and costs of the refurbishment work.

We are investigating what is needed to bring the Synchronous Condenser hydrogen systems up to modern standards, for process safety requirements where flammable gasses are present.

A mid-life refurbishment of the first SVC asset was completed during RCP3. The second SVC refurbishment is currently in project delivery, with work completing in RCP4. The third SVC refurbishment is expected to be undertaken towards the end of RCP4.

We have an ongoing expenditure of replacement of auxiliary systems such as batteries and chargers when they meet the replacement criteria in the associated asset strategies.

There are only a small number of qualified suppliers of dynamic reactive equipment. We are seeing that, as the worldwide demand for reactive equipment increases with renewable investment, the price for such equipment is currently increasing ahead of inflation. This is lifting the cost of asset investments, replacements, and components, as well as increasing the procurement lead times.

Secondary Assets

Our secondary assets support the overall operation of the grid and provide essential services for the monitoring and control of equipment. The Secondary Assets Portfolio is covered by four asset classes:

- Substation management systems
- Protection schemes
- Revenue, Local Service & Power Quality Meters
- Station DC supplies.

Substation Management Systems (SMS)

SMS refers to the systems that enable real-time monitoring and remote control of the equipment at our substations. These telemetry and control systems are based on specialised electronics that have been specifically designed to operate in substation environments. They communicate directly with Transpower's SCADA/energy management system (EMS) and therefore SMS reliability is essential to maintaining visibility and control of the power system.

Our main programme of work focuses on phasing out legacy serial-based RTU and input/output modules and replacing these with new ethernet-capable substation management platform systems. This new technology also includes remote engineering access (which allows us to interrogate and manage secondary systems without needing to be on site) and human-machine interface (HIM) capabilities (which provide local situational awareness and direct control over the site's assets). This body of work will be completed by the end of 2026.

We use a full SMS solution, as this approach leads to reduced lifecycle costs and provided the business benefits associated with remote engineering access services (quicker site restorations) through the ability to remotely work on devices reducing the need to travel to site. SMS implementation at all sites will be completed by 2026, with the roll out of duplicated SMS Gateways continuing into RCP4.

Protection

Protection schemes are used throughout the grid to rapidly detect and initiate isolation of electrical faults, protect primary equipment, and ensure the safety of employees, service providers and the public. As network loading increases, there will be more use of complex protection schemes to enable effective management of the power system within stability limits, including management of over voltages, fast-acting load management, and reactive power control. These schemes are in turn dependent on additional protection-grade communications. Accordingly, Grid and Information Services and Technology (IST) teams have been working together to plan this need from RCP4 as the TransGO wide area network (WAN) is a critical enabler of technology solutions as covered above.

The useful life of protection schemes depends on the type of protection relays, i.e. typically 20-25 years for numerical or microprocessor-type relays and 35 years for electromechanical or static type relays. Included as part of protection schemes and re-used when protection is replaced, are ODJBs that marshal secondary cabling between the primary equipment in the outdoor switchyard and the protection equipment in the control and relay room.

The forecast is based on the replacement of all protection schemes at the end of their expected useful lives or aligned with replacement of primary plant, and installation of new protection schemes.

Revenue, local service and power quality meters

A metering system or scheme is a group of secondary system assets used for monitoring and recording system conditions on power systems.

Revenue meters supply electricity volume information and are used for wholesale market reconciliation and billing. Revenue meters are typically replaced at 12 years and this will be aligned to the 3-yearly maintenance cycle. Local service supply meters are installed to record the local service load that Transpower uses within a substation. Power quality meters are used to provide a baseline harmonic fingerprint prior to new non-linear generation connections proceeding.

The forecast is based on the replacement of all meters at the end of their expected useful lives.

Station DC systems

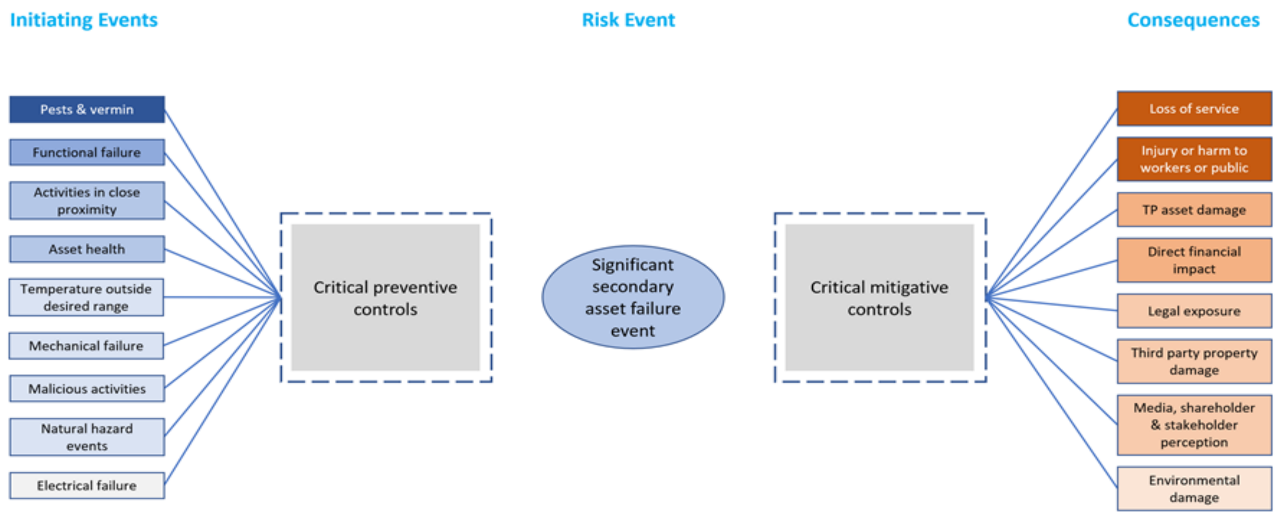
Station DC systems are required to provide power to protection schemes during normal operation and island-wide blackout scenarios, circuit breaker trip and close coils, control, and metering. Station DC batteries have a typical life that ranges from 8 to 12 years and the life of station DC chargers ranges from 20 to 30 years. Both 125V DC grid station batteries and ICT 48V DC communications, control, and indication batteries are needed to provide greater capacity and resilience for the System Operator black-start procedures to work. Therefore, both the grid and the IST teams have been working together to ensure planning and delivery targets of these batteries are aligned to ensure we have the necessary capability.

The number of station DC batteries, chargers and equipment coming due for replacement in RCP4 compared with RCP3 has decreased.

Consolidated simplified bow-tie

We have developed a simplified bow-tie describing a significant secondary asset failure event, as shown in **Figure 113**.

Figure 113: Significant secondary asset failure event simplified bow-tie



Our secondary ACPs advise the predominant likely causes of each asset class failure and the critical controls that we have implemented to reduce the likelihood and resulting impact of a failure.

Our risk modelling has identified the preventive and mitigative controls required to reduce both the likelihood and consequence of a significant secondary asset failure event.

Our preventive controls for protection assets focus on effective lifecycle management, procurement and obsolescence strategies, workforce competency, predictive modelling, performance monitoring, and strategic interventions to replace assets before failure rates become unacceptable.

Our mitigative controls include system redundancy, emergency spares, incident and emergency management plans, specialist response arrangements, and contingency measures that support rapid restoration following unexpected failures.

Technology dependencies between grid and IST assets

The grid asset technology has evolved over time to the point where the boundaries are intertwined with IST assets, requiring ongoing compatibility as assets are replaced and interface boundaries change. For example our RCP3 48V DC refresh programme in the Telecommunications, Network and Cybersecurity portfolio was to support the 125V DC grid black start carryover times required across the country. This refresh ensured that the network and secondary systems equipment connected to the 48v DC power supplies would still be provided with power during a localised power cut.

In RCP4, we are investigating the modernisation of our TransGO WAN assets in line with the TransGO Refresh sub-strategy. Our underlying fibre network will be retained while the telecommunications equipment supporting all our services including our critical SCADA and HV line protection systems, will be modernised.

The TransGO network will have the capability of supporting the delivery of precision time services (based on PTPV2 IEE 1588) to help support our increased reliance on an accurate time source as we digitise our substations.

Risks and uncertainties

The increasing use of complex protection schemes helps provide an interim solution to manage the time required before the investment in and commissioning of additional grid assets.

Complex protection schemes require greater protection grade communications. Therefore, both the grid and the ICT teams are working together to ensure planning and delivery targets of these systems are aligned to ensure we have the necessary capability.

There is an increasing use of ICT services in our substations, resulting in a growing level of sophistication, complexity, and potential operational threats that together the grid and IST teams have initiatives on. Our cybersecurity investment into operational technology (OT) protects our internet enabled devices (IEDs) from security breaches, which enables secure local then remote configuration of devices, password authentication, monitoring who has accessed devices, and active threat monitoring of devices on the substation local area network (LAN). The benefit of remote configuring is that it reduces the operational costs to maintain these assets, reduces our carbon footprint by avoiding travel to site, and provides a safer environment for our service providers.

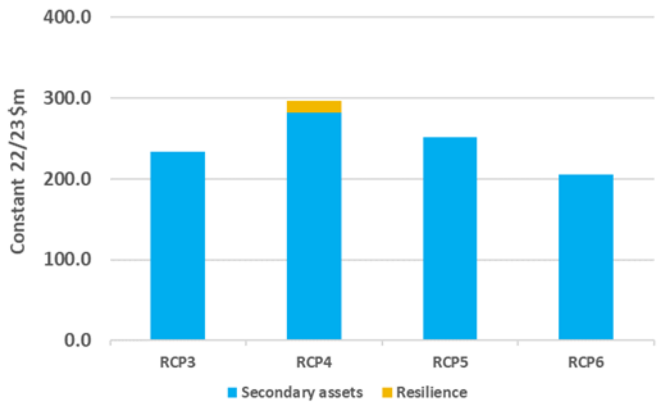
Other key uncertainties associated with this portfolio relate to 'brownfields' sites, which constitute the majority of the planned and unplanned work. Existing site legacy constraints and defects often require rectification before the deployment of deliverables can commence. The cost of such rectification is unique to each site and can impact significantly on the overall project cost, the scale of which is difficult to estimate in advance.

With the forecast electricity demand to meet Aotearoa New Zealand's de-carbonisation goals, the need for new substations continues to grow. To meet this need and provide benefits to our customer-funded investments, we now have a digital substation protection, automation, and control solution for greenfield substations. The next stages are to progress a solution for our existing brownfield sites, where we expect the solution to be cost neutral, avoid legacy issues as well as reducing inadvertent protection trips associated with testing and calibration. We currently have a wave of protection lifecycle replacements in the pipeline, so it is timely to make this change.

Expenditure forecast

Figure 114 shows the secondary assets capex in each RCP.

Figure 114: Secondary systems forecast capex



The RCP4 programme focuses on replacing protection schemes coming to the end of their expected life and bringing protection schemes up to standard to meet the Benchmark Agreement fault clearance times through new bus zone and line protection installations. The programme also improves grid resilience by enabling and enhancing auto-reclose functionality and VT selection schemes. ODJB replacements have been aligned to associated protection projects, with inclusion based on a combination of age and available condition information/asset health.

For SMS, the major RTU to SMP upgrade programme is complete, with RCP4 transitioning to lifecycle replacements, legacy mimic panel removal, and deployment of an improved telemetry data management framework.

The Secondary Assets expenditure in RCP4 has increased compared to RCP3, driven by a continued increased volume of assets across the majority of asset types within portfolios coming to end of life combined with the Benchmark Agreement remediation work and allowance for secondary cabling costs.

Asset class plans

The following sections describe in more detail our asset management approach for each of the asset classes. These ACPs describe the strategy, asset characteristics, management approach and expenditure profile for each asset class. The expenditure covers the capital requirements, along with any specific maintenance projects to be undertaken.

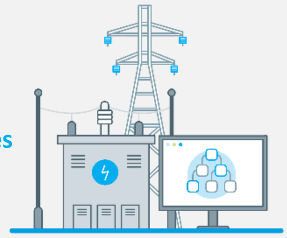
Protection

Protection schemes are used throughout the grid to rapidly detect and initiate isolation of electrical faults, protect primary equipment and ensure the safety of employees, service providers, and the public. As load increases, to fully utilise the grid there will be the addition of more complex protection schemes to increase capacity, an example of this is using special protection schemes (SPS) to enable greater power flow in the existing primary equipment. Their use can delay the need for more expensive solutions like installing new primary assets or replacing existing primary assets. Included as part of protection assets are ODJBs, which marshal secondary cabling between the primary equipment in the outdoor switchyard and the protection equipment in the control and relay room.

Asset class snapshot

Population

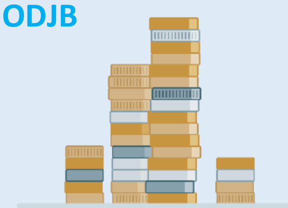
2,646 Protection schemes
1,517 Outdoor Junction Boxes



Capex protection and ODJB

RCP4 (forecast)

$252.6m



Protection asset health

- 73% Good
- 18% Fair
- 6% Poor
- 3% Very Poor

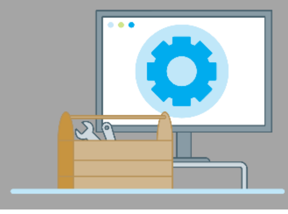
ODJB asset health[22]

- 56% Good
- 11% Fair
- 11% Poor
- 17% Very Poor

Work programme (RCP4)

529 Protection schemes

265 ODJBs



Asset class strategy

Objective
Safe and reliable operation, at least lifecycle cost.

Measure
Number of protection technician human error incidents resulting in unplanned outage to be less than 10 per annum on a five-year rolling average.

Asset strategy

- Replace relays on obsolescence or endemic failure, subject to a maximum life expectancy of 20–25 years for numerical and microprocessor relay schemes and 35-40 years for electromechanical and static relay schemes.
- Replace ODJBs when maintaining them is no longer practical or cost effective.

Investment needs are determined by age, except for ODJBs, which are replaced when their age and condition make them uneconomical to maintain. Life expectancies for protection schemes and relay types range from 20 to 25 years for microprocessor and numerical relay schemes and from 35 to 40 years for electromechanical and static relay schemes.

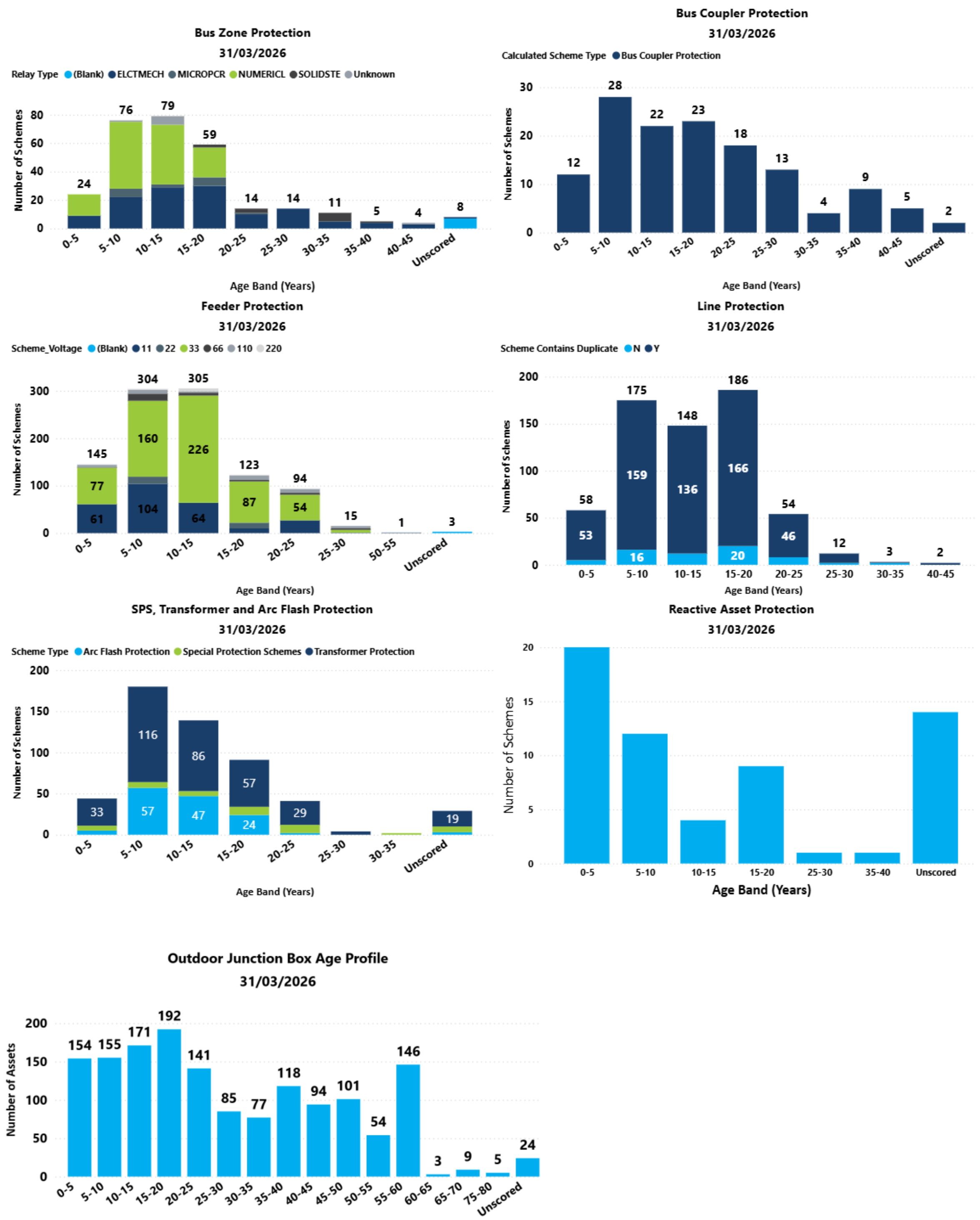
[22] The current ODJB asset health index is based on the age of the assets only.

The only option is to replace the asset, as refurbishment is not cost effective. The exception to this is if the CA of the ODJB determines it can be refurbished cost-effectively verses replacement.

The need for SPS will likely increase as we enable electrification of the economy and assist with meeting Aotearoa New Zealand's decarbonisation targets. Investment need is also age-based replacement. The SPS older than 25 years have static or electromechanical relays and will be replaced later in RCP4. The majority of arc flash protection remain within their expected useful life, however some of these schemes will be coming to their end of life in RCP4.

The population and age profile of our protection schemes are shown in **Figure 115**.

Figure 115: Protection and ODJB population and age profile



Lifecycle – deliver, operate, maintain, decommission, and disposal

Delivery times for new protection schemes is typically 3 years. This includes allowance for scoping (1 year) followed by detailed design, procurement, outage planning, and coordination with other major works at the site over the next 2 years.

We plan and manage outages in a way that creates a safe environment for employees while minimising the disruption for customers.

All protection assets are visually inspected annually. The functionality of protection schemes is regularly tested at 4 years for schemes with electromechanical, static and microprocessor relays, and 10 years for schemes with numerical relays. CAs are generally binary pass/fail assessments – some of which are self-monitored, with failure resulting in replacement.

Due to the modular nature of the assets, there are no corrective or predictive maintenance activities undertaken. The exception is that we undertake predictive maintenance on ODJB assets, based on visual inspections and CA. Preventive maintenance activities are limited to the inspection regimen.

Decommissioned protection schemes are disposed of in an approved manner. Some are retained as strategic spares, especially for the relays that are no longer manufactured.

Asset risk – health and performance

Figure 116 shows the current asset health of our protection assets and the forecast health at the end of RCP4 with investment and without investment. Our protection assets are housed within control and relay buildings; thus, corrosion is of minimal concern. The two major factors contributing to deteriorating health for protection assets are age and any design, manufacturing, or batch-type issues.

Figure 116: Protection asset health

Figure 117 shows the asset health of our ODJB population.

Figure 117: ODJB current asset health

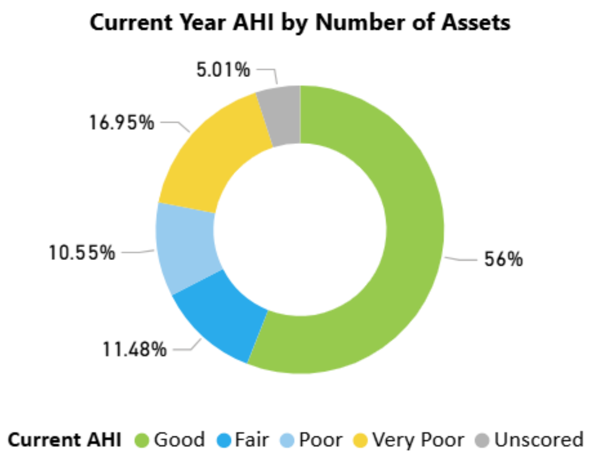
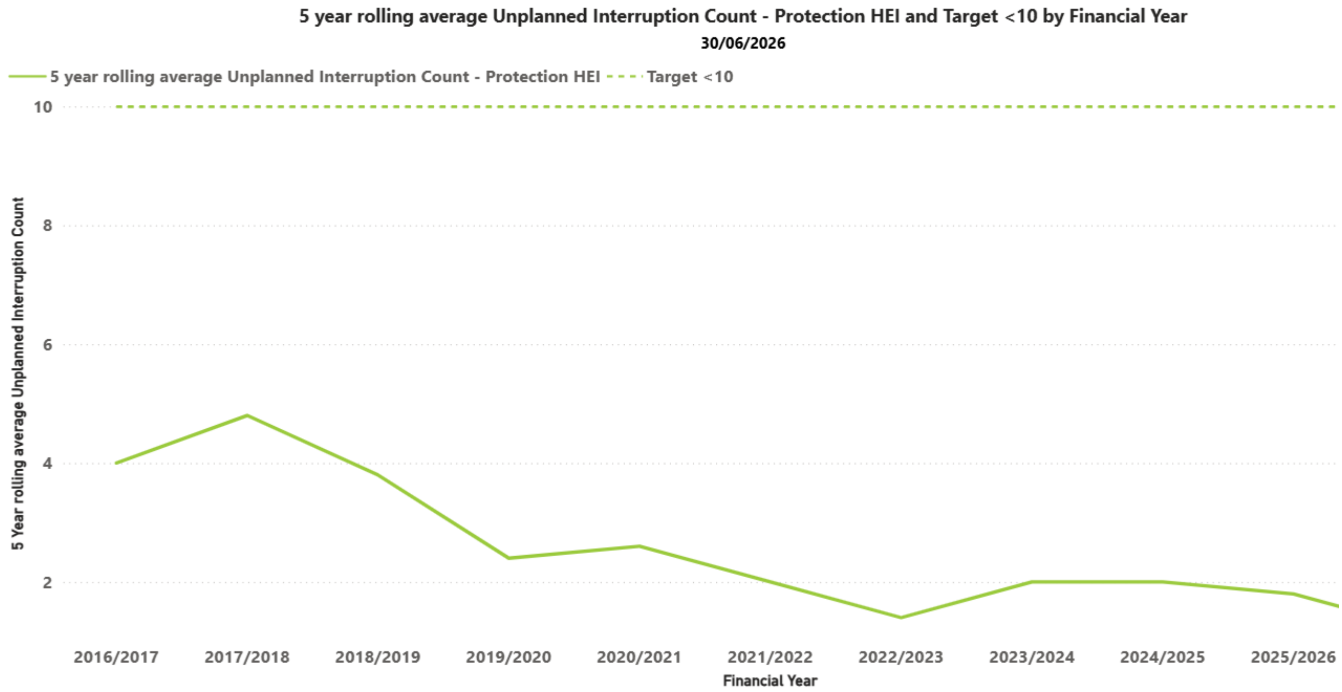


Figure 118 shows the 5-year rolling average of the number of protection technician human error incidents resulting in unplanned outages.

Figure 118: Protection performance



The predominant failure causes for our protection scheme assets are functional failure caused by software, firmware, configuration issues; mechanical failure caused by cable failure, test switches, or relay contacts fail to close/open; and electrical failure caused by loss of hardware component or power supply failure. The combined likelihood of functional, mechanical, and electrical failures increases exponentially with the age of the asset.

The three key preventive controls that are critical to reducing the likelihood of a service failure event are:

- Replacing all assets in a timely manner
- Increasing system redundancy where appropriate to minimise the impact of unavoidable failures
- Monitoring real-world failure rates and adjusting replacement timeframes accordingly.

The performance of protection schemes is categorised as either human error incidents or performance of protection schemes during unplanned outages incidents.

A significant proportion of human error incidents arise from human error during on-site work, or from incorrect settings being applied in the protection relay.

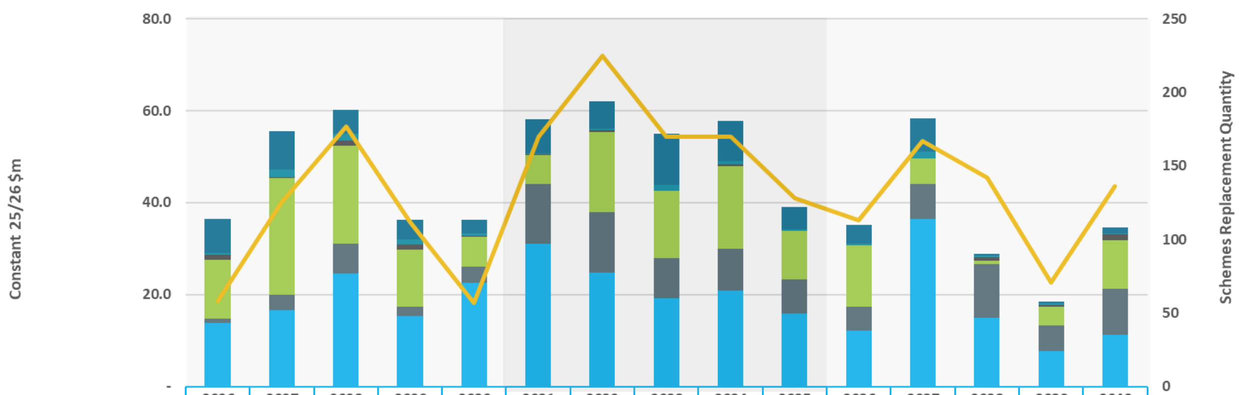
Our protection human error incidents are trending downwards. Factors attributed to this include our nationwide service provider training, information sharing events, improved visibility through modern SMS equipment, and improved standard designs.

The overall performance of our protection schemes is generally good.

Forecast work and capex

Figure 119 shows the expenditure and deliverables forecast for protection schemes.

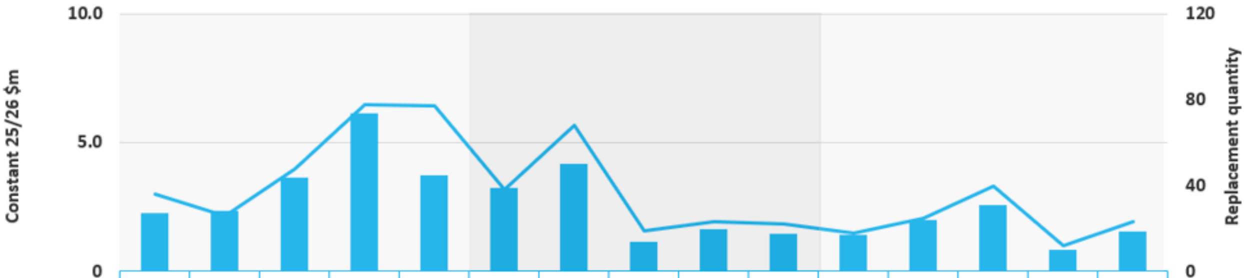
Figure 119: Protection forecast capex and quantities by year



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Transformer Protection	7.5	8.4	5.3	4.2	2.9	7.4	6.0	11.2	8.8	4.9	4.1	7.1	0.3	0.5	1.2
Special protection	0.4	1.6	1.5	1.2	0.5	0.2	0.3	1.2	0.7	0.3	0.3	1.4	0.5	0.2	0.2
Reactive protection	1.0	0.2	1.0	1.1	0.1	0.1	0.4	0.0	0.4	0.0	0.0	0.0	0.7	0.4	1.5
Line Protection	12.8	25.4	21.4	12.4	6.6	6.4	17.5	14.6	18.0	10.5	13.4	5.6	0.7	4.1	10.5
Feeder Protection	0.9	3.4	6.4	2.0	3.5	12.9	13.1	8.8	9.1	7.5	5.2	7.7	11.7	5.5	10.0
Bus zone protection	13.8	16.6	24.7	15.4	22.6	31.2	24.8	19.2	20.8	15.8	12.2	36.4	15.0	7.7	11.2
Protection schemes qty	58	125	177	112	57	170	225	170	170	128	113	167	142	71	136

Figure 120 shows the capex and deliverables forecast for ODJBs.

Figure 120: ODJB forecast capex and quantities by year



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
ODJBs	2.3	2.4	3.7	6.1	3.7	3.3	4.2	1.1	1.6	1.5	1.4	2.0	2.6	0.8	1.6
ODJBs qty	36	26	48	78	77	38	68	19	23	22	18	25	40	12	23

The forecasts are based on the replacement of all protection schemes at the end of their expected useful lives or aligned with replacement of primary plant for efficiency.

The total forecast expenditure in RCP4 increases compared with RCP4 Submission costs due to:

- Increase in costs due to a global increase in demand for materials, equipment and skilled labour
- A number of rollovers, with significant expenditure, from RCP3 into RCP4 due to resource constraints, complex design's requiring extended design timelines and site specific delivery challenges.
- Unplanned expenditure due to natural disasters e.g. Redclyffe substation rebuild due to Cyclone Gabrielle

The protection portfolios now provide replacement forecasts based on asset health for all assets.

The ODJB portfolio maturity is still developing when compared with other protection assets as intervention is driven by life expectancy and then refined based on condition, closer to the time of replacement.

SMS

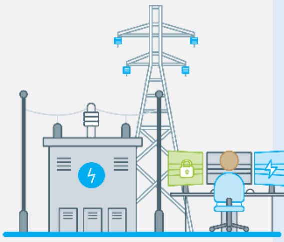
SMS enables the remote control and monitoring of our substations. SMS contains the telemetry systems based on computers and LANs that have been specifically designed to operate in electricity utility environments. SMS reliability is essential to maintaining visibility and control of the transmission network at both the national level (via the SCADA/EMS system) and the local level (via the substation HMI). The asset types covered by this ACP are:

- Substation management platforms (SMPs)
- HMIs
- GPS clocks
- SCADA junction boxes
- MIMIC Panels
- Neutral current transducers (NCTDs)

Asset class snapshot

Population

190 SMP sites
203 GPS clocks
228 HMI
64 NCTDs



Capex

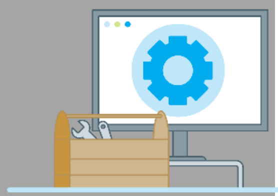
RCP4 (forecast)
$31.6m

SMS Gateway asset health

81.8% Good
16.2% Fair
0.4% Very Poor
1.6% Unscored

Notable work programmes (RCP4)

Lifecycle replacements and telemetry data standard improvements.



Asset class strategy

Objective
Safe and reliable operation at least lifecycle cost.

Measure:

- Average of six or fewer SMS failures per year
- 5-year rolling average of 30 or fewer I/O module failures
- 100% of sites converted to SMS.

Asset strategy

- Replace all legacy RTUs with SMPs.
- Implement remote engineering access while deploying substation management platforms.
- Age-based replacement for all SMS assets.

Investment need is primarily based on asset age and obsolescence. Life expectancy for each asset type is based on manufacturer's recommendations and adjusted for factors such as measured mean time between failure statistics and real-world failure rates (both our own and other comparable customers).

Lifecycle – deliver, operate, maintain, decommission, and disposal

Delivery times for SMS assets is typically 2 years, except for GPS clocks and HMI work, which is typically 1 year. Delivery times include allowance for detailed design, procurement, outage planning, and coordination with other major works at the site.

We plan to maximise site work during outages in a way that creates a safe environment for employees and service providers while minimising the disruption for customers.

As SMS assets are electronic systems there are no planned maintenance activities (these devices have no serviceable components).

Once the HMIs and substation LAN equipment is installed, this is then managed by IST who monitor, maintain, and replace the assets at the end of their life.

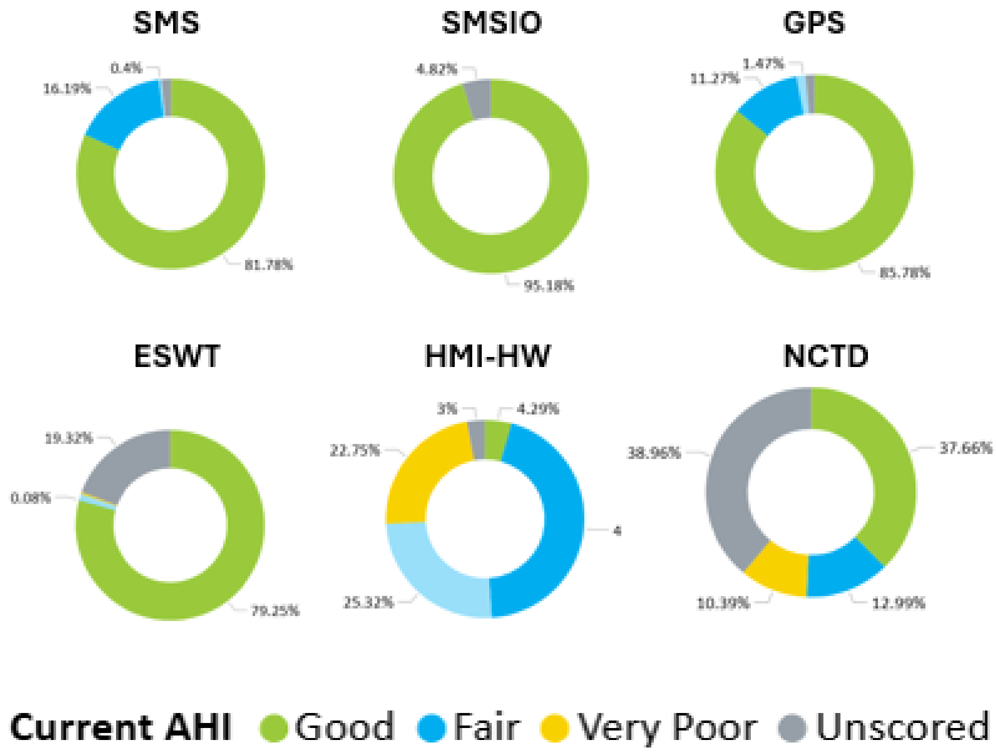
All decommissioned assets are retained as spares if required or disposed of as e-waste. Due to the specialised nature of the equipment, there is limited potential for re-use outside of Transpower.

Asset risk – health and performance

Asset age is used in the asset health model. The assets consist of modular electronic components, therefore there is presently no way of determining the condition of the units. To determine the intervention point we rely on manufacturer recommendations, measured mean time between failure statistics, and real-world failure rates (both our own and other comparable customers) to set the expected useful life of our assets.

Figure 121shows the asset health of our SMS, SMS I/O, GPS, and ethernet switches assets respectively.

Figure 121: SMS systems asset health



The predominant failure causes for SMS are:

- Electrical failure caused by loss of hardware component or power supply failure.
- Mechanical failure due to loss of cooling, fibre failure, etc.
- Functional failure caused by software, firmware, configuration issues, and cybersecurity breach.

The combined likelihood of functional, mechanical and electrical failures increases exponentially relative to the age of the asset class. The key preventive controls critical to reducing the likelihood of a service failure are lifecycle planning, predictive modelling, data quality improvements, and strategic interventions to target at-risk assets.

Observed failure rates for SMPs are low but are increasing as the first-generation devices approach replacement age. All new and replaced units will be deployed as redundant pairs to eliminate the SMP as a single source of failure.

Observed failure rates for GPS clocks and HMIs have improved with the replacement of almost all the older cohort of devices as part of RTU replacement works. We expect failure rates to gradually increase as the average fleet age increases in the coming years.

Many of the SMS services contain, or are dependent on, ICT components or services. Understanding and managing the technological, operational, and funding boundaries between grid and IST requires careful consideration and is an integral part of the overall planning process. We therefore work closely with the IST team to ensure our strategies and long terms plans remain well aligned.

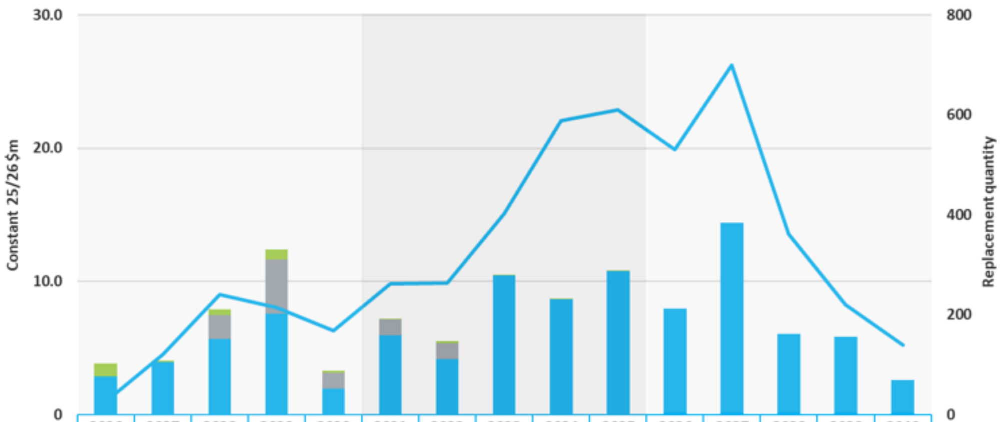
Forecast work and capex

Opex: This ACP has limited opex as most work is based on capital projects. Opex allowances are made for mimic panel decomissioning and the deployment of updated data models.

Capex: The forecast is based on the replacement of all assets at the end of their expected useful lives and any required supporting initiatives. RCP4 is focussed on delivering asset health-determined replacements of SMS assets.

Figure 122 shows the capex and deliverable quantities for SMS.

Figure 122: SMS systems forecast capex and quantities



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
SMS other	1.0	0.1	0.4	0.7	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SMS Data	0.0	0.0	1.8	4.1	1.2	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SMS	2.9	4.0	5.7	7.6	2.0	6.0	4.2	10.5	8.7	10.8	8.0	14.4	6.1	5.9	2.6
SMS Qty incl SMS, Coopers, Clocks, etc.	27	121	240	215	169	262	264	402	589	610	530	700	362	221	140

Please note: The quantity counts are predominately based on the device replacements as we now have an accurate device count following the completion of the RTU replacement work. This work will be bundled into logical projects prior to delivery.

Station DC systems

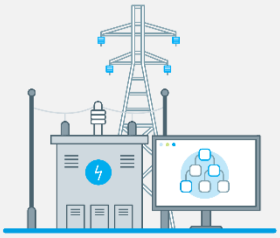
Station DC systems provide power to protection schemes, circuit breaker trip and close coils, control, and metering. These assets are required to operate not only during normal operation but also when the local AC service supply has failed, i.e. in a blackout, until power has been restored.

Asset class snapshot

Population

327 Battery banks

327 Battery chargers



Capex

RCP4 (forecast)

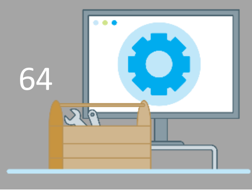
$14m

Asset performance

There have been no interruptions to customers due to minor or condition-based failures.

Work programme

	RCP4
Battery bank replacements	124
Battery charger replacements	64



Asset class strategy

Objective
To operate safely and reliably, at least lifecycle cost.

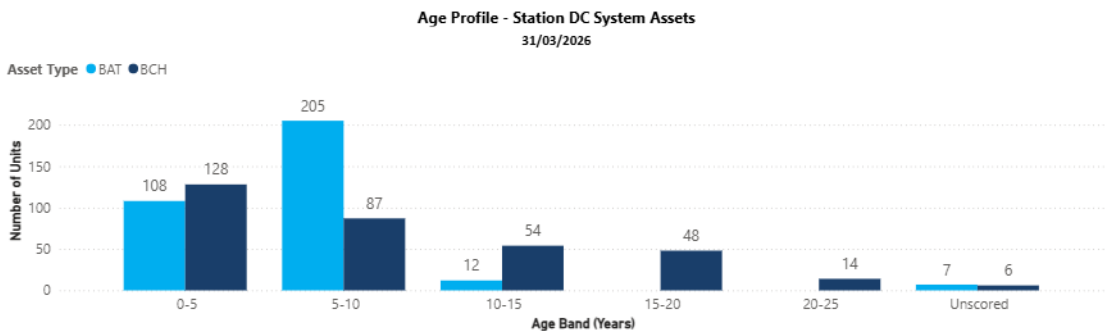
Measure
Zero instances of DC supply failures leading to interruption of supply.

Asset strategy

- Replace station batteries based on condition subject to an expected life of 8 years for existing and 12 years for new assets. A tolerance of up to 2 years either side of the nominal replacement date may be allowed, to enable efficiency in delivery through project bundling, or to allow for staggering of battery bank ages.
- Ensure new DC supply equipment meets future requirements, including sizing batteries for new carryover requirements.

Figure 123 shows our battery and charger population and age profile.

Figure 123: Battery and charger population and age profile



Lifecycle – deliver, operate, maintain, decommission, and disposal

The delivery timeframes for 125V DC comprise detailed design, procurement, and coordination with other major works at the site. The delivery timeframe for this work is typically 1 year. This lifecycle management excludes the ICT 48V DC communications, control, and indication batteries.

Station DC systems are visually inspected annually. The station DC chargers cannot be maintained but key parameters are monitored during the battery bank inspections to ensure correct operation. For the battery bank, we carry out a variety of routine inspections and diagnostic tests on our batteries to inform condition at commissioning and 6 years for batteries that are replaced in their eighth year, and at commissioning and 8, and 10 years for batteries that are replaced in their 12th year.

Asset risk – health and performance

Major failures for DC systems are defined as the inability of the DC system to provide DC supply to secondary assets and/or operate circuit breaker trip coils, leading to either interruption of supply or unplanned outages. There have been several minor battery and charger failures in recent years. Battery cell failures are usually encountered during routine inspections and diagnostic testing. In most instances, battery cells failed during internal resistance or discharge tests and were replaced immediately upon discovery. There have been no interruptions to customers because of minor or condition-based failures.

The replacement of batteries throughout RCP4 sees an overall reduction in assets with very poor asset health. After RCP4 investment, the resulting asset health profile is predominantly Good and Fair, while avoiding a concentration of assets in Good condition that could create a future replacement bow wave.

Figure 124 and **Figure 125** show the battery and battery charger asset health, respectively.

Figure 124: Battery Asset Health

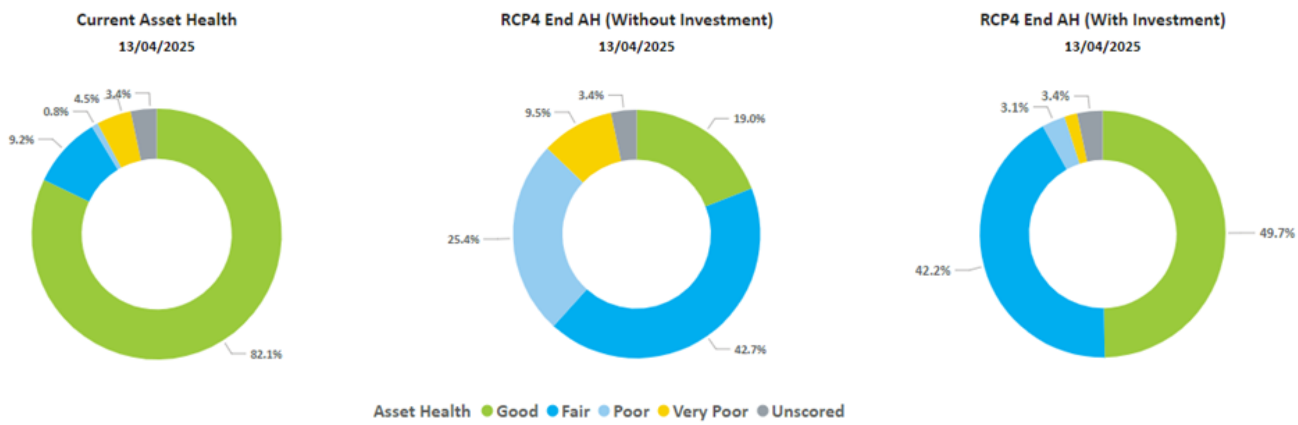
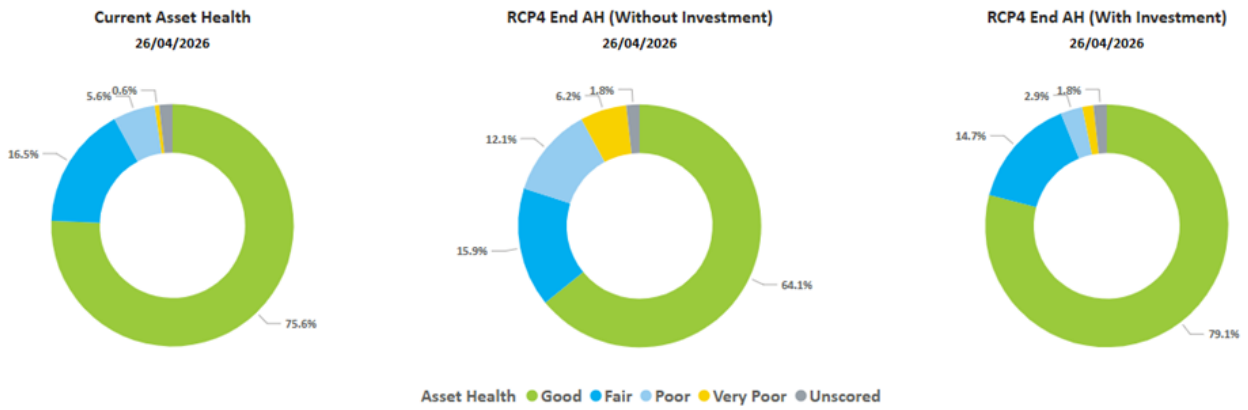


Figure 125: Battery Charger Asset Health

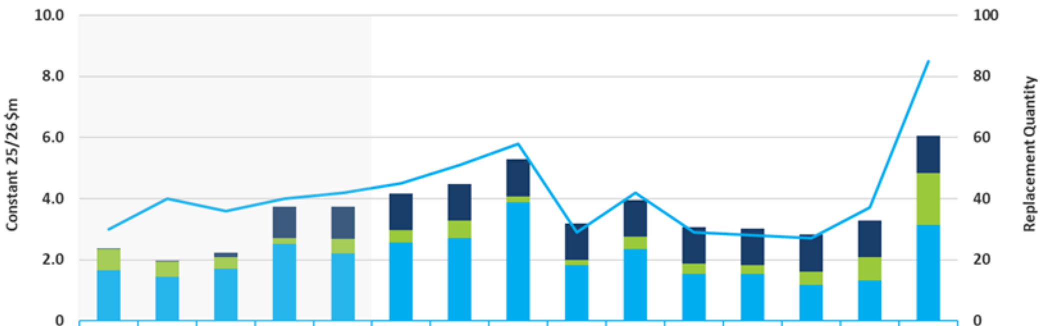


Forecast work and capex

The number or amount of station DC batteries, chargers and equipment coming due for replacement in RCP4 compared with RCP3 has decreased, as a number of batteries and chargers were pulled forward in RCP3 to meet the new carryover period defined by blackstart restoration plans. The RCP4 forecast comprises the routine replacement of batteries and chargers as they come due for replacement.

Figure 126 shows the expenditure and deliverables forecast.

Figure 126: Station DC systems forecast capex and quantities



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Other (incl. DC panels)	0.0	0.0	0.2	1.0	1.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Charger replacements	0.7	0.5	0.4	0.2	0.5	0.4	0.6	0.2	0.2	0.4	0.3	0.3	0.4	0.8	1.7
Battery Bank replacements	1.6	1.4	1.7	2.5	2.2	2.6	2.7	3.9	1.8	2.3	1.5	1.5	1.2	1.3	3.1
Battery & Charger replacement Qty	30	40	36	40	42	45	51	58	29	42	29	28	27	37	85

The increase in expenditure in 2040 is due to an increase in volume of battery and chargers due for replacement.

Revenue, local service, and power quality meters

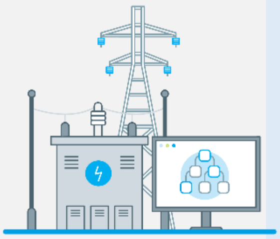
A metering system or scheme is a group of secondary system assets used for monitoring and recording system conditions on power systems. Most of our meters are used for revenue purposes by recording energy delivered through the network to our lines, direct connect, and distribution customers. The data they produce enables the allocation of transmission costs, electricity market reconciliation, and final pricing.

Our other meters are used for local service supply and power quality. Local service supply meters are installed to record the local service load that Transpower uses within a substation. Power quality meters are used to provide a baseline harmonic fingerprint prior to new non-linear generation connections proceeding. This is so that we can demonstrate with confidence and enforce compliance if required, should harmonic injection levels exceed the statutory requirements.

Asset class snapshot

Population

403 Revenue
211 Power quality
21 Local service



Capex

RCP4 (forecast)

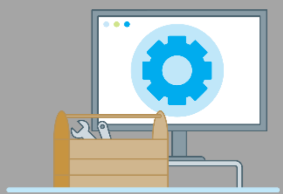
$0.65m

Asset health revenue meters

- 96% Good
- 4% Fair

Work programme (RCP4)

New Power Quality meters and replacement of PMUs as required



Asset class strategy

Objective
Operate accurately and reliably, at least lifecycle cost.

Measure
Maintain highly accurate and reliable monitoring across the network.

Asset strategy
Plan for investment in new metering equipment as required for planned new-generation and load connections.

The investment driver is to:

- Replace meters at the end of their expected useful life (12 years for revenue meters and 24 years for local service and power quality meters)
- Install meters where there are new connections to ensure that new inverter-based connections have a grid injection point (GIP) harmonic distortion baseline, prior to connecting and are monitored once commissioned.

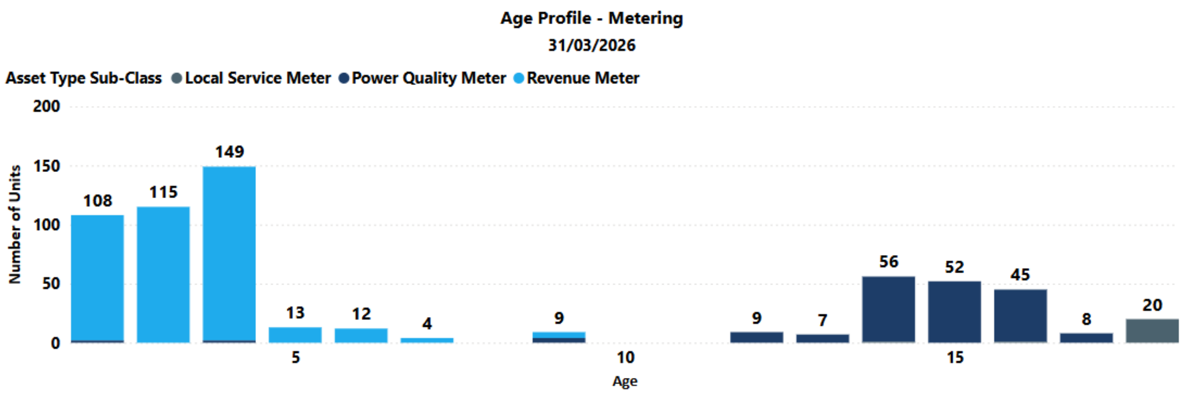
Investigations have shown that the cost of each meter replacement becomes considerably cheaper when carried out in large quantities rather than piecemeal as they fail.

The average age of our revenue meters is approximately 3 years. The majority of our revenue meters were replaced in RCP3 as planned. Local service and power quality meters have a longer expected life and are not expected to be replaced until RCP5 or beyond. The average age of our local service supply meters is approximately 17 years. Based on their 24-year lifecycle, most local service supply meters will be replaced in RCP5.

We plan to replace our meters used for power quality measurements at 24 years and will closely monitor their performance. The average age of our power quality meters is approximately 13 years.

Future metering panel renewals are driven by obsolescence, physical size of the new technology, and/or condition of auxiliary components.Figure 127 shows the population and age profile of our meters

Figure 127: Meter age profile



Lifecycle – deliver, operate, maintain, decommission, and disposal

Delivery times for revenue meters and local service meters include an allowance for detailed design, procurement, outage planning and coordination with other major works at the site. It typically takes 3 years to complete this work.

Maintenance, calibration, and data logger maintenance are carried out every three years for revenue meters and every 9 years for local service meters. Current and voltage transformer calibrations are completed every 8 years. We carry out calibrations by swapping the in-service revenue meters with recently calibrated meters. Calibration is undertaken off-site by service providers that are certified for calibration by the Electricity Authority. The maximum permitted error of a metering installation is 0.75%. We aim for as close as possible to zero error by applying corrections in the meters. The replacement of revenue and local service meters are in alignment with the expiry dates of the metering calibration certification, avoiding the need for calibration in the 12th year.

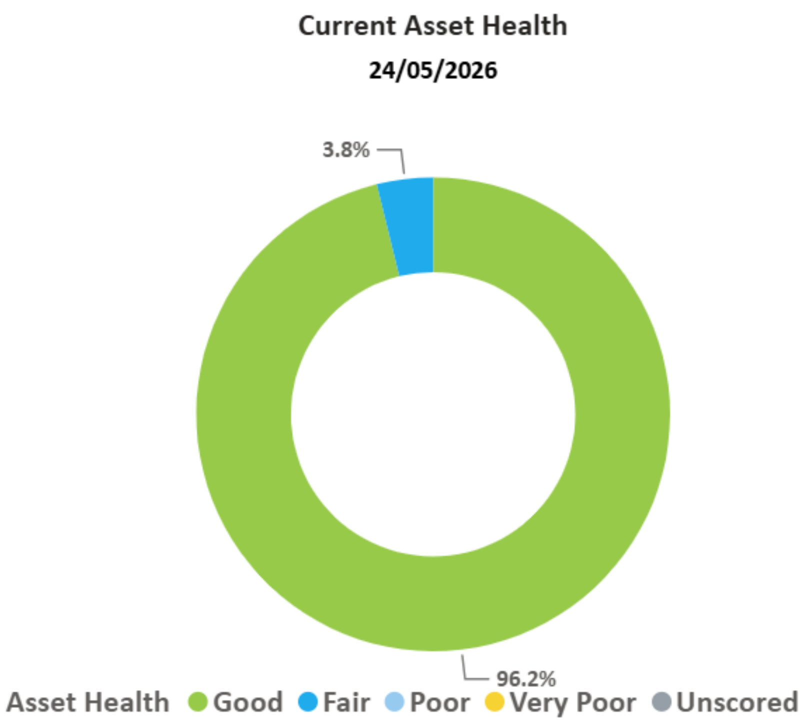
The bulk of the revenue meters were replaced in RCP3. About 1/2 the old meters were repurposed as PQ meters which don't have the same criticality and compliance requirements. These will be monitored so we can make a more informed decision on when to replace the existing fleet, i.e. extend the life from 12 years to 15 or 18.

Delivery times for power quality meters include an allowance for detailed design, procurement, and outage planning. It typically takes a few weeks to complete this work as each meter is installed as the need arises. Power quality meters are not maintained during their lifecycle.

Asset risk – health and performance

Figure 128 shows our meter asset health.

Figure 128: Revenue meter asset health

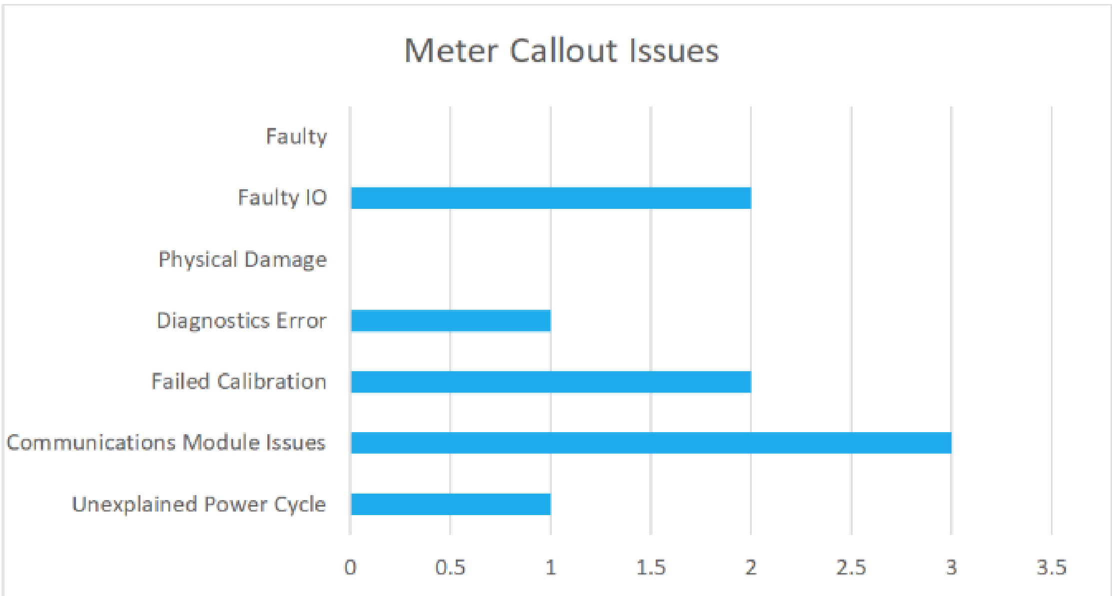


Obsolescence is a key risk to our metering assets, so we have spares on hand to manage this risk.

Since 2023 we have tracked diagnostic errors reported by the meters. In total we have observed, one meter with unexplained power cycling, three with communication module faults, two which failed calibration, one with a digital diagnostic error, and one with I/O fault. This follows a similar pattern to the original meter purchase and previous replacement cycle in 2010 where we had several failures early on but then things stabilised.

Figure 129 shows the diagnostic events and issues with our metering fleet that have resulted in a service provider being called to investigate since the recent replacement in RCP3.

Figure 129: Meter performance

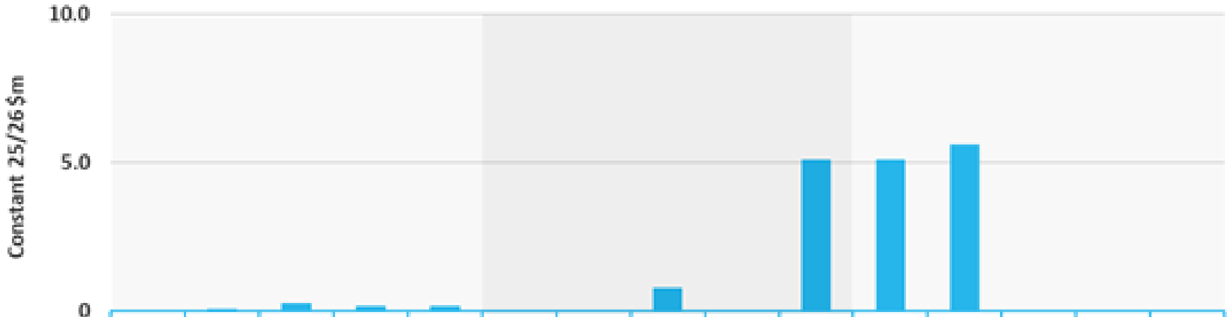


Forecast work and capex

Figure 130 shows our forecast capex. Most meters were replaced in RCP3. The next scheduled replacements will occur in late RCP5 and early RCP6, depending on asset health.

The forecast is based on the replacement of all meters at the end of their expected useful lives. Metering expenditure during RCP4 is to cover the costs of power system modelling tools, standalone phasor measurement units and power quality meters.Expenditure is forecast to increase at the end of RCP5 and early RCP6 when it is expected that local service meters and some power quality meters will be replaced.

Figure 130: Meter forecast capex and quantities



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Metering	0.03	0.05	0.26	0.15	0.15	0.03	0.04	0.79	0.00	5.09	5.08	5.59	0.00	0.00	0.00

ICT asset class plans

ICT asset class plans

This section describes our asset management approach, risks, plans and expenditure forecasts for the ICT portfolios. Each portfolio plan covers the strategic direction, lifecycle needs, and the forecast investment required for RCP4. For ease of readability, we have retained the five portfolio plans previously documented in this chapter, which consolidates the 12 Investment Cases that were the basis of our RCP4 proposal.

Portfolio plan overview

The Asset Management and Transmission Systems (including grid operations) portfolio plans describe the business requirements for managing and operating the grid. Corporate Systems, ICT Shared Services and Telecommunication Network and Security Services portfolio plans describe the underlying business capability to support our operations across the company. Our forecast expenditure for RCP4 is aligned to our allocation.

Expenditure summary

Table 30: ICT capex and SaaS Opex in constant FY25/26 dollars in millions, by portfolio

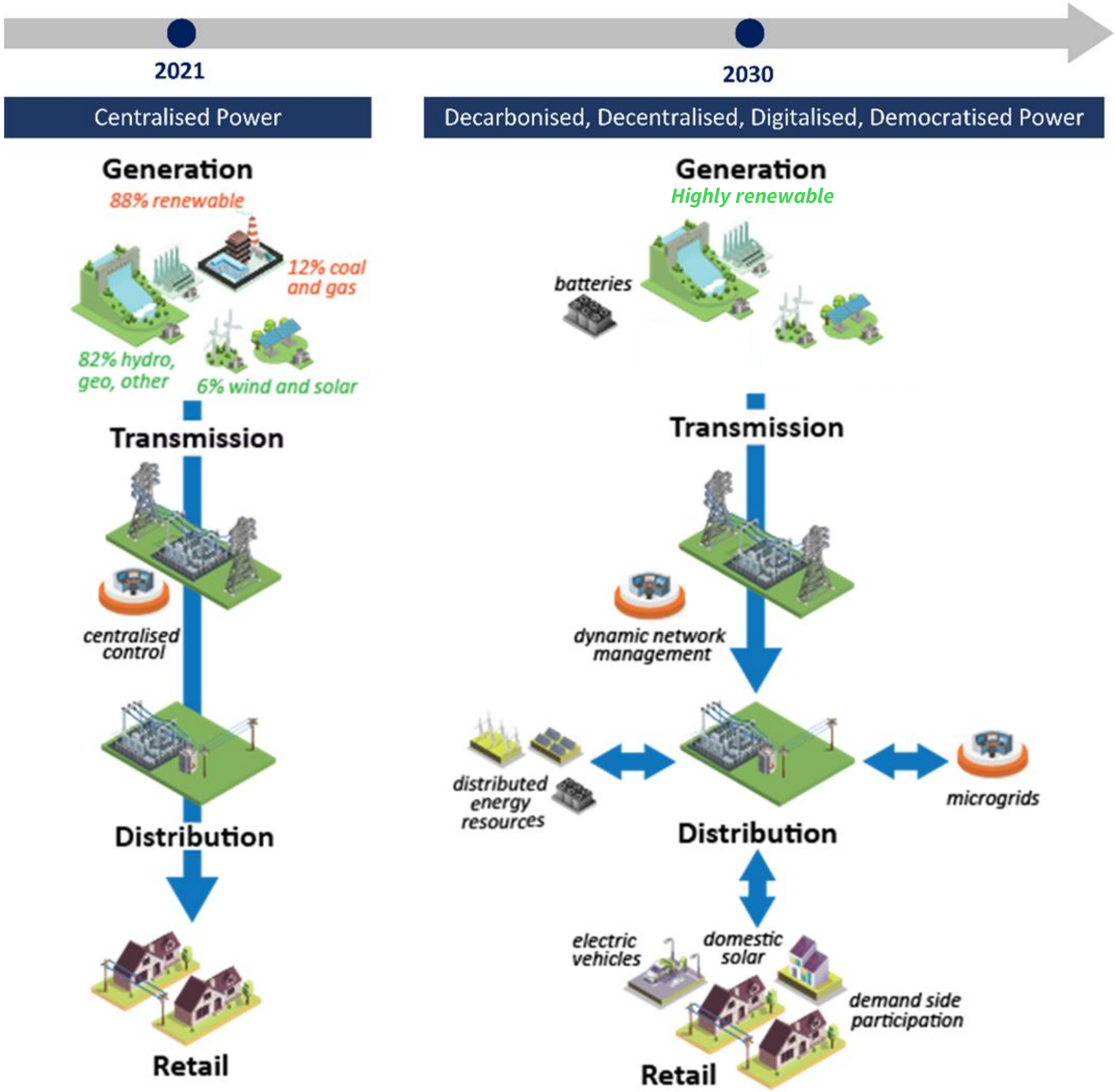
	RCP4					RCP 5					RCP 6				
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Asset Management Systems	3.4	7.2	6.2	3.6	2.2	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Corporate Systems	11.4	28.7	18.9	5.8	2.9	9.7	9.7	9.7	9.7	9.7	9.5	9.5	9.5	9.5	9.5
ICT Shared Services	2.7	0.7	0.3	0.6	4.8	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ICT Telecoms, Network & Security Services	52.0	43.4	33.8	8.0	6.1	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4
Transmission Systems	13.1	9.5	13.3	7.4	6.4	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
Total Capex and SaaS	82.6	89.5	72.5	25.3	22.4	41.1	41.1	41.1	41.1	41.1	41.0	41.0	41.0	41.0	41.0

Key Assumptions

The pace of change in ICT is expected to influence future expenditure requirements. Accordingly, while the current forecast is based on the best available information, expenditure beyond a five-year horizon is inherently uncertain and will likely change as technologies mature and ICT capability requirements evolve to support a more complex grid and operating environment.

As outlined in *Whakamana i Te Mauri Hiko*, climate change and technology disruption are creating conditions that drive structural changes in utility systems. A more dynamic and bi-directional power system is emerging, characterized by increased grid connections and evolving customer needs. This evolution is primarily driven by the 4D forces: Decarbonisation, Decentralisation, Digitalisation, and Democratisation. These forces demand more dynamic network, system, and market operations, requiring us to leverage data and analytics for optimal asset decisions and adopt a better end-to-end approach to grid management.

Figure 131: Anticipated structural changes for the NZ electricity market



The following sections describe trends that are likely to impact on our ICT investments during RCP4.

Trends and Shifts

As we move towards a zero-carbon future principally driven by electrification as described in our *Whakamana i Te Mauri Hiko* scenarios, we are seeing technology changes across the industry that we are actively considering. For example, the integration of smart grid technologies, advancements in artificial intelligence, machine learning and data management, and the increasing capabilities of operational technologies and systems are informing the way we manage and operate our assets. These developments, along with others mentioned below, have the potential to enhance the efficiency and reliability of electricity transmission, and the ability to expand the system to meet demand.

As we navigate these changes, we have adopted a forward-thinking approach that embraces innovation and leverages emerging technologies. This section delves into the key trends and technological shifts that are influencing the electricity transmission sector, providing insights into how these changes result in improvements in asset management practices and overall system performance.

We continue to monitor the impact of these changes on our ICT systems and plan accordingly through the development and refinement of our ICT sub-strategies. We are exploring and incorporating the use of emerging technologies in several areas:

Grid Orchestration and Flexibility Markets

The future electricity system will increasingly rely on the coordinated management of generation, storage, demand response and distributed energy resources. Advanced optimisation platforms and market mechanisms will enable greater system flexibility, allowing Transpower and market participants to balance supply and demand more efficiently while maintaining grid stability.

Grid-Scale Energy Storage

Grid-scale battery storage and other energy storage technologies are emerging as critical enablers of renewable integration and system flexibility. Storage supports frequency management, peak demand reduction, renewable firming and resilience during system disturbances. As renewable penetration increases, storage will become an increasingly important component of transmission planning and operations.

Climate Intelligence and Resilience Analytics

Advanced climate modelling, weather forecasting and risk analytics are improving understanding of long-term climate impacts and short-term operational risks. These capabilities support resilience planning, asset investment decisions, emergency response and adaptation strategies for increasingly extreme weather events.

IIoT for grid management

Industrial Internet of Things (IIoT) is a significant trend in grid management, involving the use of interconnected sensors and devices to monitor and manage physical assets digitally. This technology enhances grid resilience by providing real-time data and insights, enabling operators to detect issues early and respond swiftly.

IIoT facilitates predictive maintenance, reducing downtime and preventing outages by addressing problems before they escalate. Additionally, it optimises energy distribution and consumption, improving overall efficiency and reliability. By integrating IIoT, we can achieve greater connectivity and control, ensuring a more resilient and responsive grid.

Digital twins

Digital twins create virtual replicas of our physical grid assets and systems, enabling accurate simulations and what-if analyses. By integrating real-time data, digital twins can model complex grid behaviours, test scenarios securely, and optimise operations. This allows utilities to evaluate the impacts of disruptions, maintenance activities, or integrating new technologies before implementation. Digital twins enhance decision support, training, and contingency planning while reducing risks and costs associated with physical testing or unplanned events.

Digital twins are evolving from individual asset models to enterprise-wide representations of transmission assets, substations, operational systems and the wider electricity network. This enables integrated planning, operational optimisation, resilience assessment and investment decision support.

Edge computing and digital substations

Edge computing and digital substations shift more processing and analytics closer to substations and field devices, enabling faster local control, protection, monitoring and anomaly response where latency and resilience matter most. This can improve operational responsiveness, strengthen substation resilience, and support smarter field automation across geographically distributed grid assets.

IT/OT convergence and common operational platforms

IT/OT convergence connects enterprise, operational and IIoT systems into secure, governed platforms that provide a more unified view of grid operations, asset condition and business processes. This can improve situational awareness, reduce fragmentation between systems, and support better maintenance, planning and operational decisions across the business.

The convergence of Information Technology (IT), Operational Technology (OT), Engineering Technology (ET) and telecommunications networks is creating integrated digital ecosystems that support end-to-end visibility and decision-making. This convergence also introduces new governance, cybersecurity and operational risk considerations requiring robust management.

Data foundation, fabric and interoperability

This trend focuses on governed data models, integration layers, metadata, lineage and interoperability so data can be trusted, shared and reused across OT and enterprise environments. A stronger data foundation improves data quality and traceability, while enabling scalable analytics, AI, digital twins and more regulator-defensible decision-making.

Operational intelligence

Operational Intelligence (OI) is the real-time integration, monitoring and analysis of data from operational systems to provide timely insight into asset condition, network performance and emerging issues. It helps operators move from reactive response to earlier detection, faster diagnosis and more informed operational decision-making. For Transpower, OI can improve situational awareness across grid operations, support earlier intervention on asset or system issues, reduce downtime, and enable more proactive maintenance and operational planning. It also strengthens the foundation for predictive analytics, digital twins and more resilient system operations.

Operational intelligence increasingly combines real-time streaming data, AI, digital twins, predictive analytics and operational workflows to provide a comprehensive and continuously updated operational picture of the grid.

Autonomous Grid Operations

Advances in AI, automation and operational intelligence are enabling progressively autonomous operation of grid assets and systems. While human oversight remains critical, future operational models will increasingly leverage automated monitoring, optimisation and response capabilities to improve reliability, safety and operational efficiency.

DER integration

Distributed Energy Resources (DERs) include small-scale units of local generation connected to the grid at distribution level. These resources, such as solar panels, wind turbines, and battery storage systems, are transforming the energy landscape by providing decentralised power generation.

Continued integration of DERs into the grid enhances energy resilience, reduces transmission losses, and supports the transition to renewable energy. Integration at scale requires advanced grid management techniques to balance supply and demand, ensure grid stability, and optimize energy distribution.

Renewable energy forecasting

Renewable Energy Forecasting leverages advanced algorithms, Artificial Intelligence (AI), and big data to predict energy production from renewable sources like wind and solar. This trend enhances grid stability, optimises energy storage, and improves integration of renewables.

Key benefits include better demand-supply matching, reduced reliance on fossil fuels, and cost savings for utilities and consumers. Accurate forecasting supports efficient grid management and helps in planning maintenance and operations.

Machine Learning, Explainable and Responsible AI

As AI becomes increasingly embedded in business and operational processes, there is growing emphasis on ensuring AI systems are transparent, trustworthy, and used responsibly. Explainable AI (XAI) provides greater visibility into how AI models generate recommendations and decisions, enabling users to understand, validate, and appropriately challenge outcomes.

Responsible AI focuses on the governance, ethical use, security, fairness, accountability, and human oversight of AI technologies. Together, these practices help ensure AI is deployed safely and effectively, supporting stakeholder trust, regulatory compliance, and informed decision-making across the organisation.

Machine learning (a key component of AI) is a transformative trend, leveraging advanced algorithms to analyse vast amounts of data and predict outcomes. This technology enhances efficiency, decision-making, and operational effectiveness.

For example, in vegetation management, machine learning integrates data from sources like Light Detection and Ranging (LiDAR) and orthophotography to predict growth patterns and potential risks, ensuring safety and reliability. It also optimises maintenance strategies, such as economic models for optimal asset maintenance, reducing costs and extending asset lifespans. Additionally, predictive analytics powered by machine learning helps forecast weather patterns and their impacts, crucial for grid planning and resilience.

Agentic AI & Agentic workflows

Agentic AI and Agentic Workflows refer to AI systems that autonomously make decisions and execute tasks, adapting to dynamic environments. These workflows leverage core components of intelligent agents such as reasoning, planning, and tool use to execute complex tasks efficiently.

Agentic workflows are designed to streamline and optimize business processes, improving efficiency and productivity by automating routine and complex tasks, effectively acting as a virtual co-worker.

Agentic AI has the potential to automate increasingly complex analytical, planning and administrative tasks through autonomous reasoning, workflow orchestration and decision support. Within critical infrastructure environments, adoption will require strong governance, human oversight, cybersecurity controls and clear accountability frameworks before being applied to operationally significant activities.

Digital Workforce and Knowledge Augmentation

Mobile technologies, AI assistants, augmented reality and digital work management platforms are transforming how field and operational staff access information and perform work. These technologies improve productivity, support knowledge transfer, enhance safety and help address workforce capability challenges.

AI-Augmented Engineering and Software Delivery

Artificial intelligence is transforming engineering, software delivery, and digital operations by augmenting the capabilities of developers, engineers, analysts, and operational teams. AI-powered tools support solution design, code generation, testing, documentation, data engineering, and operational analysis, improving productivity, quality, and delivery speed.

AI-enabled testing and AIOps capabilities help identify defects, detect anomalies, predict failures, and automate routine activities, improving the reliability and performance of critical systems. As these technologies mature, they have the potential to accelerate innovation, reduce delivery effort, and enhance the operation of the digital systems that support Transpower's grid and business services.

Hybrid multi-cloud adoption

This trend refers to the practice of using multiple cloud service providers (AWS, Azure, Oracle Cloud, etc.) to store, process, and manage data. This approach enhances flexibility, avoids vendor lock-in, ensures compliance with our regulatory requirements, and optimises performance by leveraging the best features of each provider while considering greater cost efficiencies.

By integrating multiple cloud services with on-premises systems, we achieve greater flexibility, resilience and scalability.

Cyber Resilience and Operational Continuity

As cyber threats become increasingly sophisticated, utilities are shifting from prevention-focused cybersecurity models towards resilience-based approaches that emphasise detection, response, recovery and operational continuity. Cyber resilience capabilities are becoming essential for maintaining reliable operation of critical national infrastructure.

Zero trust security architecture

Zero trust security architecture is a cybersecurity model that assumes no entity, whether inside or outside the network, is trustworthy by default. It requires strict identity verification for every person and device attempting to access resources on a private network. This approach minimises the risk of data breaches by continuously monitoring and validating access requests.

Asset Management Systems

Transpower's ICT Asset Management Systems support our business processes to plan, build and maintain physical assets on the grid, which in turn deliver the transmission services we provide to customers.

The strategic ICT direction in this portfolio is set out in our *Asset Management, Network Risk and Planning systems, and Enterprise Information & Data ICT sub-strategies*, that are described in the sections that follow. These sub-strategies define investment needs categorised as non-recurrent modernise and benefits driven. Our approach to managing the lifecycle of the assets relevant to this portfolio, is set out in the *Asset Lifecycle Management – Applications strategy*, which describes how we manage recurrent maintain investments. This plan covers the RCP4 regulatory periods.

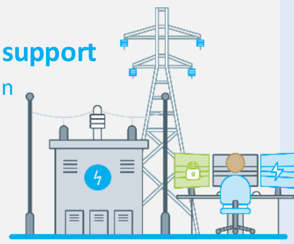
The figure below shows all the ICT sub-strategies and asset lifecycle management strategies categorised by investment type. In red we highlight the strategies covered by this portfolio.

Asset class snapshot

Asset Management Systems support

the management of over $5 billion in assets across approximately:

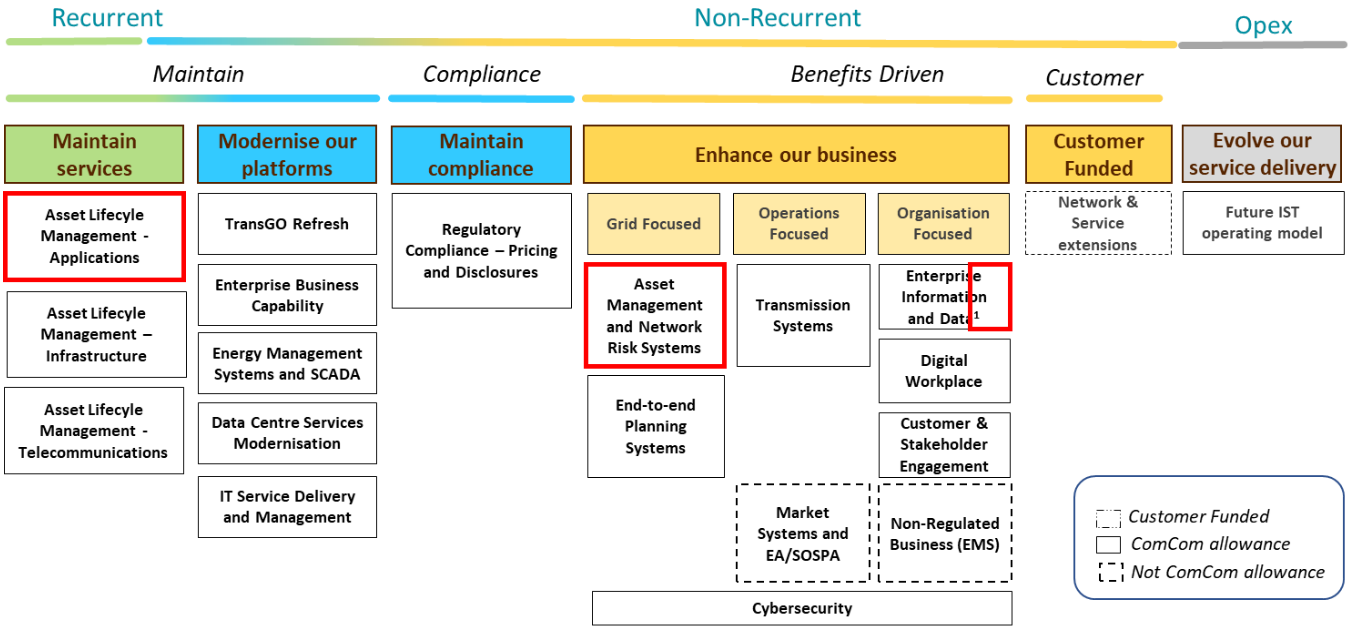
- 30,000 properties
- 180 substations
- 25,000 transmission towers
- 11,000 kilometres of lines



Capex & SaaS Opex

RCP4 Forecast

$22.6m



1 – BIM is included in Enterprise Information and Data sub-strategy

Asset class strategy

Strategic direction

Our strategic ICT direction and its alignment to Transpower business strategies is summarised below.

Providing quality data to inform asset health and network risk management

Transpower's key strategic focus is on maturing the assessment of asset health and the associated network risk and impact of failure, as outlined in our Asset Health and Network Risk Roadmap. Our ICT investments in industry-leading asset management information systems and tools, and a strong focus on improving the quality of our asset management data, are the key enablers for this maturity shift.

To continue progressing on our maturity journey we need to go beyond manual data collection and analysis and focus on adopting digital information capture, automated business processes and the use of advanced analytics. By progressively using high-quality information, e.g., conductor defects collected through our work with drones and machine learning, we can quantify current and future risk and select from a wider set of options for how and when to intervene to manage that risk. We will also increase the cadence of data capture where appropriate to provide advanced warning of emerging risks on the grid and mitigate them before an incident occurs. Using advanced analytics will reduce the amount of manual inspection work needed, freeing up engineering resources to focus on higher value activities.

Increasing breadth and sophistication of asset health and network risk models

We are focused on improving the breadth and sophistication of our asset health and network risk models and the associated tools and integration between them. These improvements are needed so that we continue to deliver our safety, service and sustainability commitments during a period of rapid change that the electricity transmission industry is going through. We are developing models via the new Python ecosystem and migrating away from the existing Conditional Based Risk Management (CBRM) system.

National vegetation management

We now have a national vegetation management approach that enable full visibility of the vegetation risks, hazards, and defects. This will provide us with a complete picture of all the approaching vegetation issues and risks for effective prioritisation and apportionment of necessary expenditure across the grid network. We now have the tools for managing/visualising vegetation using LiDAR data.

Empowering our field workforce, improving information exchange and mitigating risks around a changing workforce

Our field workforce mobility approach provides ready access to information from any location and presents information in ways that are intuitive and actionable, so that our workforce can act with confidence and reinforce consistency in accordance with our standards and objectives. Transpower needs to manage a safe transition for new entrants into our workforce who have higher information technology exposure and expectations whilst ensuring ongoing engagement from our experienced workers. The upgrade of Maximo to MAS9 (Maximo Application Suite 9.1) introduces new functionality that we will investigate to help drive the adoption of newer ways of working. We also need to further invest in interfaces with high usability and easy access to context specific information in the field.

Improving access to information and consistency of decision making through building information modelling

Digital Engineering simplifies organisational decision-making across the entire asset lifecycle (plan, design, construction, operation, maintenance, and decommission) by providing a single view of information about an asset that is standardised and easy to find. It supports measurement, analysis and scenario planning to improve the quality, speed, and consistency of decision-making across the asset lifecycle.

Continuous improvement in safety

Health and safety will continue to be a top priority as we strive for a zero-fatality workforce with reduced severe harm and injury frequency. This will enable Transpower to continue to meet our obligations under the Health and Safety at Work Act.

Driving a continuous quality improvement culture

We continue to invest in industry standards and best practices supported by tools that drive a continuous quality improvement culture. Several industry recognised quality improvement frameworks highlight the need to demonstrate conformity to standards and to systematically identify and eliminate non-conformances, such as to design standards, material quality, policies and agreed work practices across the asset management lifecycle. Transpower will continue to align to best practices by enhancing our digital processes and field mobility interfaces to enable the systematic capture, root cause analysis and routing of non-conformances across teams to improve quality across the asset delivery lifecycle and drive a continuous improvement culture.

Integrate enterprise planning with processes and tools that optimise our plans

Under Transpower's Enterprise Planning initiative, we are implementing business process changes to optimise and adopt an integrated approach to asset planning. Our goal is to digitise workflows, enhance alignment across the organisation, and identify opportunities to optimise our plans, thereby delivering greater efficiency and throughput in line with our strategic objectives. We are promoting collaboration to drive effective and efficient portfolio planning and delivery. From an ICT strategic perspective, we are enhancing integration between existing systems to provide the necessary cross-functional planning and optimisation capabilities through our Enterprise Business Capability programme.

Improving warehouse efficiency, asset utilisation and delivery

There are opportunities to investigate the use of digital technologies, smart tags and sensors to enhance our asset inventory management and warehousing to improve utilisation of warehouse capacity and improve supply chain efficiency. Our inventory and warehousing initiatives will integrate with work planned in our corporate strategy to improve our purchasing, supply chain and contract management capabilities.

Enabling self-service data and analytics

We have empowered over 100+ citizen data scientists across the organisation through a standardised development and deployment ecosystem and self-service through Python and Power BI. By doing so, we have provided them with trusted analytical modelling source data, thereby enhancing data re-usability and consistency and reducing overall effort in the process.

Our delivery in RCP3

Our most significant investments in RCP3 focused on improving our mobility services, enabling geospatial knowledge management and consolidation of our photos and multimedia systems.

Field workforce mobility

Significant progress has been made in providing ready access to collect asset management data from the field using a mobile application (Mātai) to replace manual paper-based processes. The application was co-designed with representatives from our field workforce to ensure high usability in the field and we are continuing to drive adoption with our field crews. Mātai provides a step change in our capabilities in line with our strategy to improve the speed and accuracy of information exchange across the organisation, empower our workforce and feed high quality data into our asset planning functions.

Maturity of Field workforce mobility tools continue to improve, and we will investigate opportunities to adopt more modern field workforce management systems.

The second LiDAR survey has completed and includes additional requirements to better support Transpower's broader needs. This includes enhanced capture of transmission lines and extended imagery of substations, providing a more comprehensive and high-quality dataset across the network.

These improvements support more advanced analytics and the optimisation of vegetation management activities by providing improved visibility of conductor clearances, vegetation proximity, and network risk areas.

Improved tracking and visualisation of our five potential energy futures

We have successfully delivered a new interactive geospatial application (Te Kāpehu Hiko) that allows us to visualise and track the five energy futures outlined in *Whakamana i Te Mauri Hiko – Empowering our Energy Future*. This tool supports our asset planning decisions and consultation with customers and industry as we navigate through a period of accelerated electrification (68 per cent increase in generation by 2050) and a move towards a carbon zero future.

Interface to transmission network information

TPR Envision Tools' complements the Transmission Planning Report. This is a public facing visualisation providing information to help our customers understand the opportunities and constraints on the transmission network.

Improving access to multimedia and providing a platform that will support future improvements in asset health assessment and network risk identification

Transpower uses photos and multimedia to identify risks and issues that could impact our assets, network services and public safety. We have consolidated our photos and multimedia systems to provide a single digital multimedia repository that can be easily linked to our core asset management systems and data. This initiative has simplified and extended access to multimedia across our teams and service providers, and we are exploring the use of drone and machine learning data to quantify current and future risk with intelligent conductors. This is an essential first step in our plans to incrementally lift the quality and cadence of data capture. The planned next step is to use analytics to convert large data volumes into insights and progressively automate inspections to provide a forward-looking view of high priority risks to inform our plans.

Inventory management

In 2024, a programme was initiated to enhance Transpower's inventory management, with core capabilities delivered by the end of 2025. This included improvements to inventory data quality, the establishment of a more structured approach to spares management, and enhancements to the functionality of our inventory management systems.

These changes have improved visibility and control of inventory, supporting better-informed decision-making and more consistent processes. They also contribute to more efficient inventory utilisation and support broader improvements warehouse operations. initiatives.

Lifecycle maintenance to provide fit-for-purpose tools

We have maintained our current systems to ensure that they remain fit-for-purpose, secure and supported through managed lifecycle investments and minor enhancements. A software refresh of our core asset information system (Maximo) has been implemented, and we are planning another refresh in the latter part of RCP4. We have completed a strategic investigation to confirm Maximo is suitable through to RCP5.

Our future investments

Our investments across RCP4 will focus on the following key areas:

Digital Engineering

Investment in Digital Engineering will provide a methodology, standards, tools, collateral, and training to supply owned, managed, and discoverable high-quality data about our assets to improve decision making. This will enable us to improve data access, share structured asset information and enable enhanced insights. We have procured a Model Management System that will provide a single source of truth to manage our asset model data across Transpower and our partners. Our Digital Engineering programme will unlock future capability such as automated detection of conflicting changes, enhanced construction sequencing and more accurate site set out works. This investment will enable material cost and time savings and other efficiencies across the grid project and asset lifecycle. Further information can be found in our *Enterprise Information and Data sub-strategy*.

Digital twin

Investment into a digital twin will extend Digital Engineering capabilities, accelerating Transpower's efficiency and asset management capabilities, empowering smarter decision-making and risk-informed strategies for a stronger future. Further information can be found in our *Enterprise Information and Data sub-strategy*.

Asset health and network risk management

Further expansion of our asset health and network risk models is planned to enable continuous improvement in asset management maturity and to manage expected changes on the grid. Significant improvements have already been made to our asset health models and focus has shifted towards improving our network risk models, taking a broader array of risks and organisational objectives into consideration. From an ICT perspective we need to ensure our tools and associated integration continue to support the breadth and sophistication of models needed. Our investments in Data and Analytics, as well as the Python Ecosystem will help to simplify the process of combining data and generating insights that feed into our models.

Further information can be found in *our Asset Management and Network Risk and Planning Systems sub-strategy*.

Field workforce mobility

As part of our *Asset Management and Network Risk Systems sub-strategy*, we will enhance Maximo and our geospatial systems with new data from the national vegetation management system. This will enable our service providers to visualise the risk across the network or specific spans and to manage vegetation encroachment work orders more efficiently.

Health and safety

Enhancements to our health and safety systems are needed to provide a much more dynamic and engaging exchange of information with our people, stakeholders and the public regarding health and safety. By increasing collaboration and awareness we can continue to reduce risks to our people and the public. Further information can be found in our *Asset Management and Network Risk and Planning Systems sub-strategy*.

Enterprise planning

Enterprise Planning is a framework that incorporates strategic, financial and operational planning to optimise decision making at Transpower. It incorporates business planning, forecasting, budgeting, reporting, optimisation, scenario analysis and performance analysis against strategic direction and goals. Enterprise Planning at Transpower covers specific planning activities across two distinct time horizons: Short Term Planning (up to 2 years) and Long-Term Planning (2 – 10+ years

During RCP4, we plan to enhance data exchanges with our service providers, enabling integrated planning, improved visibility, and systematised enterprise planning by tracking cross-functional process performance indicators against objectives.

Further information can be found in *our Asset Management and Network Risk and Planning Systems sub-strategy* and *our Enterprise Business Capability Sub-Strategy.*

Estimation

Our Transpower Enterprise Estimation System (TEES) supplying quantity surveyor capabilities to support grid investment planning will be replaced during RCP4. We will also improve integration with our end-to-end planning process to ensure consistency, quality, and traceability of estimates across the planning phases. Further information can be found in our *Asset Lifecycle Management – Applications strategy*.

Inventory and warehousing

Our inventory and warehousing initiatives will focus on improving the capability of our inventory and warehousing systems, along with targeted enhancements to physical warehouse operations. This includes improvements such as better mobility access, more effective asset identification, and increased use of digital tagging and supporting technologies.

These improvements are expected to enhance visibility and control of inventory, support more efficient utilisation of assets, and contribute to improved warehouse operations. Further information can be found in our *Asset Management and Network Risk and Planning Systems sub-strategy*.

AI and Emerging Technologies

AI and emerging technologies will support a gradual uplift in Transpower's asset management capability over RCP4, primarily by building on the data and analytics foundations established in RCP3. During this period, our focus will be on improving data quality, governance, and integration across asset, operational, and enterprise systems, enabling more consistent and timely decision support. We will selectively apply advanced analytics and AI-assisted techniques to enhance asset health and risk insights, including improved interpretation of inspection, LiDAR, and sensor data where supported by mature data sets. Analytics capabilities will increasingly be embedded into core systems and workflows, enabling planners and operators to make more informed, proactive decisions. Targeted improvements will also be made to works planning and operational processes through better use of data, integration with enterprise planning initiatives, and incremental automation of high-effort activities such as data capture, defect identification, and prioritisation. These improvements will focus on increasing efficiency and consistency rather than full end-to-end optimisation.

Lifecycle management

Our assets will continue being maintained in line with the *Asset Lifecycle Management – Applications strategy*. The major upgrades planned in the period are upgrades of our asset information management system (MAS9), our Asset Capability Information system (ACI), our Transpower Enterprise Estimation System (TEES), our Asset Management Planning System (AMPS).

The Commissioning Activity Tracker (CAT) will be transitioned to the Service Delivery Platform (SDP), representing a step-change from a standalone lifecycle upgrade to an integrated, enterprise capability. This migration enables improved end-to-end visibility of commissioning activities, stronger integration with planning and delivery systems, and more streamlined, standardised processes to enhance delivery efficiency and governance across the asset lifecycle.

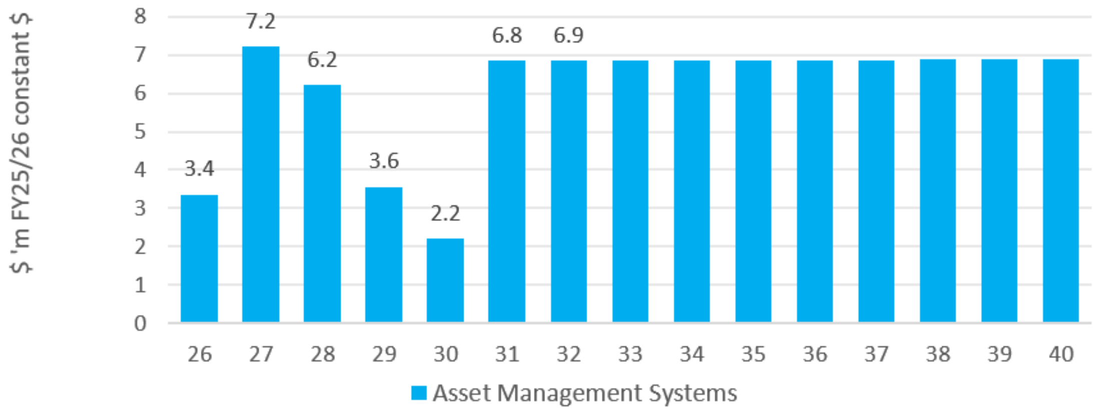
Our geospatial platforms will also require an upgrade during RCP4. Our photos, multimedia and drawings systems have been replaced in RCP3 with a Software as a Service (SaaS) arrangement which will require ongoing Opex to support but will not require any major upgrades.

Forecast expenditure

Capex and SaaS Opex: Since our AMP 2023 we have revised our roadmap to align with our updated ICT sub-strategies.

Figure 132 shows asset management and network Capex and SaaS forecast.

Figure 132: Asset Management Systems - AMP 2026 Capex and SaaS Opex forecast



Transmission Systems

Transpower's ICT Transmission Systems enable the real-time operation of the national grid, and the day-to-day operations and maintenance activities required to ensure Transmission asset safety, performance, and reliability.

The strategic ICT direction, in this portfolio, is set out in our *Energy Management Systems and SCADA and Transmission Systems* sub-strategies. These sub-strategies define investment needs categorised as non-recurrent modernise as well as benefits driven. Our approach to managing the lifecycle of the assets, relevant to this portfolio, is set out in the *Applications Assets asset lifecycle management strategy*, which describes how we manage recurrent maintain investments. This plan covers the RCP3 and RCP4 regulatory periods.

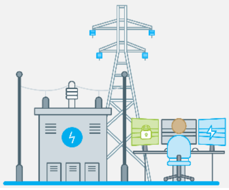
The figure below shows all the ICT sub-strategies and asset lifecycle management strategies categorised by investment type. In red we highlight the strategies covered by this portfolio.

Asset class snapshot

Transmission systems support:

Maintaining situational awareness and control of our assets through approximately 234k real-time data points supported by 5,521 SCADA visualisation displays.

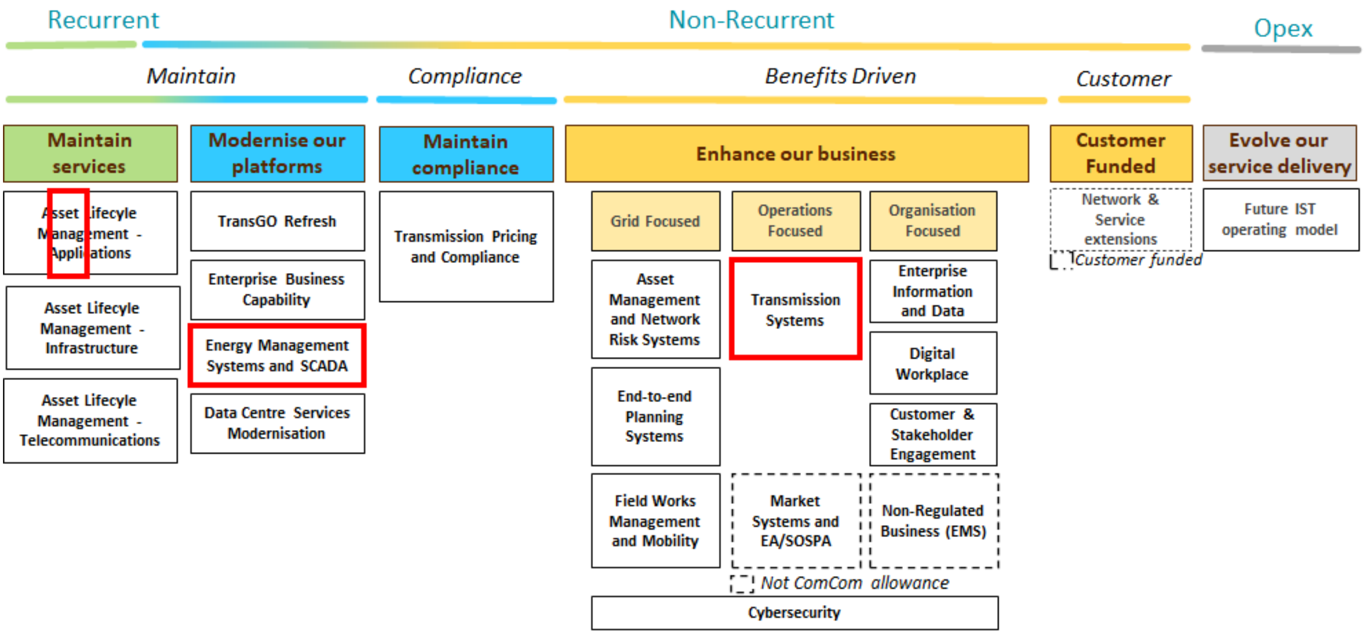
Connecting to over 8171 IED's (Secondary systems) across all substations.



Capex & SaaS Opex

RCP4 Forecast

$49.6m



Asset class strategy

Strategic direction

New demands on our operational functions as the power system evolves

There are new demands on our operational functions as the power system evolves to be more complex while the need for affordable, reliable and sustainable electricity becomes increasingly critical to Aotearoa New Zealand. Transpower needs to invest in our people, processes, and technology during this transitional period to ensure that we can continue to operate a safe, reliable, and secure grid, be ready for a complex future and adapt for an increased workload (complexity and volume). Transpower is in a unique position to play an active role in enabling Aotearoa New Zealand's energy future by extending our network analysis capabilities and improving collaboration with connected parties to manage a more dynamic, intermittent, and bi-directional power system.

Technology investments in our outage management systems, extending the use of situational information for decision making, usability of operational tools, and improvements in operational data quality will enable us to successfully manage the power system through a period of accelerated change, increased complexity, and higher volumes of work.

Our alignment to Transpower business strategies is summarised below.

Safe, efficient, and simplified grid operations

We will progressively enable a more integrated and self-service model for industry interactions with the grid, improving transparency and accessibility of key information such as outage schedules, asset status, and safety controls. This will make it easier for industry participants to plan, coordinate, and safely interact with the power system. This approach will be supported by continued collaboration with industry participants, technology vendors, and service providers, leveraging Transpower's operational expertise to accelerate the adoption and integration of new technologies into grid operations.

As electrification increases and the energy system evolves, the complexity of grid operations will continue to grow, particularly with the rising contribution of distributed and renewable energy resources. In this context, we will continue to enhance outage planning and associated digital switching capabilities to ensure the grid can be operated safely and reliably under a wider range of conditions. This includes developing more advanced capabilities to better understand and predict system behaviour, enabling more informed decision-making when planning and managing increasingly complex outage scenarios.

To support these capability improvements, we will also focus on evolving the underlying business processes and planning workflows that enable outage coordination. This will ensure that planning approaches remain sufficiently agile and responsive to changing system conditions and operational demands. Over time, this will support more efficient and optimised outage planning, allowing competing requirements to be balanced more effectively, reducing system and safety risks, minimising impacts on customers, and managing the workload of operators and service providers, while making the best possible use of available assets.

Processes, systems integration, and data

Improving end-to-end data governance and the underlying process and systems integration is essential to:

- Providing high trust, high resolution data for operational and non-operational use cases,
- Simplifying non-critical data acquisition processes to remove barriers for capturing a broader array of information to support decision making, and
- Continuing to automate business processes to improve productivity, agility, and quality.

Our delivery in RCP4

Since the start of RCP4 we have invested significantly in our SCADA/EMS modular upgrade programme, Digital Switch Management, Telemetry Change Release Tool and maintaining our systems.

Supervisory control and data acquisition (SCADA) / Energy Management System (EMS) modular upgrade

Our revised modular upgrade approach to SCADA/EMS has reduced delivery risk while improving efficiency through enhanced ICT delivery practices. SCADA/EMS systems are maintained through a rolling lifecycle refresh programme to ensure continued performance, security, and vendor support for critical grid operations.

The current upgrade cycle (Habitat EMP Refresh Project) has been delivered over several years and has included extensive development, testing, and rehearsal activities to support a controlled, low-risk highly successful transition into production.

Digital switch management (DSM)

DSM has made significant progress in establishing end-to-end digital support for switching operations, with Enhanced Checking and Switch Execution now successfully delivered. These capabilities represent a step-change in how switching is planned, validated, and executed—driving greater consistency, strengthening operational control across the full switching lifecycle, and materially reducing reliance on manual interventions.

Telemetry Change Release Tool (TCRT)

The Real-Time Systems (RTS) function ensures that accurate, reliable, and timely data from field devices is continuously available to the National SCADA and PI environments. This data is critical to Transpower's ability to monitor, operate, maintain, and plan investments across the national grid and wider power system.

The TCRT programme delivered a purpose-built Jira workflow solution to standardise and streamline project delivery processes across Real-Time Systems. A key capability enhancement was the introduction of MMS (IEC 61850) support within the Modelling Integrator (MI). This advancement enabled a transition from traditional DNP3-based workflows to a fully MMS-driven modelling approach.

As a result, MI designs can now directly automate configuration activities within Eaton SMS, reducing manual effort, improving consistency, and enabling a more efficient and integrated end-to-end delivery process.

Lifecycle maintenance to provide fit-for-purpose tools

We have also maintained our current systems to ensure that they remain fit for purpose, secure and supported through managed lifecycle investment and minor enhancements. Lifecycle upgrades to several key systems including Stationware, Lightning Detection and Corporate and Sanctum PI tools have been implemented.

Our future investments

Our investments across the remainder of RCP3 and RCP4 will focus on the following key areas:

DSM

The next phase of DSM investment is focused on enabling Field Mobility, extending digital switching capabilities beyond the control room into the field. This will enhance safety, traceability, and operational efficiency by providing field crews with real-time access to switching information and execution workflows.

Field Mobility will reduce reliance on paper-based processes, address current fragmentation across field activities, and strengthen coordination between control room and field teams. As grid complexity and operational demands continue to increase, this capability is critical to ensuring consistent, timely, and well-controlled execution of switching operations across the end-to-end lifecycle.

Operational Intelligence

We are strengthening our **Operational Situational Intelligence** capabilities in alignment with the objectives of the **Control Room of the Future (CRoF)** initiative, which is currently underway.

CRoF is a strategic transformation programme designed to ensure Transpower's real-time operational capabilities remain resilient, adaptive, and effective in an increasingly dynamic and complex energy environment. Working collaboratively across the business, the initiative is defining how control room operations, decision-making, and supporting technologies must evolve to meet future system, market, and customer needs.

A key focus of this initiative is identifying and prioritising investments that enhance situational awareness, operational intelligence, and decision support capabilities for both **Grid Operations** and **System Operations** teams. These investments will establish a modern operational intelligence platform that transforms operational data into actionable insights, enabling faster and more informed decision-making.

Expected capabilities include:

- Real-time aggregation and contextualisation of operational, asset, market, and environmental data.
- Identification of correlations, trends, and root causes across events, incidents, outages, and network conditions.

- Predictive analytics and early-warning models to identify emerging risks and potential asset or system failures before they occur.
- Scenario modelling and impact analysis to support proactive operational planning and contingency management.
- Integration of weather, environmental, and external data sources to improve forecasting of operational impacts and network risk.
- Enhanced visualisation and decision-support tools to improve situational awareness and operator effectiveness.

These capabilities will provide the foundation for a more proactive, data-driven operating model, enabling Transpower to improve network reliability, operational resilience, and decision quality while supporting the evolving needs of New Zealand's electricity system.

Collectively, these capabilities will enable a shift from reactive to proactive operations enhancing situational awareness, improving decision accuracy, and supporting more confident and timely responses in real-time system operations.

Wide Area Monitoring

Wide Area Monitoring (WAM) capabilities will be enhanced to strengthen Transpower's existing real-time observability and dynamic stability monitoring capabilities. This investment will improve visibility of fast grid dynamics and oscillatory behaviours that are not fully observable through existing SCADA/EMS systems, supporting improved situational awareness and operational decision-making. The enhancement will focus on advancing analytics, improving integration with operational systems, and increasing scalability to ensure the capability remains fit-for-purpose as system complexity increases with greater penetration of inverter-based resources, while supporting ongoing grid reliability and resilience outcomes.

Knowledge Management

Knowledge Management is a key strategic investment under the Control Room of the Future (CRoF) initiative to enable a shift towards a more consistent, accessible, and intelligence-driven operating model. This capability will establish a structured approach to capturing, curating, and sharing operational knowledge, procedures, and insights across Grid and System Operations teams. By embedding knowledge into workflows, decision support tools, and operational processes, the investment will reduce reliance on tacit knowledge, improve decision quality and consistency, and enhance workforce capability. This will support safer, more efficient operations and strengthen organisational resilience as system complexity continues to increase.

Grid resilience and work distribution

Our objective is to develop advanced workload sharing to build on work distribution resilience and flexibility. We will drive optimisation and reduce risk by even work distribution across operators as well as across regional centres through business process standardisation, targeted training, and tools alignment.

Outage planning and management

The Outage Handling and Management System (OHMS) successfully replaced the legacy Integrated Outage Notification System (IONS), with the modernised platform going live in March 2026 as the first major delivery of the Operations Work Programme (OPSM).

Following this milestone, the programme has transitioned into an Enhancement and Optimisation phase, focused on extending the value of the modernised platform through targeted capability improvements, increased automation, and enhanced user experience and an optimisation engine. These enhancements are being delivered through a structured release roadmap across 2026, enabling incremental business benefits while reducing implementation risk.

The ongoing evolution of OHMS is aligned with Transpower's broader Outage Optimisation Strategy, ensuring the platform can support increasingly sophisticated outage optimisation, and decision-making requirements. This includes strengthening integration with operational and asset management systems, improving planning efficiency, and establishing the foundation for future optimisation and decision-support capabilities.

Strategic Outcomes

- Reduction in overall outage volume through improved planning, coordination, and optimisation across the programme of work.
- Lower operational costs across Transpower and the market by minimising inefficiencies, rework, and outage-related impacts.

- Reduced operational and system risk exposure for both Transpower and market participants through more controlled and optimised outage management
- Improved outage planning efficiency and coordination across Transpower and external stakeholders.
- Enhanced visibility of network impacts, risks, and constraints during outage planning.
- A scalable and adaptable platform capable of supporting future outage optimisation initiatives and advanced planning capabilities.

Protection systems

We will continue to evaluate and modernise our Protection Systems Management capabilities by phasing out legacy tools and replacing them with future fit products. This will encompass deployment of power system modelling and protection fault diagnostics. There will also be further improvements into protection information sharing resources to support related business processes. This will reduce risk and ensure better utilisation of the grid enabled by highly trusted protection systems for more effective response to events.

SCADA / Energy management system

We will undertake upgrades to safeguard the security, reliability, and long-term supportability of the SCADA System and Market Solver, key platforms that support the operation of New Zealand's electricity market. This work involves upgrading essential components, including GE products such as Habitat, Platform, SCADA, and Archive, to their latest versions, in line with the SCADA Refresh Roadmap.

These upgrades support the evaluation of Grid Orchestration Software (GridOS) as a potential next-generation approach for managing future grid complexity, including consideration of a shift towards a more modular, service-based architecture to improve scalability, flexibility, and resilience. .This transition will require additional investment beyond standard lifecycle upgrades, including platform re-architecture, integration uplift, and data capability enhancements. These investments are essential to establish a future-ready operational technology foundation that improves system resilience, enhances decision-making, and supports the long-term evolution of Transpower's grid operations.

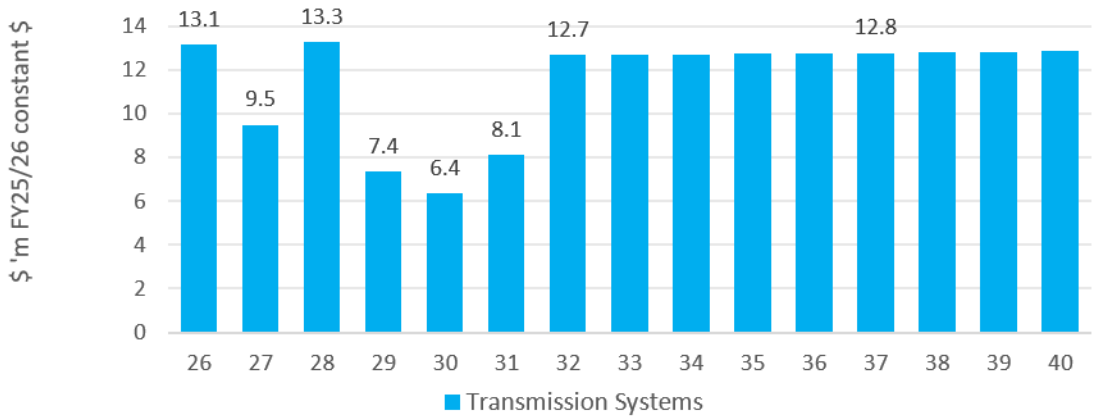
Forecast expenditure

Capex and SaaS Opex:

Since our AMP 2023 we have revised our roadmap to align with our updated ICT sub-strategies.

Figure 133 shows the Transmission Systems Capex and SaaS forecast.

Figure 133: Transmission Systems - AMP 2025 Capex and SaaS Opex forecast



Corporate Systems

Transpower's ICT Corporate Systems support Transpower's core day to day business operations, providing shared capabilities across all business teams.

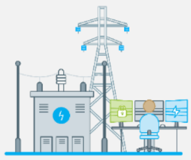
The strategic ICT direction in this portfolio is set out in our *Enterprise Business Capability*, *Customer & Stakeholder Engagement*, *Regulatory Compliance – Pricing & Disclosures* and *Enterprise Information and Data* sub-strategies. These sub-strategies define investment needs categorised as non-recurrent modernise, benefits and compliance driven. These enable us to take a strategic approach to progressively digitise and transform our corporate processes, improve our collaboration and empowerment across internal and external stakeholders to achieve higher levels of business performance and accelerate our organisational effectiveness. Our approach to managing the lifecycle of the assets, relevant to this portfolio, is set out in the *Applications Assets asset lifecycle management strategy*, which describes how we manage recurrent maintain investments. This plan covers the RCP4 regulatory periods.

The figure below shows all the ICT sub-strategies and asset lifecycle management strategies categorised by investment type. In red we highlight the strategies covered by this portfolio.

Asset class snapshot

Corporate Systems support the management of approximately:

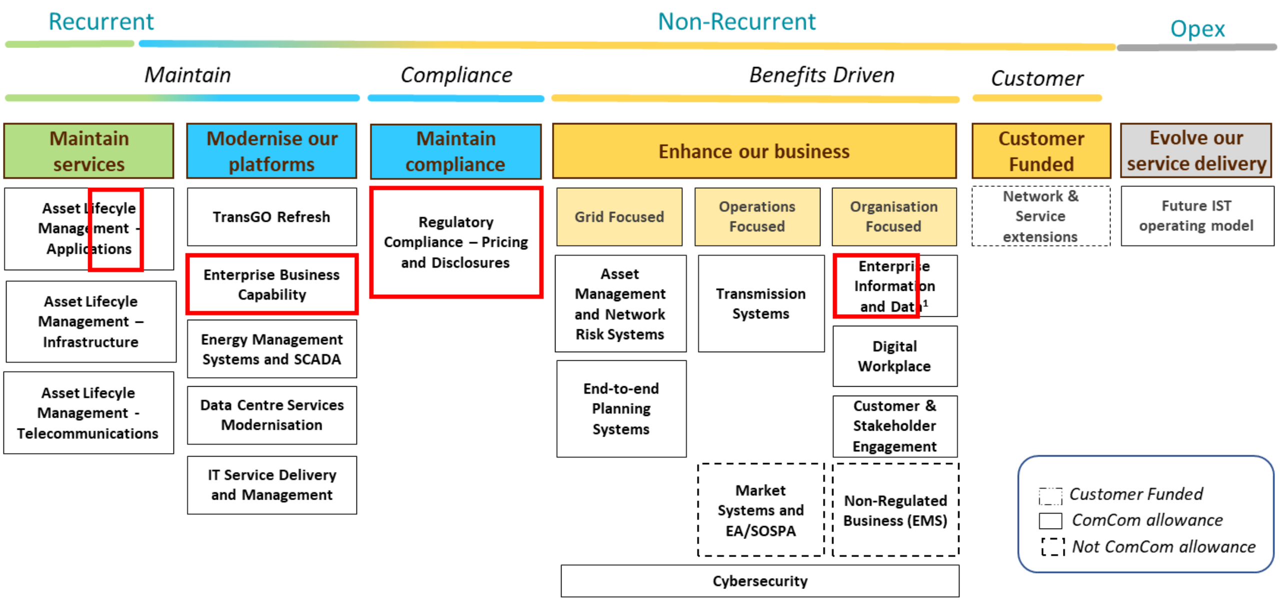
- $1,000m - Totex through financial systems p.a.
- $980m – processing revenue p.a.
- 29k Landowner interactions p.a.



Capex & SaaS Opex

RCP4 Forecast

$67.7m



1 – Data & Analytics is covered in Enterprise Information and Data sub-strategy

Asset class strategy

Strategic direction

The transmission utility industry is going through a period of rapid change with increased demand for new customer connections, increased reliance on electricity to reduce Aotearoa New Zealand's carbon footprint and the advent of new technologies that have the potential to impact on our corporate systems capability to meet customer and regulatory expectations.

Our alignment to Transpower business strategies is summarised below.

Enterprise business capability

Whakamana I Te Mauri Hiko describes a future that will require a step change in the way Transpower operates, supported by improved capability, efficiency, and organisational effectiveness. To enable this, we must continue to focus on cost-effectiveness while accelerating our transformation.

The Enterprise Business Capability (EBC) programme is a key enabler of this transformation. Its intent is to transition from fragmented, highly customised systems to an integrated, modular platform that supports standardised business processes, improved system integration, and greater availability of trusted data. Leveraging industry-standard data models and practices, the EBC programme will streamline how we manage core corporate functions—enabling more efficient operations, reducing manual effort, and supporting more timely, informed decision-making.

Customer and stakeholder engagement

Our stakeholder map is highly diverse and focused. It ranges from generators, distributors, direct customers to landowners, regulators, partnering government agencies and city councils. While the customer numbers are small, they are large, complex entities. We engage with the various stakeholders across various capacities. New connections, planning and design, commissioning, consenting, environment planning, permits, corporate communications, and a large part of operations. Customer operations involve detailed engagement around outage management and planning, maintenance, upgrades and providing insights on performance to enable power transmission.

Our current stakeholder engagement systems and their underlying maturity, integration capability, lifecycle and architecture are diverse. We are centralising systems and functions to manage interactions and engagements with customers and stakeholders across appropriate channels, to provide a single or "360" view of stakeholders across all touch points within Transpower using Salesforce as our Customer & Stakeholder Relationship Management. This will ensure our customers and stakeholders have a compelling engagement experience and that we understand the specific needs for the stakeholder engagement so that the experience can be tailored and integrated with other business systems and systems of our key stakeholder partners, and to provide Digital workflows that facilitate and enhance customer engagement and supporting processes.

By modernising our customer and stakeholder experience we will continue to support the increasing volume of interactions around new connections, renewable energy zones and reporting on our sustainability as we move to a net zero carbon future. This will enhance how teams coordinate with each other to communicate with customers and stakeholders and identify future opportunities to improve planning and coordination and delivering compelling user experiences and providing the ability to interact through a multitude of digital channels.

Regulatory compliance – pricing and disclosures

The intent is for Transpower to maintain and improve our ability to meet regulatory compliance obligations, as set by the Electricity Authority (EA) and Commerce Commission through the Transmission Pricing Methodology (TPM), investment contracts, pricing and information disclosures. In 2025, Transpower initiated an Operational Review of the TPM to reduce the complexity, uncertainty and volatility in transmission pricing, and make pricing information more easily consumable. This work will result in change proposals for the EA to consider for consultation and decision. We will ensure system costs are carefully considered and included in our change proposals, and where possible, deliver any change initiatives required as modular or incremental additions to the existing platform, effectively mitigating non-compliance risks.

The Transmission Pricing System (TPS) system is bespoke, designed to accommodate its complexity and the pricing regime. Fulfilling our compliance obligations to regulators includes providing regular information and IPP disclosure requirements on various aspects of the business, such as grid performance, price impacts, financial reporting, and providing sufficient TPM pricing information to our customers. Our strategic direction involves moving away from manual reporting and analysis, streamlining information retrieval, and ensuring easily consumable pricing information to sustain our social license to operate in the Aotearoa New Zealand electricity market.

Enterprise information and data

In response to increasingly complex grid management demands and consequently decision making, we have implemented the data and analytics capability with the processes, tools and expertise to deliver rich insights and support Transpower's strategic decision making. The platform provides an enterprise-wide repository of corporate and operational data, using cloud-based technology to rapidly integrate advanced storage, analytics and machine learning services to scale as data volumes grow.

We continue to invest in an annual programme of data and intelligence products that will consolidate and prioritise informational and analytical needs across the organisation. Using advanced analytics with machine learning allows for more complex and automated decision making that will maximise the value of data and insights with improved returns on investment. By embedding Generative AI into our analytics ecosystem, we will enable more intuitive, automated, and context-aware decision support—enhancing the speed, depth, and accessibility of insights, and maximising the value of our data.

Our delivery in RCP3

Enterprise business capability

In RCP3, we delivered Stage 1 (Investigation and product selection) of the Enterprise Business Capability (EBC) programme, confirming the need for change and establishing the strategic case for a modular, enterprise-wide business capability platform. This included assessment of process transformation opportunities across finance, human resource management, programme and project management, purchasing, and contract management, alongside the selection of a preferred delivery partner and platform approach.

This phase validated the transition from fragmented, highly customised systems to an integrated, standardised capability model, and established a clear foundation for progression into the RCP4 blueprint, design, and delivery stages.

Enterprise information and data

During RCP3 Transpower has implemented an enterprise-wide business process management capability as a strategic enabler, to drive operational excellence and continuous improvement throughout the organisation.

We have successfully implemented a modern data and analytics platform using Snowflake, Informatica, and dbt, which enables cloud-based data warehousing, integration, and transformation at scale. Our legacy data warehouse has been decommissioned, with all core data migrated to the new platform with a new paradigm of capturing all change to a transactional system enabling future proofing analytics and data capabilities. Building on this foundation, we are expanding our Historised Data Set (HDS) and Operational Data Set (ODS) and developing high-value data and intelligence products. Additionally, we are significantly enhancing self-service capabilities, allowing business users to access trusted data and generate insights independently using tools such as Power BI, Python, and SQL. This supports faster, more informed decision-making across the organisation. This is a step change from previous capability and already supports machine learning-enabled predictive asset maintenance, self-service analytics, and early generative AI use cases.

Regulatory compliance – pricing and disclosures

The new TPM has seen us invest significantly in changes to our TPS. In RCP3, we replaced our existing legacy pricing applications with modern, fit for purpose solutions. We also extended TPS to cater for the new TPM requirements, such as the calculation of the Residual Charge, Benefit Based Charge, and Transitional Cap charge.

Lifecycle maintenance to provide fit-for-purpose tools

We have maintained our current systems to ensure that they remain fit for purpose, secure and supported through managed lifecycle investment and minor enhancements. This has seen us upgrade our Financial and payroll systems to ensure they remain compliant with Aotearoa New Zealand regulations.

Customer and stakeholder systems

The successful delivery of the new CRM platform has established a modern, integrated foundation for Customer and Stakeholder relationship management. This capability enables improved engagement, better information visibility, and enhanced service delivery. It will also support the key strategic outcomes planned in RCP4.

Our future investments

Our investments RCP4 will focus on the following key areas.

Enterprise business capability

In RCP4 we will progress the Enterprise Business Capability (EBC) programme through blueprint, design, and delivery. This will transition Transpower from fragmented, highly customised systems to an integrated, modular platform that enables standardised business processes and improved data management across core corporate functions.

We will implement a business-led capability approach, leveraging pre-integrated, Out-of-the-Box (OOB) functionality and industry-standard data models to reduce manual effort, simplify processes, and improve system integration. This will support key functional areas including financial management, human resource management, purchasing, contract management, and project and programme delivery.

The transition to an evergreen, cloud-based platform will enable continuous improvement through incremental capability delivery, improved user experience, and enhanced availability of timely, trusted information for decision-making. Over time, this will uplift Transpower's enterprise-wide business process modelling maturity, reduce operational complexity and cost, and provide a scalable foundation for ongoing business change and growth.

We will establish a product-based enterprise capability model, enabling ongoing evolution of corporate systems through business-led ownership, prioritisation, and continuous capability delivery. We will also look to embed AI-driven automation and decision support as an enterprise capability, integrated across corporate platforms to improve efficiency, reduce manual effort, and support timely, informed decision-making.

Customer and stakeholder systems

Our customer and stakeholder systems have been modernised onto the Salesforce CRM platform, establishing a consolidated and scalable foundation aligned to our strategic direction.

We will continue to invest in enhancing CRM capabilities to strengthen landowner engagement and expand the functionality of the customer portal. This includes improving mobility-enabled interactions to support more effective and timely engagement in the field.

In parallel, we will invest in our public website to enhance the overall customer, stakeholder, and landowner experience, ensuring more accessible, intuitive, and consistent digital interactions across all touchpoints.

Regulatory compliance – pricing and disclosures

We will maintain and incrementally improve the Transmission Pricing System to ensure longevity through the RCP5 period and remove transactional activities that are costly to maintain. A roadmap will be updated during RCP4 to address any substantial code amendments and/or changes in policy if required.

Enterprise information and data

In RCP4, Transpower will build on these foundations by embedding trusted data, governance, analytics, and intelligence directly into operational systems and workflows. Analytics will shift from standalone tools to embedded decision support, enabling faster, more proactive decisions. Generative AI will further augment how teams interpret data, identify risks, and act on insights.

This will require stronger data management and governance, including master and reference data practices, so high-quality data is created and maintained at the point of capture. Improved governance will increase consistency, reduce reconciliation effort, and provide trusted foundations for SaaS, machine learning, and AI adoption at scale.

A key priority is near-real-time operational intelligence. Integrating high-volume operational data with asset, environmental, and enterprise data will improve situational awareness, decision speed, and the ability to predict and pre-empt issues. This will support future operating models such as the control room of the future and further strengthen predictive asset maintenance.

Transpower will also uplift capabilities for secure industry data exchange and geospatial intelligence. Standardised data sharing will improve interoperability, regulatory reporting, and sector coordination, while linking geospatial, operational, and enterprise data will provide a richer spatial view of assets, networks, and operating environments.

Together, these investments extend RCP3 foundations into an embedded, enterprise-wide data and intelligence capability that enables predictive asset management, responsible AI adoption, and more dynamic responses to increasing operational and sector complexity.

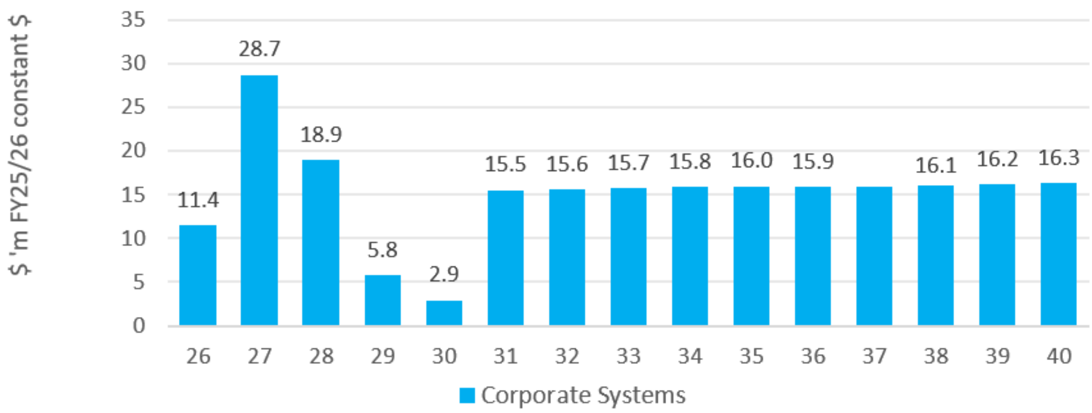
Lifecycle management

Our assets will continue being maintained in line with the *Asset Lifecycle Management – Applications strategy*. The major upgrades planned in the period are upgrades of our Peoplesoft Financial Management to maintain support until replacement in RCP4, our payroll systems, and our ENVi system (Environmental Management and Reporting tool).

Forecast expenditure

Figure 134 shows the Corporate Systems Capex and SaaS forecast.

Figure 134: Corporate Systems - AMP 2026 forecast (including capex reclassified as SaaS Opex)



Shared Services

Our ICT Shared Services portfolio supports the ICT infrastructure, systems and processes that are required for the delivery of ICT services. The focus of investments in this portfolio are predominantly risk-driven lifecycle changes whereby we continue to proactively maintain our ICT assets by upgrading them, so they remain supported and fit-for-purpose.

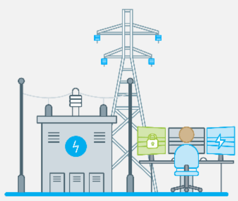
The strategic ICT direction, in this portfolio, is set out in our *Data Centre Services Modernisation* and *Digital Workplace* sub-strategies. These sub-strategies define investment needs categorised as non-recurrent modernise, benefits and compliance driven. Our approach to managing the lifecycles of the assets, relevant to this portfolio, is set out in the *Asset Lifecycle Management – Applications & Asset Lifecycle Management – Infrastructure strategies*, which describe how we manage recurrent maintain investments. This plan covers the RCP3 and RCP4.

The figure below shows all the ICT sub-strategies and asset lifecycle management strategies categorised by investment type. In red we highlight the strategies covered by this portfolio.

Asset class snapshot

Shared Services manage approximately:

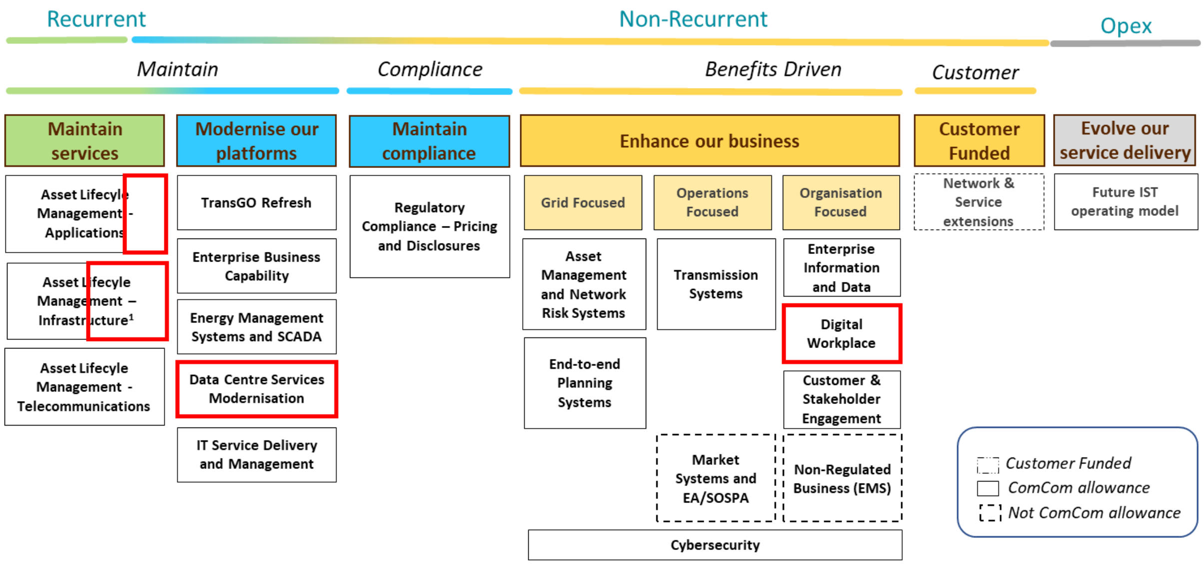
- 1500 Server Instances
- 247 Physical Servers
- 1500 TB Managed Storage
- 1800 Corporate Desktops



Capex & SaaS Opex

RCP4 Forecast

$9.1m



1 – IP Networking assets are covered in TNSS Portfolio

Asset class strategy

Strategic direction

The primary objective of this portfolio is to maintain the ICT infrastructure which supports our application hosting, workplace productivity and operations, delivery, and assurance services. As such, the *Asset Lifecycle Management – Applications & Asset Lifecycle Management – Infrastructure strategies* provide detail on how we lifecycle manage our existing assets, optimising our investment and managing our asset risk effectively.

Enhanced data centre services modernisation strategy

Global constraints in compute and memory supply are driving sustained cost increases and higher delivery risk across the industry, affecting both on-premises infrastructure and cloud services. These conditions reduce pricing certainty, extend lead times, and make long-term technology commitments harder to plan and justify.

We have reset our data centre services strategy from cloud-first to an affordability-optimised on-premises approach to reduce cost and delivery risk while preserving future flexibility. We've taken a pragmatic hybrid, service-based model that prioritises resilience, affordability and flexibility. We are managing lifecycle risk by extending asset lifecycles where safe, actively controlling procurement by re-purposing infrastructure, progressively reducing footprint through SaaS adoption, and deferring irreversible infrastructure or cloud commitments so we can adapt as market conditions stabilise.

Key considerations include:

- Robust Hosting environment: Ensuring critical and corporate systems have a robust and reliable hosting environment.
- Affordability and cost certainty: We will maintain delivery within the approved allowance by optimising on-prem investments for affordability with appropriate risks until market conditions stabilise. We will ensure residual footprint clarity and maintain clear visibility of remaining on-prem footprint as SaaS adoption reduces demand, to avoid over-investing in capacity.
- Hybrid Cloud integration: We will ensure seamless integration of the cloud environment with our on-premises systems, supporting a hybrid cloud environment
- Leverage of cloud-native and SaaS capabilities: Utilising SaaS, IaaS and PaaS solutions where they deliver clear benefits, to reduce our footprint and drive innovation and efficiency
- Preserve future optionality: We will preserve optionality for later strategic shifts while delivering a stable and affordable RCP4 plan
- Operational maturity uplift: We will uplift infrastructure operations maturity to enable better cost transparency for cloud and hybrid operations.

Digital Workplace

Transpower is adapting our ways of working, learning from the lessons provided through the COVID-19 global pandemic. The drivers for doing things differently include the continued "war for talent" and need to provide a compelling employee experience in line with the shift in expectations of employees. In addition, the need to codify our knowledge continues.

Our *Digital Workplace sub-strategy* seeks to embed a flexible workplace culture without losing the productivity and performance of teams. Building on a successful roll-out of mobile-first, O365, our new intranet, Windows 11, a Modern Desktop Environment and more recently Microsoft Office Copilot, Transpower aims to build a blended workspace that enables seamless working between office and virtual environments.

Our operating environment spans a diverse range of settings—from corporate and regional offices to field-based locations such as inventory stores, warehouses, and substations, as well as specialised environments including Service Provider Workstations and Engineering Workstations. To support our workforce across these varied contexts, we will continue investing in the Digital Workplace. As our workforce transitions from a knowledge-rich group that acquired digital skills in adulthood to a predominantly digital-native generation, we aim to foster a culture that embraces AI-powered tools and digital-first ways of working.

ITSM modernisation

As part of the IT Service Delivery and Management transformation, we are modernising how technology services are delivered by introducing a Service Delivery Platform (SDP), enabled by the ServiceNow SaaS solution. This establishes a single, organisation-wide service management platform that replaces multiple fragmented tools. This creates a consistent, standard way of managing requests, issues, changes and improvements, aligned to proven industry practices and designed to scale over time.

We will also be connecting the SDP with related operational and business systems, to gain a complete view of services, improving reliability and enabling faster problem resolution. Teams will benefit from a simpler, more transparent experience with support staff working from one clear, shared view of services.

Our delivery in RCP4

Our investments focused on proactively renewing and modernising core platforms and services to reduce end -of-life risk, strengthen resilience, and ensure the ICT environment remains supported, scalable, and fit-for-purpose.

Lifecycle management

In RCP4 we have invested in the following:

- Consolidated EMS platforms into Shared Services, simplifying the technology footprint, and improving operational supportability and lifecycle governance.
- Delivered the Modern Managed Desktop (Windows 11), moving from on-premises builds to a standardised, vendor-supported desktop builds model. This reduced provisioning effort and ensured desktops remain on a supported platform.
- Implemented an isolated Recovery Environment, strengthening cyber resilience and enabling secure restoration of critical systems following major incidents.
- Completed other lifecycle upgrades across systems and platforms, ensuring continued vendor support and reducing operational and security risks
- Upgraded Teams and meeting room technology, improving reliability and user experience for collaboration across physical and remote environments.
- Upgraded Active Directory infrastructure strengthening foundational services that underpin the ICT environment.

Our future investment

Building on the foundations established in early RCP4, our future investments across the remainder of RCP4 will be tightly targeted to maintain resilient, affordable, and supportable data centre and hybrid cloud services, while preserving future flexibility for post-RCP4 decisions as market conditions evolve.

Supporting business change

As the delivery of corporate and critical applications continues to evolve, we will take a considered approach to cloud adoption, progressing where clear benefits can be realised while allowing the domestic cloud market to mature. To balance affordability, resilience, and delivery risk, we have reset our data centre strategy from a cloud-first position to an affordability-optimised, on-premises-led hybrid model.

Under this approach, we will remain in dedicated data centres through RCP4 and RCP5, focusing investment on sustaining fit-for-purpose on-premises platforms and uplifting the maturity of our hybrid cloud practices. This provides strong control and resilience for critical systems, while retaining flexibility to integrate with SaaS and cloud platform services over time.

As demand grows for on-premises systems to connect with cloud services, elements of our cost profile will progressively shift from traditional capital investment toward consumption-based operating expenditure. This transition will be supported by improved cost transparency, stronger governance, and active lifecycle management, ensuring affordability and future optionality beyond RCP4.

Asset management - infrastructure

Infrastructure assets will continue to be maintained in line with the *Asset Lifecycle Management – Infrastructure* strategy, with a strong emphasis on optimised asset utilisation, explicit lifecycle risk management, and delivery assurance. Where appropriate, asset life will be safely extended, supported by targeted upgrades and vendor support arrangements., to avoid premature investment and manage cost pressures.

Tooling and operational practices will be modernised where required to support business demand and maintain service resilience.

Our investments for ICT asset management and tooling will include the following:

- Aligning the TransCloud converged compute platform refresh to the revised Data Centre Services Modernisation strategy, including extending asset life where safe, undertaking targeted upgrades, and migrating of residual workloads when SaaS transitions are completed.

- Transitioning from Cherwell ITSM to ServiceNow solution, mitigating end-of-life risks and establishing a modern standardized service management platform;
- Modernising our Corporate File Share Services solution, transitioning from on-premises Windows File Services to Azure Files, reducing dependency on ageing infrastructure while improving resilience and scalability
- Leveraging ITSM investments to consolidate and mature environment monitoring and management, enabling a shift from reactive fault resolution to proactive maintenance and self-service.
- Refreshing our control room end-user technology, including desktops, operating systems, and monitors to support critical operational functions.
- Improving build and run efficiency through automation, reducing manual effort and operational risk.
- Enhancing end-to-end observability and cloud financial management practices across infrastructure and platforms to improve reliability, cost transparency, and decision-making.

Modernise our data centre services

In line with the Proposed Target State for Data Centre Services Modernisation, we will continue to operate from dedicated data centres while progressively uplifting our hybrid cloud practice maturity. The focus is on sustaining critical platform posture, extending the life of corporate infrastructure assets, and enabling considered cloud adoption where benefits can be realised. Investment will be directed toward affordability-optimised lifecycle management, operational control, and integration rather than data centre exit or wholesale cloud migration. This includes:

- Considered cloud adoption: We will continue with SaaS and cloud platform adoption journey where clear benefits can be realised, progressively reducing the data centre footprint over time while maintaining affordability and resilience.
- Maintain critical platform posture: Prioritising risk-driven lifecycle investment to refresh and sustain supported, resilient, and fit-for-purpose on-premises infrastructure, with lifecycle risks explicitly accepted and actively managed in line with affordability constraints.
- Uplift hybrid cloud practice maturity: Deploying cloud-native ITSM and management capabilities to improve visibility, cost transparency, and governance across a hybrid ICT environment, supporting more effective operational and financial control.
- Enable hybrid connectivity and future options: Enhancing secure, resilient, and scalable connectivity between Transpower’s data centres and public cloud platforms to support SaaS and cloud platform adoption, reduce the data centre footprint over time, and retain flexibility for post-RCP4 decisions.

Digital workplace

Our future investment in the Digital Workplace is focused on enabling a secure, resilient, and insight-driven digital ecosystem that supports Transpower’s evolving ways of working. These investments are designed to improve productivity, enhance employee experience, and ensure our workforce can operate effectively across physical, virtual, and field environments.

Student management

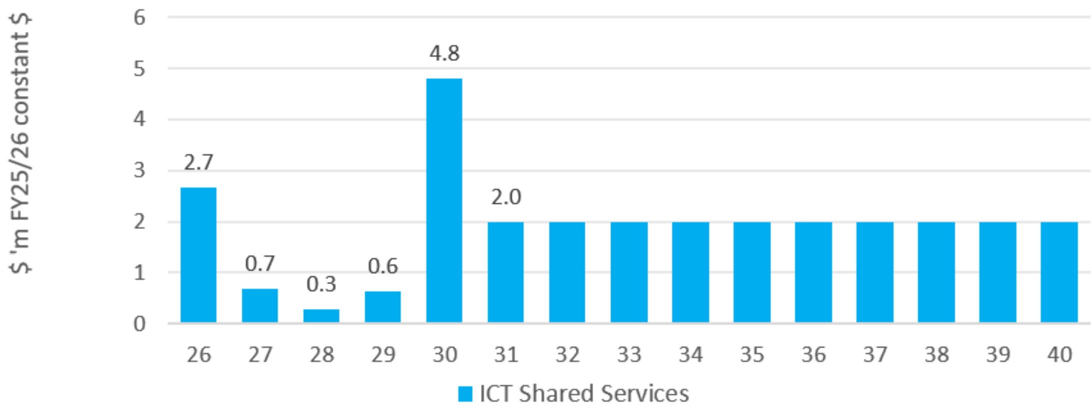
Our role as a Private Training Establishment for Grid Transmission qualifications requires capabilities that enables enrolment in courses, tracking of progress, and management of student assessments and records.

We continue to explore opportunities to enhance our capability to manage training for external partners, supporting the growth of a skilled workforce to deliver on Transpower’s targets.

Forecast expenditure

Figure 135 shows the Shared Services Capex and SaaS forecast.

Figure 135: Shared Services - AMP 2026 forecast (including capex reclassified as SaaS Opex)



Telecommunications, Network and Security Services

Transpower's Telecommunications, Network and Security Systems (TNSS) portfolio delivers services which provide a secure, high-capacity nationwide communications network which underpin our mission critical grid operational services and our business-critical corporate services. This portfolio addresses our Local Area Network (LAN), Wide Area Network (WAN) and Unified Communications network services as well as providing the end-to-end protection against cybersecurity threats to our people, systems and data.

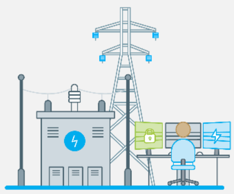
The strategic ICT direction, for this portfolio, is set out in our TransGO Refresh sub-strategy for our non-recurrent modernise investments. Our approach to managing the lifecycle of the assets, relevant to this portfolio, is set out in the Telecommunications and Infrastructure asset lifecycle management strategies, which describe how we manage recurrent maintain investments. Our Cybersecurity sub-strategy is guiding all our Cybersecurity investments in this portfolio. This portfolio also supports and is influenced by the Data Centre Migration and Digital Workplace strategies.

The figure below shows all the ICT sub-strategies and asset lifecycle management strategies categorised by investment type. In red we highlight the strategies covered by this portfolio.

Asset class snapshot

Telecommunications, Network and Security Systems manage approximately:

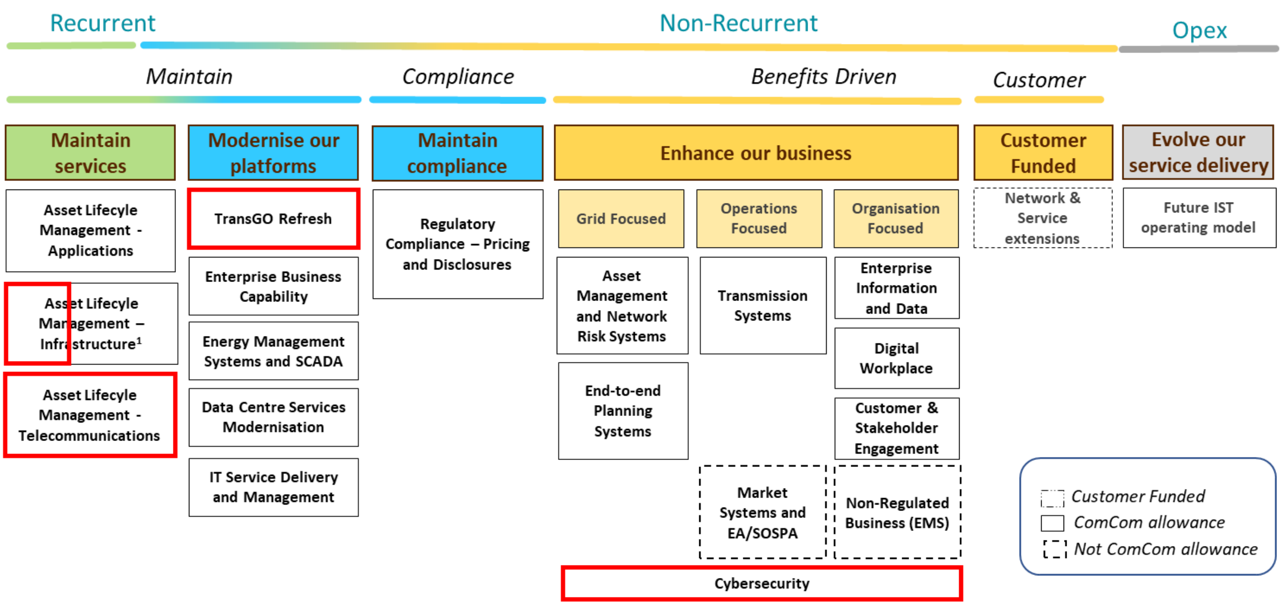
- 7500km Fibre
- 560 Multiplexors
- 38 MPLS Routers, modernising to 360
- 2700 Network Devices



Capex & SaaS Opex

RCP4 Forecast

$143.4m



1 – IP Networking assets are covered under Asset lifecycle management – Infrastructure sub-strategy and in TNSS Portfolio

Asset class strategy

Strategic direction

Our strategic ICT direction is summarised below.

TransGO Refresh - major reinvestment to modernise our telecommunications network to ensure the network continues to meet the needs of the business

Several key components of our nation-wide area network, TransGO, are reaching the end of their effective life. This is driving a major investment to modernise the network, which commenced in the latter part of the previous regulatory period (RCP3) and continues through RCP4. When we developed our RCP3 proposal, we expected to be able to defer the TransGO refresh to RCP4. During RCP3, it became apparent that the TransGO refresh could not be deferred. We therefore invested in strategic spares, established extended support arrangements, and started the TransGO refresh programme early, supported by careful lifecycle management. As part of the development of the TransGO Refresh sub-strategy we revisited the services supported by the communications network and reconfirmed their current and future requirements. The development of some of these services is informed by other ICT and business strategies and include:

- Supporting the adoption of cloud services and the modernisation of our data centre services.
- Supporting our field mobility systems.
- Supporting the ongoing upgrade and modernisation of our line protection and telemetry systems.
- Supporting the development and deployment of our digital substation solution.
- Supporting our substation asset management capabilities.

We anticipate that this will drive the need for more services and greater network capacity into our substations while shifting network services away from our data centres and towards internet and cloud hosted services.

The remote nature of some of our sites, the specialised nature of our high voltage line protection and Supervisory Control and Data Acquisition (SCADA) telemetry services, and the design constraints they place on the communications network means that we cannot source telecommunications services from the open market for these. This, along with our existing long-term commercial commitment to our national fibre infrastructure drives us to continue to deliver these services using bespoke network infrastructure.

For our network services that are not industry specific, we have a choice to either leverage our dedicated network infrastructure or to source services from the telecommunications market.

Cybersecurity - protecting our people, systems and assets

We use cybersecurity controls to secure our people, systems and data. We ensure we understand and measure risk and respond with the appropriate level of information security controls.

The cybersecurity landscape continues to change, with:

- An increasing number of evolving cyber threats targeting national critical infrastructure and organisations like ours.
- Increased use of data sharing, cloud-based services, artificial intelligence, and connected Operational Technologies.
- The increasing deployment of connected Operational Technology (OT) and Internet of Things (IoT) devices, and the extension of network services further into substations and edge environments.
- The evolution to a digitally enabled workforce and new ways of working.
- How we respond to business, technology, and threat change, including the TransGO Refresh and Data Centre Services Modernisation.

We are adopting and applying appropriate controls for data management, privacy, and security, to continue to provide our services in a safe and secure manner.

Our strategic direction is to drive cybersecurity by design, and to maintain and modernise our security controls to ensure Transpower continues to operate within our risk appetite.

The consequential cost of cybersecurity control failure remains significant and could include failure to operate the National Grid or Electricity Market.

Asset lifecycle management - effective lifecycle management of our existing assets

Our asset lifecycle investments are informed by our Cybersecurity, Asset Lifecycle Management - Infrastructure and Asset Lifecycle Management - Telecommunications strategies. These strategies set out how to lifecycle manage our existing assets; optimise our investment and manage our risk.

Our Cybersecurity sub-strategy addresses our future investment across all aspects of Cybersecurity. This includes the lifecycle of our existing physical security assets and supporting systems (e.g. Firewalls). We are adopting a low-risk approach to this investment ensuring our assets remain supported.

Our Asset Lifecycle Management - Infrastructure and Asset Lifecycle Management - Telecommunications strategies inform our investment for each class of assets. The approach for each asset class is defined considering a simple likelihood/impact model which takes into consideration the criticality of the services supported by the assets.

Data centre service modernisation – supporting our migration to the cloud

The Data Centre Modernisation strategy directs our approach for providing cloud and datacentre compute services. This portfolio will support this strategy and by evolving the telecommunications, networking and security services to meet the needs of this modernisation.

Delivery to date and through RCP4

Our most significant investments to date and through RCP4 focused on:

Telecommunications

Our recurrent maintain investments to date have been aligned with our lifecycle objectives to maintain capability and service levels, support process efficiency and meet the privacy and security standards.

When we developed our RCP3 proposal, we expected to defer the major TransGO refresh into RCP4. To extend the life of our current TransGO assets in the interim, we implemented several network reconfigurations and localised capacity upgrades. However, during RCP3 the effective end of life of key TransGO assets was brought forward. As a result, we brought the TransGO refresh in earlier than planned and had to fund strategic spares for critical equipment to maintain the continuity of operations.

TransGO Refresh completed the procurement selection phase and has progressed through site preparation and detailed network design. Technical Acceptance Testing (TAT) is in progress. Build readiness activities continue through RCP4, followed by staged migration of services. In parallel, TransGO OSS is currently in a pre-production proof-of-concept stage to validate service assurance capabilities for teleprotection services, with core capabilities demonstrated but not yet operationalised.

Network

IP Network Equipment Lifecycle has been an ongoing recurrent investment which maintains the capability and service levels for data networking equipment. This has been supported by modernising IP networking management tools, including rationalising and consolidating the current toolsets. It has delivered a consolidated and holistic end to end view of the network.

The corporate office and warehouse Wi-Fi service was refreshed, and the existing office access points were redeployed to the substations. We also progressed substation LAN, Wi-Fi and voice modernisation activities to improve local service resilience and supportability. In parallel, we are progressing Megaport connectivity for Waikoukou (Wellington) to enable Internet offload at our largest office, rather than carry the traffic over the existing TransGO network.Corporate and Operational Unified Communications lifecycle activities have been progressed to maintain service levels and availability requirements, alongside supporting device platform refresh activities across offices, control rooms and operational environments.

Cybersecurity

We continue to use cybersecurity risk modelling to ensure we maintain the effectiveness of our existing controls and enhance or implement new controls, where changes to our risk posture occur from new technology, changes in the threat landscape, or the way we deliver services and requirements from our customers and industry.

We invest in initiatives prioritised based on risk reduction, and the level of risk mitigation that can be delivered within the available budget in each financial year of an RCP period. This process is repeated on an annual basis based on an updated cyber threat profile for Transpower and results of our ICT assurance programme. This investment modelling approach is repeatable and contextual, based directly on our risk-based approach.

Key highlights to date include:

- Enhancement and expansion of our endpoint detection and response (EDR) capabilities.
- Progression of firewall lifecycle and upgrade activities including TransGO enhancements to move to edge firewalls from an aggregated approach. Ongoing improvements are progressing to enhance secure connectivity between corporate and higher trust environments..
- Enhancement of Operational Technology (OT) visibility and security within substation networks including OT vulnerability management and supporting platforms for OT threat detection.
- Enhancement of our Identity and Access Management (IDAM) environments and capabilities, including Active Directory lifecycle improvements and privilege access uplift.
- Modernisation of our SOAR/SIEM platform (cyber operational monitoring platform), cybersecurity threat hunting and incident management capabilities.
- Enhancement of secure software engineering practices, cloud security controls and service resilience.
- Strengthening of security controls across corporate, OT, and internet-facing environments through remediation activities informed by environmental penetration testing. These improvements have increased the effectiveness of network segmentation, tightened identity and access controls, and reduced exposure across externally accessible services, resulting in a more resilient and defensible operating environment.

Our future investments

Our investments across RCP4 will be targeted at these key areas:

TransGO

Our TransGO WAN assets are being modernised in line with the TransGO Refresh sub-strategy. Our underlying fibre network is retained while the telecommunications equipment supporting our high voltage line protection systems will be refreshed including critical and non-critical substation IP Services. It leverages the substation network investment to also modernise core network connectivity between our data centres, control centres and offices.

TransGO Refresh site preparations and network design continue and Technical Acceptance Testing (TAT) continue through RCP4. This enables network build and staged service migration to be completed before the current network reaches the end of vendor support in 2028. Planning and preparation for this commenced in the previous regulatory period (RCP3), once the effective end of life of key TransGO assets was brought forward, with most of the capex investment occurring in the first 3 years of RCP4.. To minimise the impact on our operational services we will need to operate parts of the old and new network infrastructure in parallel for several years and temporarily lease additional fibre across much of the network. During this time our operational costs will temporarily increase as we support and maintain both sets of infrastructure.

We will also modernise our current cloud connectivity to Hyperscaler providers, including Azure, AWS and other cloud providers. This aligns with our Data Centre Services Modernisation sub-strategy. The current solution direction includes scalable cloud on-ramps.

Cybersecurity

Our cybersecurity assets will continue to be maintained and modernised in line with the Cybersecurity sub-strategy to manage our cybersecurity risk to the agreed risk appetite.

We will continue to use the RCP3 approach to cybersecurity risk modelling and prioritisation for investment across the following initiative categories:

- Maintain and modernise existing capabilities. Key initiatives include:
    - Substation and TransGO security controls, including firewall lifecycle and upgrade activities
    - Identity & Access Management Capabilities, including privilege access improvements
    - OT Vulnerability Management and threat visibility capabilities
    - Software Security and secure engineering uplift
    - Security Logging & SOAR platform
    - Vulnerability Management - Improve and automate the vulnerability management end to end process and reporting
    - Cardax Connectivity & Virtualisation (Gallagher refresh): Refresh the Gallagher physical access platform.
    - Security Logging Refresh: Refresh the security logging platform to maintain supportability and alignment with standards.

- Sustain security control effectiveness.
    - The expenditure proposal relating to this category was rejected for RCP4. Proposed initiatives will be refined and reevaluated for implementation by funding substitution through our productisation governance process.

- New capabilities in response to threat change. Key initiatives include:
  - Critical Applications Security Risk Improvements
  - Market System Security Investments

- New capabilities in response to business change, including secure integration between corporate and highest trust environments and support for EMS security requirements
- New capabilities in response to technology change, including cloud security foundations and landing zone security enhancements

Lifecycle management – Network

Our IP networking assets will continue being maintained in line with the Asset Management - Infrastructure asset lifecycle management strategy. We will continue to invest annually to maintain our fleet of IP network switches and routers to an appropriate level of support to meet the business need. This lifecycle investments will increase as our substation IP network assets introduced in the last ten years approach the age where they need to be refreshed. As we transition away from our current physical data centres we will reduce our ongoing investment in our datacentre IP networking infrastructure. We will also continue our regular investments to maintain our operational and corporate unified communications platforms to the appropriate service level meeting the business needs.

Lifecycle management - Telecommunications

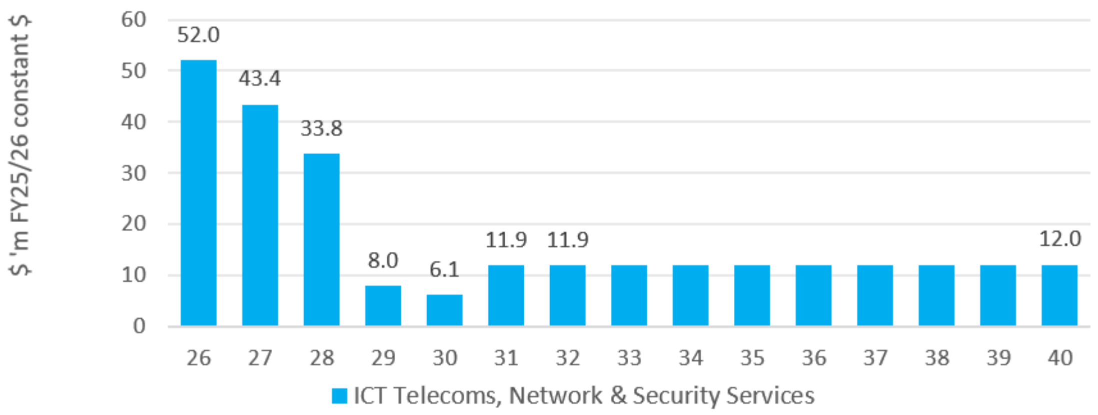
Our Telecommunications assets will continue being maintained in line with the Asset Lifecycle Management - Telecommunications strategy. We will continue annual maintenance of our supporting substation infrastructure e.g. batteries and power supplies and lifecycle upgrades of our device firmware and network management applications. We will perform the minimum required updates to the TransGO network up to its replacement.

Forecast expenditure

Capex and SaaS Opex: Since our AMP 2023 we have revised our roadmap to align with our updated ICT sub-strategies.

Figure 136 shows Telecommunications, Network and Security Systems Capex and SaaS forecast.

Figure 136: Telecommunications, Network and Security Systems - AMP 2026 forecast (including capex reclassified as SaaS Opex)



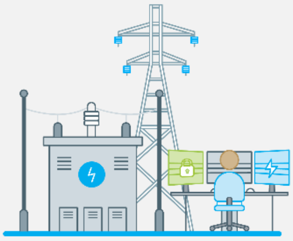
ICT Opex

Our ICT Opex portfolio covers the external costs to run our ICT function and comprises leases, third party support and maintenance, outsourced services, licenses, communications and control, and investigations.

Expenditure related to people in our teams i.e. costs of employees, contractors, consultants and overheads associated with these resources is included within the scope of Business Support Opex and is explained in the separate section on Business Support Opex. We continuously try to optimise our workforce through insourcing and outsourcing arrangements to balance the trade-offs between cost and maintaining in -house capability.

ICT Opex snapshot

ICT Opex complements the delivery of investments across all five ICT portfolios

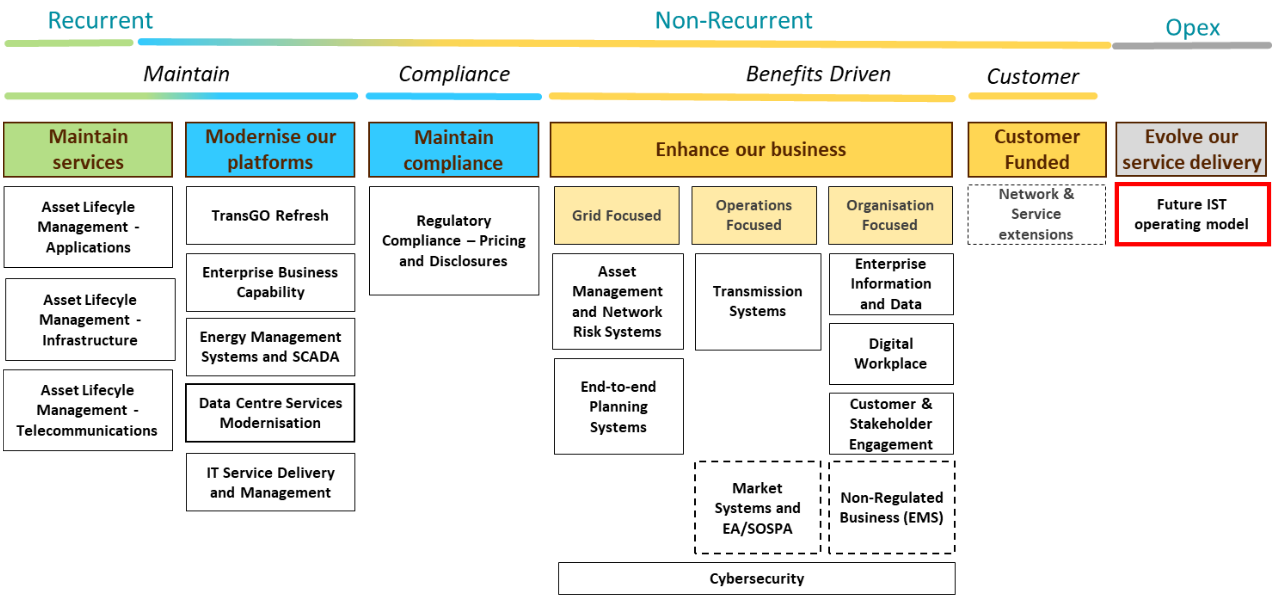


Opex

RCP4 Forecast

$263.2m

The figure below shows all the ICT sub-strategies and asset lifecycle management strategies categorised by investment type. In red we highlight the area covered by this portfolio.



ICT Opex Strategy

Strategic direction

Our ICT Opex portfolio is defined by the work programme set by our sub-strategies and asset lifecycle management strategies as outlined in the five ICT portfolio plans.

We applied the base-step-trend approach to forecast our Opex. We used the FY22/23 actuals as a base from which adjustments are forecasted due to known initiatives and trends. This chapter expresses the expenditure numbers in FY24/25 real dollars.

The strategic investments with the most significant impact on the forecast Opex step changes across RCP4 are:

- **Digital capability uplift**: Investment in data and analytics, Digital Engineering and Generative AI is increasing licensing and SaaS subscription costs, with additional upward pressure from structural increases in global ICT infrastructure and cloud service costs.
- **Shift to consumption-based services**: Transition to SaaS and cloud services is increasing operating expenditure due to subscription models and cost pass-through from providers, reflecting a broader shift from capital investment to consumption-based Opex.
- **Data centre modernisation (affordability-led)**: The revised strategy prioritises extended use of some assets and vendor support arrangements to manage affordability and market cost pressures. This reduces capital investment but increases ongoing operating costs for support and lifecycle management.
- **SaaS transitions across enterprise platforms**: Implementation of key enterprise platforms (including the Service Delivery Platform, ERP and Customer and Stakeholder capabilities) consolidates legacy systems but introduces recurring subscription-based costs.
- **Following the major upgrade to our TransGO network** the Opex cost of running our telecommunications network will increase, driven by replacement of our radios and new core network capacity.
- **Other cost drivers**: Additional Opex impacts arise from increase in licensing costs, and increased lease costs for new Grid connections.

Our RCP4 forecast will see a shift in cost classification from capex to Opex for any initiatives recognised as SaaS arrangements. Our portfolio plans present both capex and SaaS Opex together for comparative purposes.

Our investment

Leases

From 1 July 2019, under NZ IFRS 16 Leases, our long-term leases for fibre and data centres have been capitalised. Of the remaining leases, the most significant costs relate to telco leased circuits and other minor leases. These were not capitalised as they did not meet the capitalisation criteria of the standard.

Our fibre requirements and lease costs are increasing beyond what was planned as additional Grid Connections are added. We continue to manage our lease costs carefully. With the re-classification, improvements in lease costs will show in the depreciation line rather than under Leases.

Our total forecast for lease costs is $5.7m for RCP4.

Third-party support and maintenance

Our total forecast for in this category is $36.8m for RCP4. The significant cost elements in this area are:

- general infrastructure support and maintenance
- support for critical systems (SCADA/EMS)
- Inter Control-Centre Communications Protocol (ICCP) support
- enterprise application support by various service providers
- telecommunications support and maintenance
- internet gateway, video, telephony and data network support
- outsourced IT Service Management
- bureau/data services

We expect to see annual third-party support and maintenance to increase progressively during RCP4 due to several initiatives.

IST outsourced services and cloud

Our total forecast for in this category is $118.4m for RCP4. The significant cost elements in this area are:

- infrastructure support (server management and desktops)
- operations management of the TransGO network by specialist providers supporting the Transpower Network Operations Centre
- data centre facilities management
- operations management of our on-premise Infrastructure and tenancies
- amortisations of telecommunications service fees
- service desk services
- cloud services

The remainder covers a range of other outsourced providers for system and operations support.

We expect to see increases in our IST Outsourced Services and Cloud expenditure over RCP4 driven by:

- Revised affordability-led Data Centre Services Modernisation approach, under which critical infrastructure platforms are refreshed in line with lifecycle requirements, while corporate infrastructure assets are selectively extended beyond standard lifecycle through deferred refresh and prolonged vendor support arrangements. This approach reduces capital investment, but results in higher ongoing operating costs for support, maintenance, and lifecycle management. These increases are partially offset by reduced capital expenditure associated with deferred corporate platform refresh.
- An ongoing increase in cloud services as more applications are delivered via cloud-based Software as a Service instead of on-premise. This will be partially offset by a reduction in hosting costs.
- Software licensing costs increase in line with the forecasted growth in Transpower FTEs, reflecting additional user requirements across our core platforms.
- Increased costs of outsourced core capacity and maintenance services in line with the TransGO upgrade.

IST licences

The base costs in this category for Microsoft, Oracle, and other licences was $11.6m. All Transpower software licences are consolidated into the ICT Business area.

Our investment in Digital Engineering capabilities and Generative AI is expected to drive an increase of approximately $1 million per year in licencing and SaaS subscriptions. Our investment in Cybersecurity and firewalls required for TransGO upgrade will drive a further increase of license costs by $3.4 million in RCP4.

Our total forecast for in this category is $89.7m for RCP4.

Communications and Control

Communications and Control refers to operating and maintaining operational technology communications and control infrastructure across the grid, including telecom networks (TransGO), substation comms/control equipment, and associated preventative and corrective maintenance services.

The base costs in this category totalled $1.4 million. We have maintained our discipline in managing preventative maintenance visits to the grid sites in a conscious effort to drive costs down. The current level of spend is believed to be sustainable in the long-term based on current operational needs and will continue to be required also after we refresh our telecommunications network (TransGO Refresh).

Our total forecast for in this category is $7.9m for RCP4.

Investigations

Selected investigations are carried out on an as required basis. The level of expenditure is nominally capped to an assigned budget.

The investigation expenditure is related to the scale and timing of our delivery across the portfolio. Our forecast was built bottom up based on the Capex and SaaS Opex investments included in our forecast.

In RCP4, the investigation effort is expected to be driven primarily by the establishment and scaling of the Service Delivery Platform and ERP initiatives alongside the ongoing TransGO Refresh programme. This will result in a higher level of investigative activity during the earlier phases of these initiatives, as solution options are defined and delivery approaches refined.

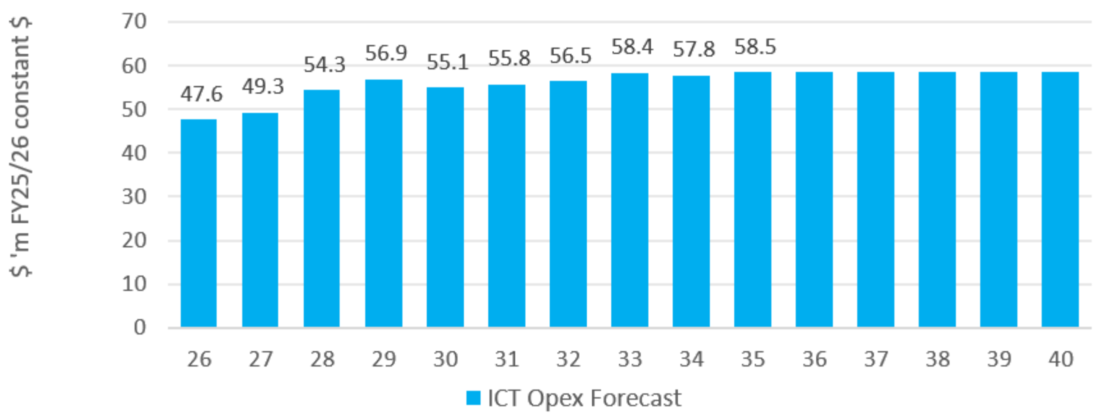
As these platforms and capabilities mature and transition into steady-state operations, the need for investigation activity is expected to reduce, resulting in a corresponding decline in expenditure in the latter years of RCP4.

Our total forecast for in this category is $4.6m for RCP4.

Forecast expenditure

Figure 137 shows the ICT Opex forecast.

Figure 137: ICT Opex (excluding capex reclassified as SaaS Opex)



Business Support Asset Class Plan

Business Support Asset Class Plan

Our business support assets include assets not otherwise included in other asset classes and required for the successful operation of the business as a whole. They are diverse in nature and, as such, are managed individually, dependent on the type and nature of asset involved. This ACP covers:

- Office buildings
- Vehicles
- Minor fixed assets – office equipment
- Minor fixed assets – IT and other
- Residential houses
- Forecast RCP3 and RCP4 expenditures.

Table 31 below provides a summary of the assets included.

Table 31: Business support asset population

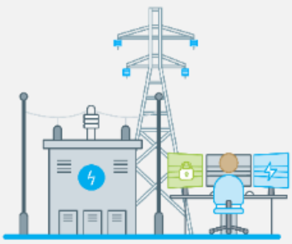
Asset category	Description
Office buildings	Two leased offices – Wellington and Palmerston North Three owned offices – Auckland, Hamilton, and Christchurch
Vehicles	128 vehicles (including passenger vehicles, utility vehicles, and minibuses)
Minor fixed assets - Office equipment	Office desks, chairs, and meeting room furniture for all our corporate offices, plus the warehouses, training centres, Hamilton Control Centre, and NGOCs
Minor fixed assets – Information Technology	Replacement of IT office equipment, e.g. laptops, mobile phones, and peripheral devices for corporate end users.
Residential houses	Three residential properties that are tenanted. We also have ten houses that are used as emergency accommodation by our contractors and field staff

Asset class snapshot

Population

128 Vehicles

5 Corporate offices



Capex

RCP4 (forecast)

$41.8m

Asset class strategy and lifecycle approach

Each of the asset categories are described below.

Office buildings

We have corporate offices in Auckland, Wellington, Hamilton, Palmerston North and Christchurch. The Auckland, Hamilton and Christchurch offices are on sites owned by Transpower, so the maintenance of these sites is included as part of buildings and grounds asset management. The Wellington and Palmerston North offices are leased. All the offices are in good condition and regularly maintained.

Planning

Various works are planned at all the offices

Operations and maintenance

We have agreements with suppliers to maintain the office buildings. These are regularly reviewed.

Disposal and divestment

We are not proposing to dispose of any offices during RCP4, however we are relocating our Palmerston North office in March 2027. The cost of this relocation is budgeted in FY27.

Grid skills training facilities

We have Grid Skills training facilities in Huntly, Blenheim and Bunnythorpe that offer training programmes aimed at developing a qualified workforce for the transmission industry. All the sites are owned by Transpower and the maintenance is included as part of buildings and grounds asset management.

Planning:

Included within the forecast is $10.6m to expand the capacity of our Grid Skills training facilities. Grid skills training is increasing, as we increase the overall workforce to deliver the required work in RCP4 and beyond.

Operations and maintenance

We have agreements with suppliers to operate and maintain the training facilities.

Disposal and divestment

We may construct a new training facility and divest an existing one as part of our plan to expand the capacity of our training facilities.

Vehicles

Our vehicles are predominantly located at the Auckland, Hamilton, Palmerston North, and Christchurch offices. They are either used as pool vehicles or allocated to staff who regularly visit our sites and landowners.

Planning

We replace vehicles when they meet our replacement criteria. We have committed to changing all our passenger vehicle fleet to plug In hybrid electric (PHEV) or battery electric vehicles (BEV). We participate in the All of Government contract for the supply of motor vehicles, which is regarded as the best available price offered in the market. A similar approach is planned in RCP4. In response to the evolving fuel security situation, we decided to bring forward our planned purchase of PHEV and BEV vehicles in FY27 to FY26.

Operations and maintenance

The vehicle fleet is managed by an external provider who takes a consistent and cost-effective approach to maintenance based on manufacturer's guidelines. GPS is fitted to vehicles to ensure they are operated efficiently and safely. We also participate in the Ministry of Defence syndicated fuel contract with BP to minimise our annual fuel bill.

Disposal and divestment

Generally, petrol vehicles are replaced after 4 years or 120,000 kms travelled and diesel and electric vehicles are replaced every 5 years or 150,000 kms travelled. We usually sell vehicles through established auction houses.

Minor fixed assets - Office equipment

Planning

Each year, we review the office equipment needs at all our offices and budget for replacements in the following year's business plan. Office furniture mainly consists of desks, chairs, and meeting room furniture. There are numerous projects in 2026/27 to replace office equipment.

Operations and maintenance
Office equipment is repaired or replaced as required. We purchase office equipment from established furniture suppliers.

Disposal and divestment
We sell redundant office equipment or donate it to charities.

Minor fixed assets – ICT

Our digital workplace consists of end-user computing devices for all corporate users, which are managed and maintained by our desktop team.

Planning
The forecast plan for the asset class comprises:

- Refresh of primary devices for staff laptop and desktop bundles (with keyboard, mouse, pen and cabling) that are 4 years old based on purchase date
- Refresh of high-performance graphics laptops used by specialist graphics, digital modelling, and mapping staff and are 4 years old based on purchase date
- Refresh of smartphones for employees that are 3 years old based on purchase date
- Peripheral equipment for the office – monitors, headsets, webcams, encrypted USBs, laptop bags and occupational safety and health-recommended items such as ergonomic keyboards
- Refresh of display screens and purchase of new miscellaneous collaboration equipment across Transpower.

Operations and maintenance
This category comprises numerous low-value IT items that are maintained or replaced. The budget provides equipment for both new staff as well as replacing existing equipment that has reached the end of its useful life.

Disposal and divestment
These assets are replaced in line with industry standard (on a 3 to 4-year cycle, depending on the asset type). These assets are supported by a regularly reviewed disposal policy, with a focus on sustainability.

Residential houses

The houses are predominantly ex-substation operator houses that have been retained to act as a buffer between adjoining private properties. Some houses have been purchased as part of projects and retained as strategic landholdings for future line routes or substations.

Planning
Each year, we review the residential house portfolio and identify any properties for disposal. We typically divest a house if the maintenance becomes too expensive, the land is surplus to requirements, or as part of a substation asset transfer. Any houses required as part of a project are identified during the project planning stage, and the purchase is budgeted for in the project. A similar approach is planned for RCP4.

Operations and maintenance
The tenanted houses are managed by external property management companies who collect the rent, arrange any maintenance that is not the responsibility of the tenant and ensures compliance with any relevant legislation. The emergency houses are managed by the relevant regional office, and any maintenance is completed by the substation grounds and buildings maintenance contractor.

Disposal and divestment
We sell the houses via a real estate agent or tender them for removal to ensure the highest price is obtained.

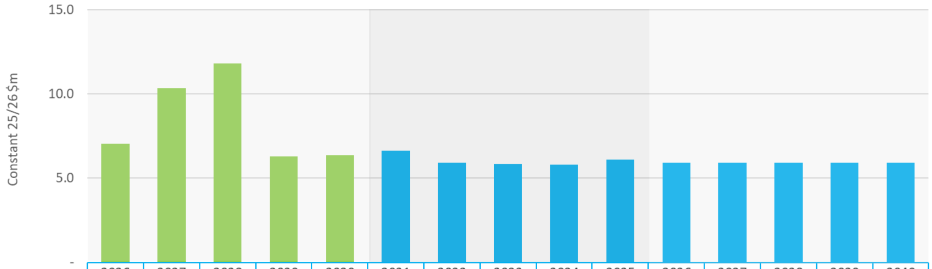
Expenditure Summary

Figure 138 shows the forecast capex. Included within the forecast is $10.6m to expand the capacity of our grid skills training centre. Grid skills training is increasing, as we increase the overall workforce to deliver the required work in RCP4 and beyond.

Operating lease costs

The Wellington and Palmerston North office leases are being capitalised in accordance with the new IFRS 16 Accounting Standard.

Figure 138: Business Support forecast capex



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Business Support	7.0	10.3	11.8	6.3	6.4	6.6	5.9	5.9	5.8	6.1	5.9	5.9	5.9	5.9	5.9

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