TRANSPOWER

Regulatory control period 4 proposal

April 2025 – March 2030
Transpower New Zealand Limited

November 2023

Contents

1.0 Chief Executive's letter

Our next regulatory control period 2025–2030 (RCP4) will be key in defining how Aotearoa New Zealand powers its energy future. This RCP4 proposal is a detailed account and costing of the work needed to deliver the standard of service our customers and consumers expect.

The grid is ageing, with significant volumes of assets requiring replacement or refurbishment within the next 10 to 15 years.

Without significant investment in refurbishment or replacement, we risk our service levels dropping. Our proposed expenditure over the period will enable us to replace, refurbish, and maintain assets critical to keeping the lights on while allowing us to invest in the areas necessary to support future energy needs.

This proposal was developed using information from our customers, consumers, and other stakeholders, as well as independent experts. It is a detailed account and costing of the work we expect to undertake over 2025–2030. We know that to supply more electricity and to connect more renewable generation we need to ensure our network is reliable, safe, and environmentally sustainable. In addition, following extreme weather events in 2023, we are now even more aware that our planned work must incorporate the need to build resilience.

We have worked hard to maintain our service levels through the challenges of the COVID-19 pandemic and the associated disruptions to our supply chains. Interruptions, excluding extreme weather events, have remained low during RCP3.

As the complexity of operating the power system grows with more diverse, distributed, and intermittent sources of both generation and load, data gathering and the use of artificial intelligence in real time will emerge as a critical competency for the industry. Stakeholders tell us that, as electrification of the economy increases, the reliability and resilience of the grid will become even more important.

We have continued to mature our asset management planning in our current regulatory period, and we will make further improvements during RCP4.

We are proud that independent experts identified areas of our asset health modelling as leading industry practice in our part of the world. These experts also acknowledged that the way we build our work plan demonstrates good electricity industry practice across the board. This endorsement supports our confidence in our ability to carry out the work Transpower needs to do, now and in the future.

At the onset of RCP3, we initiated an enhanced strategy for information and communications technology, to maximise the advantages derived from digitisation. We integrated advancements in data and analytics into our proactive roadmap for the future. A great example of this is our use

of drones to help monitor the condition of our lines, and the innovative, award-winning analytical tools that support this.

We know that time is limited to ensure our country can meet the Paris Agreement targets that limit the earth's warming to below two degrees by the end of the century. Transpower's central contribution to climate change mitigation comes from our role in enabling electricity to substitute for fossil fuels, lowering Aotearoa New Zealand's carbon emissions. Building and consenting infrastructure to provide new capacity, and strengthening the grid to meet the new demands, is a priority that affects all New Zealanders.

We are a purpose-driven organisation and as we look ahead to continued growth, we are actively improving how we communicate our purpose to our customers, stakeholders, and future employees. Over the coming years, most countries will be grappling with the complex priorities and needs of their own energy transition. Their challenges are in many ways much greater than ours, and this will create pressures on our global supply chain and resources.

We are clear about the effort involved in building our workforce to deliver affordable, secure energy for future generations. Plans are already underway to ensure our work programme can be delivered.

At the same time that we need to increase our investment, inflation and interest rates have significantly increased our operating and financing costs. These costs changes are largely outside our control, and, while our customers benefited from low interest rates when our current regulatory period was set, we can no longer escape the need for our expenditure to increase. However, this is not new. During RCP2, interest rates were at a similar level to those forecast for RCP4. Our RCP4 revenue in real terms will be similar to that in RCP2.

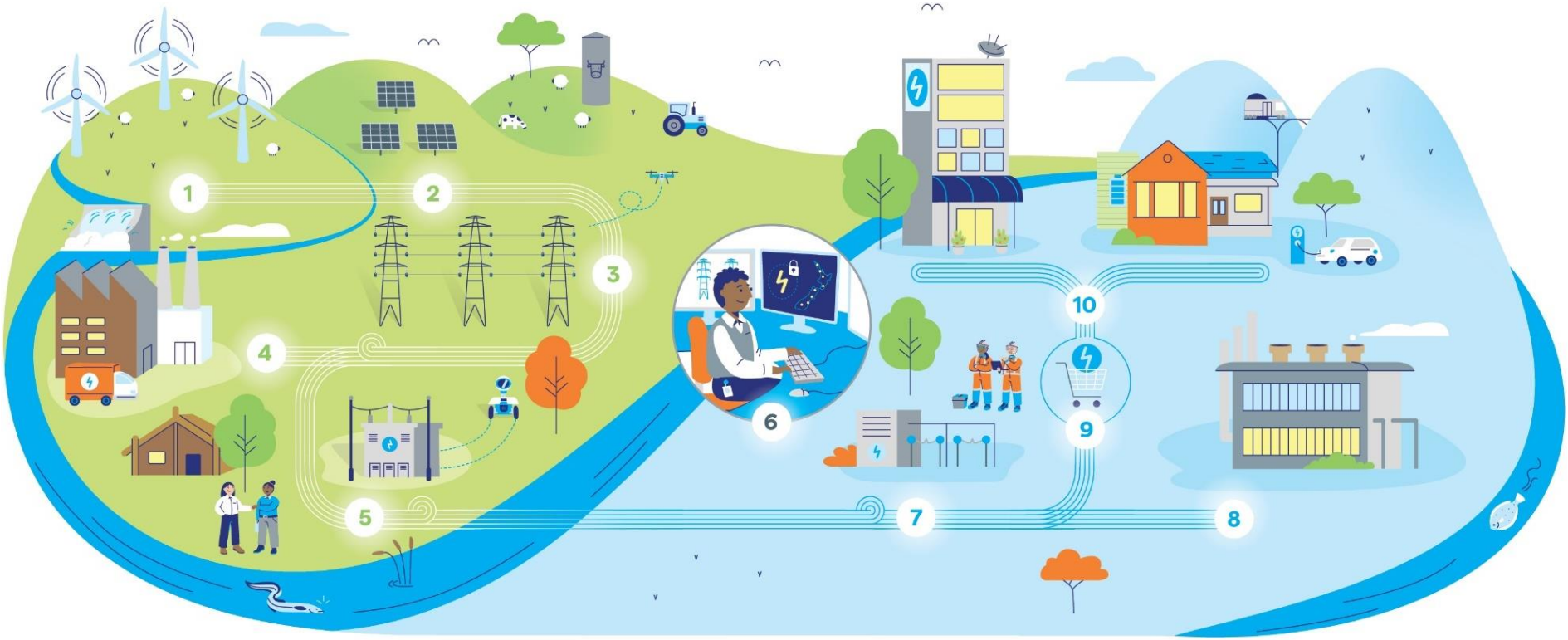
Currently, Transpower makes up 8 per cent of the average residential electricity bill. We are forecasting a slight increase, to 10 per cent at the start of RCP4. This change arises from an increase in our regulated rate of return, and our proposed 34 per cent increase in our base capital expenditure and 20 per cent increase in our operating expenditure when the impact of the consumer price index (CPI) is excluded. Most of the expenditure is to allow us to continue to provide a reliable and safe electricity transmission service. These investments will also support Aotearoa New Zealand's businesses and people to shift to electricity as their main source of energy, helping mitigate the impact of climate change. As the use of electricity increases, transmission costs as a proportion of consumers' bills will come down again.

The investment in our national electricity transmission network outlined in this proposal is essential to enable us to play our part in meeting our country's decarbonisation targets. By investing now, we will avoid more costly and pressured expenditure in the future.

This proposal allows us to prepare for a future characterised by significant change with a secure, highly functional, flexible grid. Transpower is proud to be part of a sector that is making bold and collaborative moves to make an electrified future a reality.

Alison Andrew
Chief Executive

Figure 1: Where we fit in



1 Generation
Generation companies generate power from wind, thermal, hydro and geothermal. They sell the power they generate on the electricity market. Emerging distributed generation includes electric vehicles, batteries and solar photovoltaic.

2 New grid connects
As New Zealand moves to electrify its economy, Transpower is receiving more requests to connect to the grid. This includes new generation such as solar and wind, as well as new industrial demand.

3 Transmission
Transpower transports high voltage electricity from where it is generated to distribution companies and some large directly connected customers.

4 Industrial customers
A few major industrial companies receive their power directly from Transpower.

5 Substations
Substations reduce the voltage at the point where electricity is delivered to distribution companies – our customers.

6 System Operator
Operates the wholesale electricity market and manages system security.

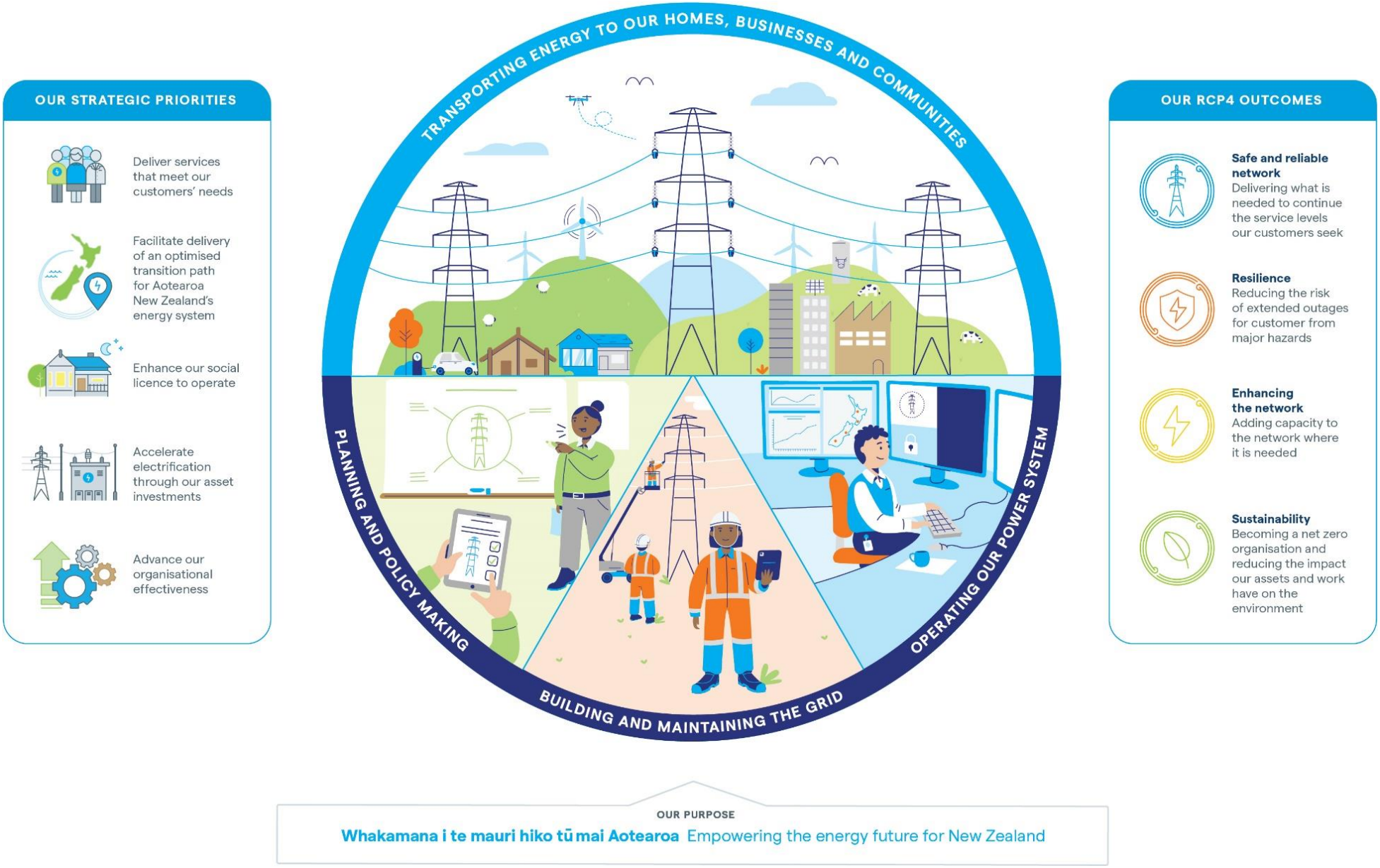
7 Distribution
The lower voltage electricity is transported by distribution companies to homes and businesses throughout New Zealand.

8 Commercial
Some commercial customers that consume large quantities of energy purchase power directly from the wholesale electricity market.

9 Retail
Retailers buy power on the electricity market, package it together with other costs of delivering power (transmission and distribution), and on-sell it to customers.

10 Domestic and business users
Domestic and business users receive their electricity directly from retail companies, which deliver power to homes, businesses and commercial operations using distribution companies' lines.

Figure 2: Our strategic priorities and outcomes



2.0 Executive summary

Our regulatory control period 4 (RCP4) proposal, covering the years 2025–2030, is pivotal to ensuring Aotearoa New Zealand can transition to a highly electrified economy.

Every 5 years, we submit a proposal to the Commerce Commission (the Commission) that enables it to set the expectations on expenditure and service levels for the next 5-year period. Our proposed expenditure over the period will allow us to replace, refurbish, and maintain assets critical to delivering service levels expected now and in the future.

As Transpower is a statutory monopoly service provider, the Commission examines and sets the quality of the services we provide and expenditure allowances to operate and maintain the grid. We are incentivised to outperform our allowances and service targets.

This RCP4 proposal uses information from our customers, consumers, and other stakeholders, as well as teams across Transpower. It is a detailed account and costing of the work we expect to undertake over 2025–2030. This is our best forecast of what is needed to operate and maintain the grid, and where we plan to invest.

2.1 Our plan

For RCP4, we are seeking to continue to deliver outcomes our customers and consumers value. These link with our Transmission Tomorrow strategy and our work on Whakamana I Te Mauri Hiko and our Electrification Roadmap.

Our proposal covers our RCP4 outcomes and our incentives for network performance and asset health and presents our best view of prudent and efficient levels of operational expenditure (opex) and capital expenditure (capex) to deliver these.

We are forecasting base capex for RCP4 of $2,250.2 million (constant 2022/23 $)[1] an increase of 32 per cent compared with RCP3 ($1,698.9 million).[2] To undertake more maintenance and support our capex programme, we are forecasting $1,957.6 million (constant 2022/23 $) of opex during RCP4, an uplift of 20 per cent from RCP3 ($1,632.6 million).

[1] Constant $ removes the impact of the consumer price index to allow a better comparison of the change in expenditure.
[2] Including capitalised leases.

Figure 3: Key messages

To continue to provide the service levels our customers expect, we need to increase our investment in the grid. The grid is aging, with significant investments made from the 1950s through to the 1970s. These assets are degrading and will require replacement or refurbishment in the next 10 to 15 years. Without this significant investment we risk our service levels dropping.

Over RCP3 we have continued to mature our asset management planning, and this will be ongoing throughout RCP4. Independent experts identified areas of our asset health modelling as leading industry practice in Aotearoa New Zealand and Australia. These experts also acknowledged that the way we build our work plan demonstrates good electricity industry practice across the board. This gives us confidence in the amount of work needed during the final years of RCP3 and into RCP4.

Stakeholders tell us that a reliable transmission service is required to create confidence that major industries can switch to electricity from fossil fuels, and consumers can shift to electric vehicles and electric heating. As electrification of the economy increases, the reliability and resilience of the grid will become even more important.

We are working closely with all our customers to ensure we can be responsive to their future needs. This includes greater engagement on an ongoing basis and more flexibility to adjust our plans as customers' needs change. While it has been part of Transpower's thinking for several years, we are now also hearing from customers and consumers that we need to increase our resilience in the face of the changing climate and the country's exposure to natural hazards.

We are investing in increasing the capability and capacity of our workforce to deliver our workplan. The investments we are making in attracting and training skilled workers to the sector will directly benefit Transpower over the next 10 years and beyond but will also benefit the wider industry by creating more roles and pathways in the sector. We have also embedded efficiency gains into planning.

Affordability is one of our key concerns. However, a reliable and safe electricity transmission grid is critical to the whole economy. We consider that deferring investment will lead to higher costs and poorer services over the long-term. Critically, as more of New Zealand's energy is from renewable electricity supplied through the grid, consumers' overall energy costs are likely to decrease.

Table 1: Proposed RCP4 base expenditure by outcome (excluding uncertainty mechanisms)

Outcome	Total expenditure (2022/23 $m)	Per cent
Reliable and safe	4,009.4	95.2
Resilient	87.2	2.1
Enhancing the network (enhancement and development)	111.7	2.7
Sustainability	2.4	0.1
Total	**4,210.7**	**100**

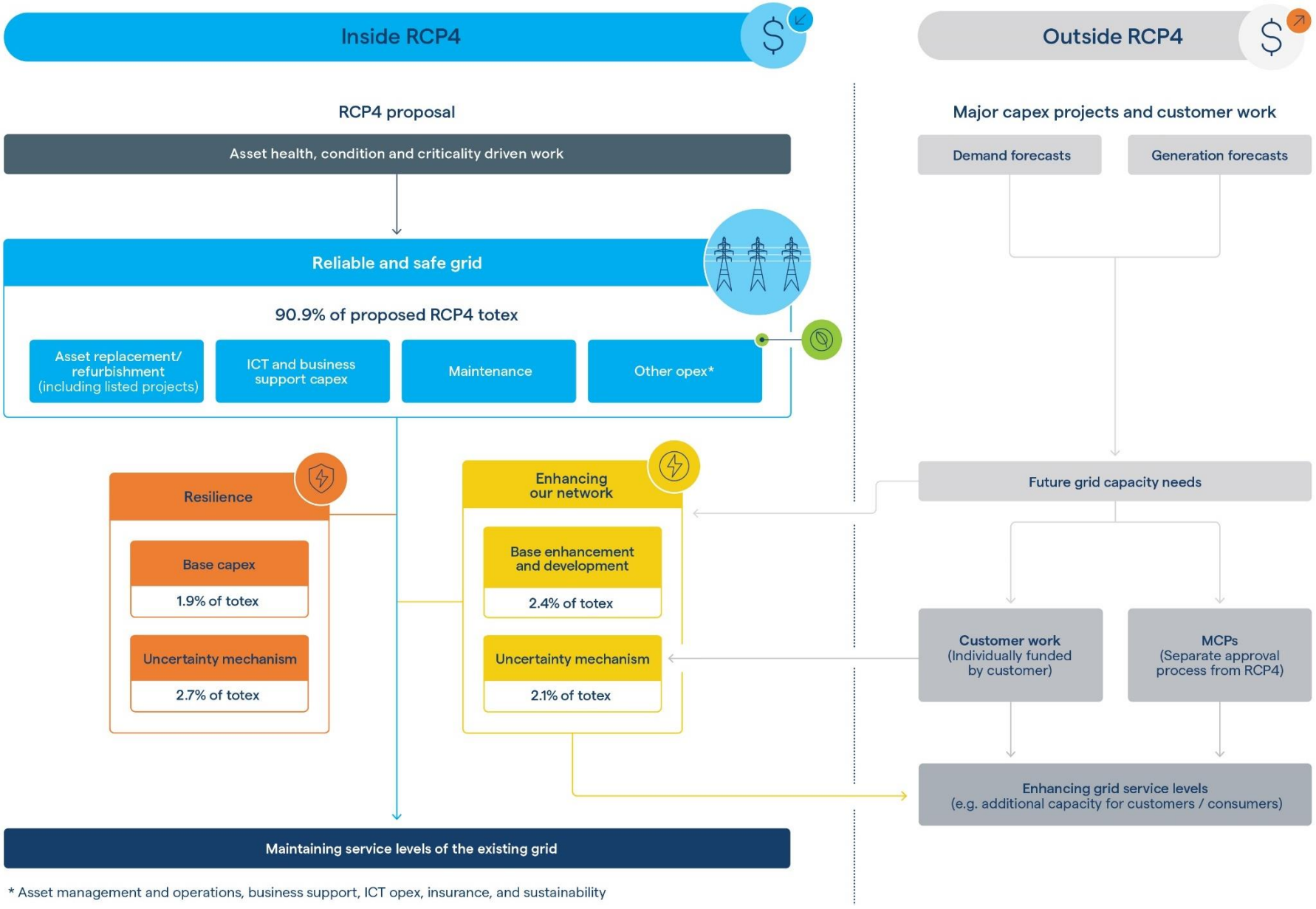
* per cents totals are rounded

We have proposed expenditure within RCP4 under uncertainty mechanisms. These amounts are not included in our 'base' expenditure but, if accepted by the Commission, can be added to our allowance during RCP4. We have proposed $488.2 million of uncertainty mechanism expenditure for RCP4.

Our RCP4 proposal does not cover all our forecast expenditure during the 2025 to 2030 period. Other areas of expenditure are agreed directly with customers or have a different Commission process for approval.

Figure 4 outlines the split of expenditure, and key drivers, between what is inside the Commission's RCP4 decision and what lies outside. The percentages include the expenditure associated with uncertainty mechanisms.

Figure 4: Scope of RCP4



2.1.1 Developing our proposal

During RCP3 we have focused on:

- further maturing our asset management planning
- finishing the implementation of our end-to-end planning and delivery process
- continuing to improve our cost estimation
- implementing a new information and communications technology (ICT) strategy and framework.

Our plan reflects a robust internal review and governance process. This has included ongoing board engagement throughout the development of the proposal. Following internal peer review, senior management have reviewed and challenged each area of expenditure. This process ensures that:

- the forecasts were developed in line with our relevant policies and governance
- these reflect good electricity industry practice
- the appropriate inputs and assumptions have been used
- an appropriate range of methods for developing the forecasts have been considered
- possible deliverability issues have been considered.

Independent verification has also further tested our planning processes.

2.1.1.1 Customer engagement

A key feature of our approach to our RCP4 planning was to test the assumption that customers are happy with the levels of service they currently receive and do not want the risk of service interruptions to increase materially.

We engage with our customers every year, often multiple times and across many teams, to seek to ensure that both our short- and our long-term planning fits with their expectations. The RCP4 proposal provided us with an opportunity to include service changes that can benefit customers, consumers, and wider stakeholders. To take advantage of this, we:

- presented our customers with multiple engagement opportunities, both face to face and online
- provided support information and opportunities to discuss questions or concerns with our teams
- issued a formal written consultation
- provided outreach opportunities to several representative groups and industry bodies.

As our existing and traditional customer base is changing, we also sought engagement and conversation with potential future customers.

Feedback on our proposal is an important step in the RCP4 process. We received feedback on our October 2022 RCP4 consultation paper from eight submitters.[3] We reached out to each of these submitters individually to better understand their positions and where improvements or changes could be made to our proposal. In addition, due to the limited responses from electricity distribution businesses (a key customer group), we ran four workshops throughout the country specifically for the distribution businesses.

[3] RCP4 Consultation Summary December 2022

Stakeholders confirmed to us that they did not want to see a deterioration of service levels; however, they provided feedback on some areas of our proposal. These are discussed in Section 5.1.2.

Since our consultation, we have undertaken the following.

- **Published the independent verifier (the verifier) report**.[4] The verifier reviewed 98.4 per cent of our proposed expenditure and verified 99.0 per cent. It concluded that our RCP4 proposal was consistent with good electricity industry practice.
- **Reviewed and updated our plans.** We have updated our plans to:
    - include the customer engagement and verifier's feedback
    - incorporate new information and CPI changes
    - revise proposed spend on proactive resilience work following the extreme weather events in early 2023.
- **Made changes to our service measures proposal.** This was in response to comments received from stakeholders. However, we are still proposing some changes stakeholders or the verifier did not fully support. These are discussed in Chapter 7.0.
- **Reduced our proposed spending on sustainability**. This reflects comments we received that we should be a fast follower in this area. We have, however, incorporated more sustainability outcomes in our business-as-usual activities where this is cost effective.

2.1.2 Delivering our proposal

During the development of our RCP3 plan, we used option value to refine the work programme and defer some work by extending the life of assets. With our maturing asset management planning, and asset information, we now have increased certainty around the interventions needed to maintain and improve the grid.

The forecast volume of work we need to do throughout RCP4 is materially higher than what we have undertaken during RCP3. The work volume growth is expected to continue through RCP5 and RCP6.

To complete our RCP4 work programme, we will require significant growth in our own workforce as well as growth of local engineering consultants, service providers, and the use of specialist contractors from offshore.

With an ageing asset base, increasing customer work, and a need to reinforce the grid for increasing electrification, now is the time to invest in developing our workforce capabilities. We cannot defer work to future RCPs. The growth in the work programme for RCP4 presents a significant challenge to our service providers. We estimate that they will need to grow their workforces by 11 per cent per year, and we are working with them to make this happen. We are already undertaking initiatives and have more planned between now and the end of RCP4 to support workforce growth. We are not unique in our sector; we have heard that our electricity distribution colleagues also need to grow their workforces and those of their service providers.

The events of the COVID-19 pandemic and its effects on global supply chains have necessitated more agility and flexibility from our procurement team, alongside closer management of the performance

[4] Independent Verification report: RCP4 base expenditure and service measures 2025–30 proposal

and sustainability of our key suppliers due to increased supply risk. We are modernising our procurement and supply chain systems to reduce risk, improve operational efficiency, and simplify supplier engagement. We also note the pressure on international suppliers from global electrification, particularly in the USA and Europe.

2.2 Service performance

The key transmission lines services we provide to our customers are as follows.

- **Grid reliability** (grid performance): Keep interruptions to a very low level and restore supply quickly when there is an interruption.
- **Grid availability**: Keep sufficient grid capacity and resilience available to allow Aotearoa New Zealand's lowest-cost sources of supply to be used to meet demand.
- **Event communications**: Communicate with our customers when supply is interrupted so we can achieve the best outcomes for end-consumers.
- **Customer connections**: Work with customers to connect their assets to the grid.

Engagement with our customers, end-consumers, and wider stakeholders during 2022 and 2023 has shown that our customers are satisfied with the level of service we are currently providing. Based on feedback received during that engagement, we are aiming to deliver similar levels of service to those of the last 5–10 years.

We consider that the majority of the RCP3 measures set by the Commission achieve their intent. We are proposing amendments where we have identified some measures that may not be incentivising our performance in the way intended by the Commission. We have also identified areas where we are keen to test new (pilot) measures.

Our proposed total revenue at risk for the four revenue-linked measures is 1.4 per cent of our total forecast revenue. This percentage is the same as the Commission set for RCP3. We consulted on 1.4 per cent, and stakeholders did not propose an alternative amount.

2.3 Reliable and safe network

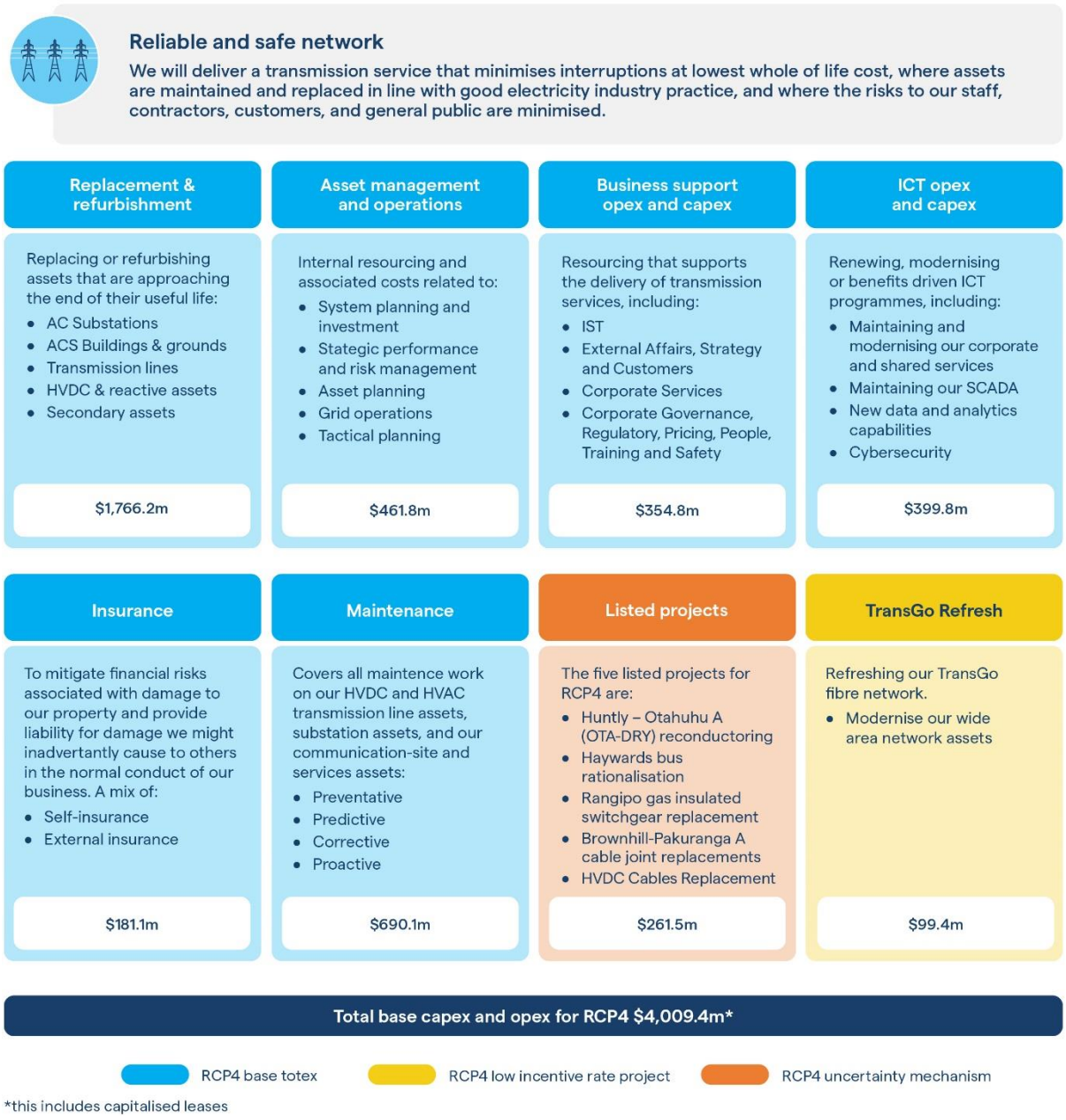
We manage our assets to ensure that our network is resilient and safe and provides the level of reliable service our customers expect. Our RCP4 expenditure on the grid is about ensuring we maintain the service levels our customers expect.

A key driver of our increase in capex is that many of our assets were installed between the 1950s and 1970s. These assets are degrading and will require replacement or refurbishment in the next 10 to 15 years. While we rely on condition assessment to determine when to replace most of our assets, rather than replacing solely on age, there is a strong correlation between age and condition.

We have included an associated increase in our operating costs. We also need to increase our staff numbers so we can support our larger work programme. Legislative requirements for consenting and consultation are increasing, and we are committed to building relationships that support our

common future, as well as the assets we own. Like other companies in Aotearoa New Zealand, we are also facing significantly higher input costs than we did at the start of RCP3.

Figure 5: Delivering a reliable and safe network



2.4 Resilient network

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. To achieve this, we work to understand the network

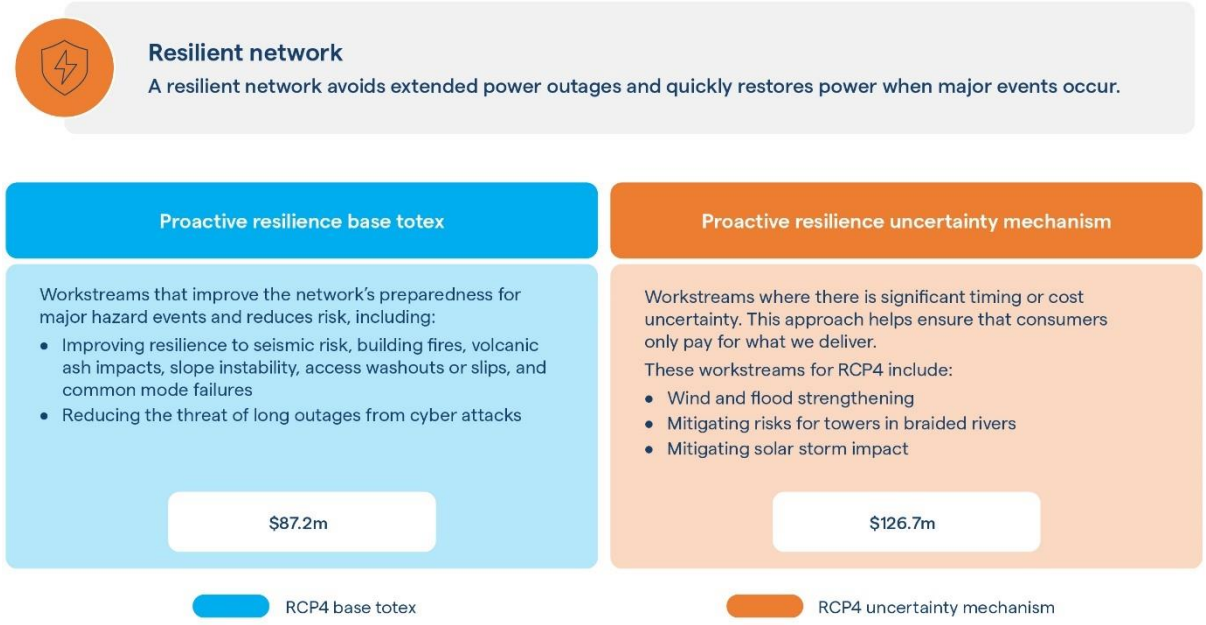
vulnerabilities, service impacts, and acceptable risk levels for a range of credible resilience threats, including common mode failures, cyber-attacks, and natural hazards.

Stakeholder expectations of a resilient electricity system are increasing, and greater reliance on electricity due to decarbonisation, for transportation and heating, will further increase the expectation of a resilient transmission service. At the same time, climate change is exacerbating many natural hazards.

Cyclone Gabrielle highlighted the public's expectation of resilience post-disaster. Our consumer advisory panel indicated that Transpower needs to take a longer-term view of resilience, including climate change risk, and a recent survey by the Consumer Advocacy Council found that, after affordability, the key issue for consumers and small businesses was the resiliency of the electricity system to extreme events.[5] We must ensure the grid is resilient to climate change and meet our obligations under the Government's national adaptation plan in developing a Transpower adaptation plan.

We have developed proactive resilience programmes for our vulnerable and critical assets. Our proposal reflects an acceleration of some workstreams following Cyclone Gabrielle. Our proposed total resilience expenditure, including the amount proposed for the uncertainty mechanism, would add approximately 26 cents per month to each consumer connected to a distribution network.[6]

Figure 6: Delivering a resilient network



[5] Electricity consumer sentiment survey – residential consumers and small businesses (cac.org.nz)

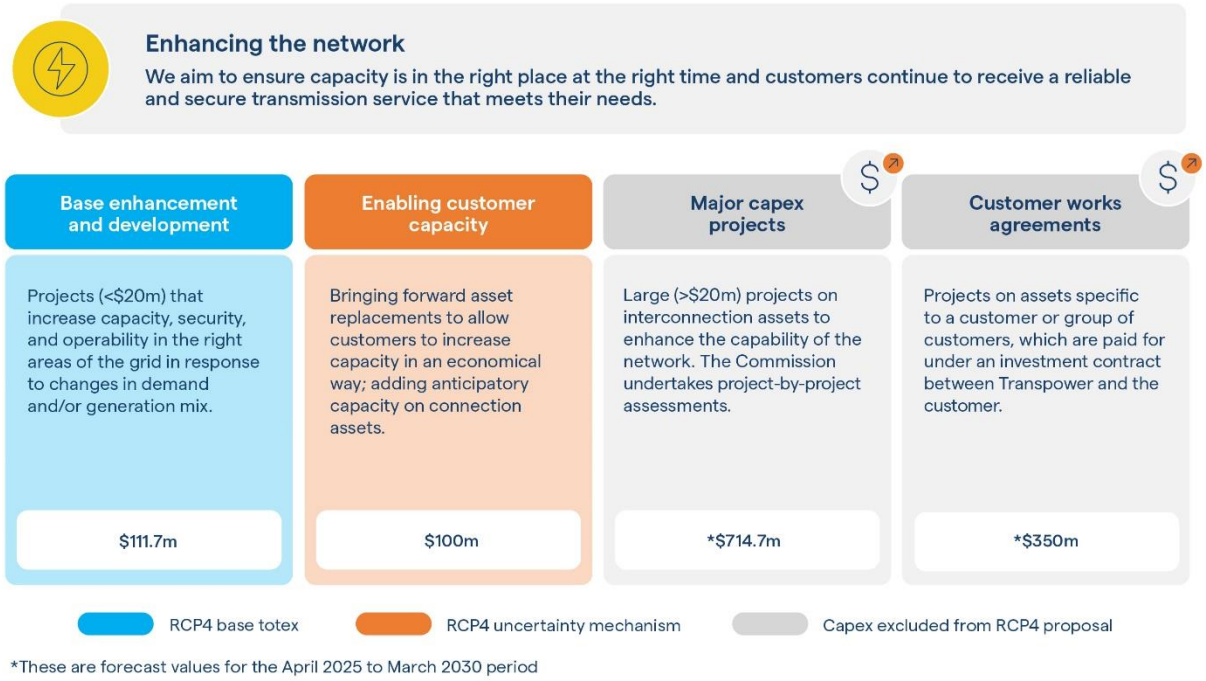
[6] To derive transmission costs to households, we use the latest transmission charges to distribution businesses, together with the total number of ICPs to proxy the monthly transmission bill to an average household. We assume resilience spend would be evenly proportioned across electricity distribution businesses.

2.5 Enhancing the network

Aotearoa New Zealand is targeting net zero emissions by 2050. Our customers are spending millions of dollars on innovation, infrastructure, and new technology to prepare for a clean energy future and to cut their emissions. Government policies are supporting this private investment and further driving demand for electrification across transportation and process heat.

We need to invest to enhance or develop the grid to meet changes in demand and the generation mix, including the transition to an economy heavily dependent on a highly reliable electricity supply for its energy needs. A small amount of this expenditure is within our RCP4 proposal; the majority will be undertaken as major capex projects or via customer works agreements.

Figure 7: Delivering an enhanced network



*These are forecast values for the April 2025 to March 2030 period

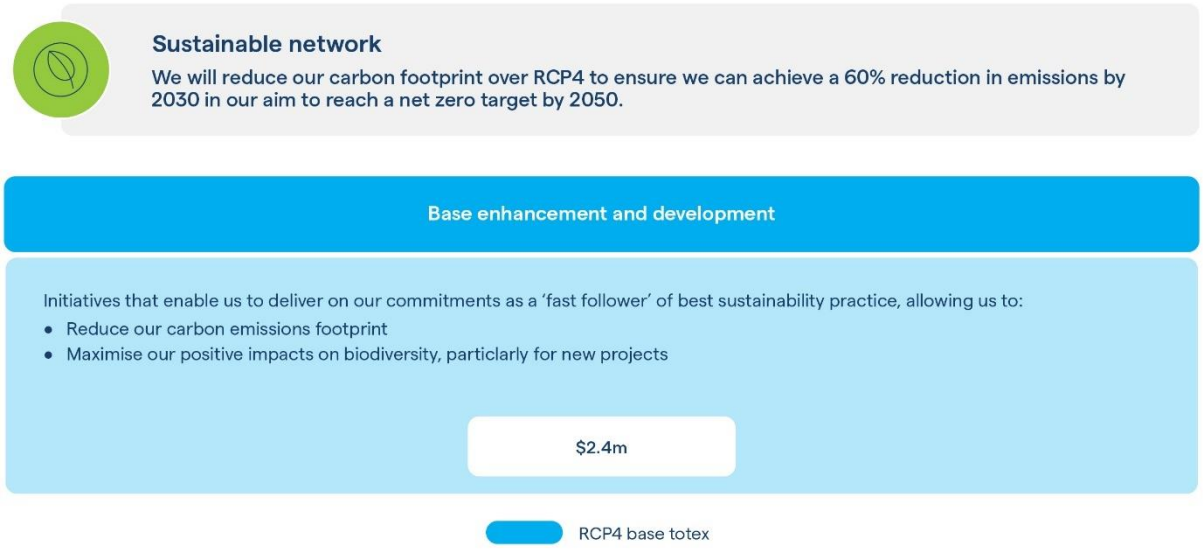
2.6 Sustainable network

Our sustainability strategy provides our overarching aspirations and targets in relation to climate change, environmental stewardship, operating a sustainable business, and working effectively with our communities.

Our sustainability programme includes a variety of initiatives to meet our sustainability aspirations across Transpower, our service providers, and suppliers. It cuts across all elements of our business and is largely unfunded under our RCP3 allowance. We require increased investment to understand our environmental impacts and ensure we can deliver on our commitments. Most of our sustainability work is embedded within businesses as usual; however, we are proposing a small amount of additional expenditure to support further reducing our carbon footprint and meeting our biodiversity targets over RCP4.

Much of what is required here is consistent with our requirement and activity to implement the Task Force on Climate-Related Disclosures Framework in a manner that will comply with the Aotearoa New Zealand (XRB) Climate Standard reporting requirements for climate-reporting entities from 1 July 2023.

Figure 8: Delivering a sustainable network



2.7 Revenue forecasts

Alongside the required increase in investment requirements for RCP4, our input costs have also increased. We are forecasting a much higher interest rate and therefore our regulated rate of return (7.17 per cent) compared with when RCP3 was set (4.57 per cent).[7] Inflationary pressures are reflected in labour costs and technology and across all parts of the supply chain.

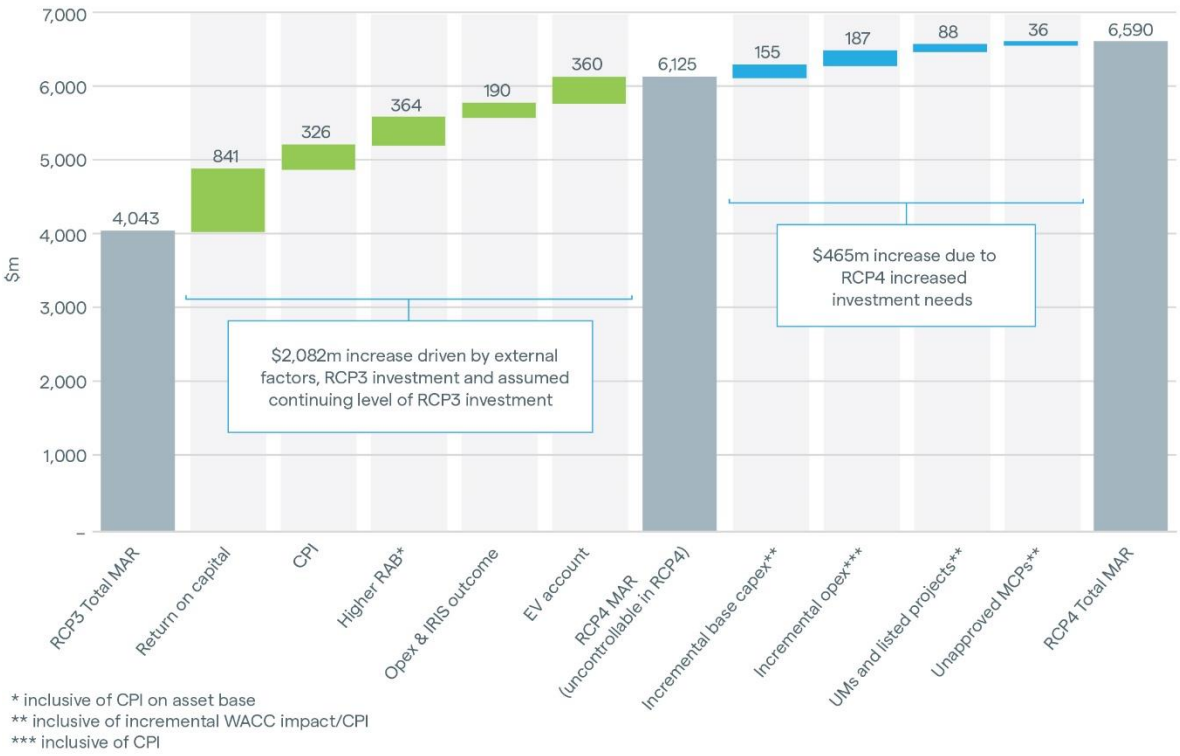
Our revenue requirements and therefore prices will increase. In nominal terms (including inflation) our current plan, including higher forecast interest rates, increases by 39.5 per cent from the final year of RCP3 to the first year of RCP4.

While a 39.5 per cent initial step change is a significant increase, in real terms (i.e. excluding CPI), it takes us back into line with our revenue requirements in RCP2, prior to the significant revenue reductions in RCP3.

Figure 9 illustrates the drivers of the overall revenue increase from RCP3 to RCP4. To break down the cost drivers, we have assessed the revenue changes where we assume our RCP4 expenditure stays the same as at the end of RCP3. This shows that only $342 million of the increased revenue requirements are driven by an increase in expenditure from the end of RCP3 to RCP4.[8]

[7] This rate of return is based on a vanilla weighted average cost of capital (WACC). Vanilla WACC is a weighted average of the pre-tax cost of debt and the post-tax cost of equity.
[8] Not including the revenue requirement for currently unapproved major and listed capex projects and proposed uncertainty mechanisms.

Figure 9: Revenue movement forecast from end of RCP3 to RCP4, nominal $m



Under the 2022 transmission pricing methodology, we are required to allocate revenue in the following ways.[9]

- **Connection charges**: recover the cost of assets that connect individual customers to the interconnected grid and are paid for by those customers.
- **Benefit-based charges**: for new and some historic interconnection investments, paid by the customers who are expected to benefit from them.
- **Residual charges**: recover residual revenue (maximum allowable revenue [MAR] less all other transmission charges). Residual charges are allocated according to each customer's gross load, whether the load is supplied from the grid or from embedded generation and regardless of season or time of use.

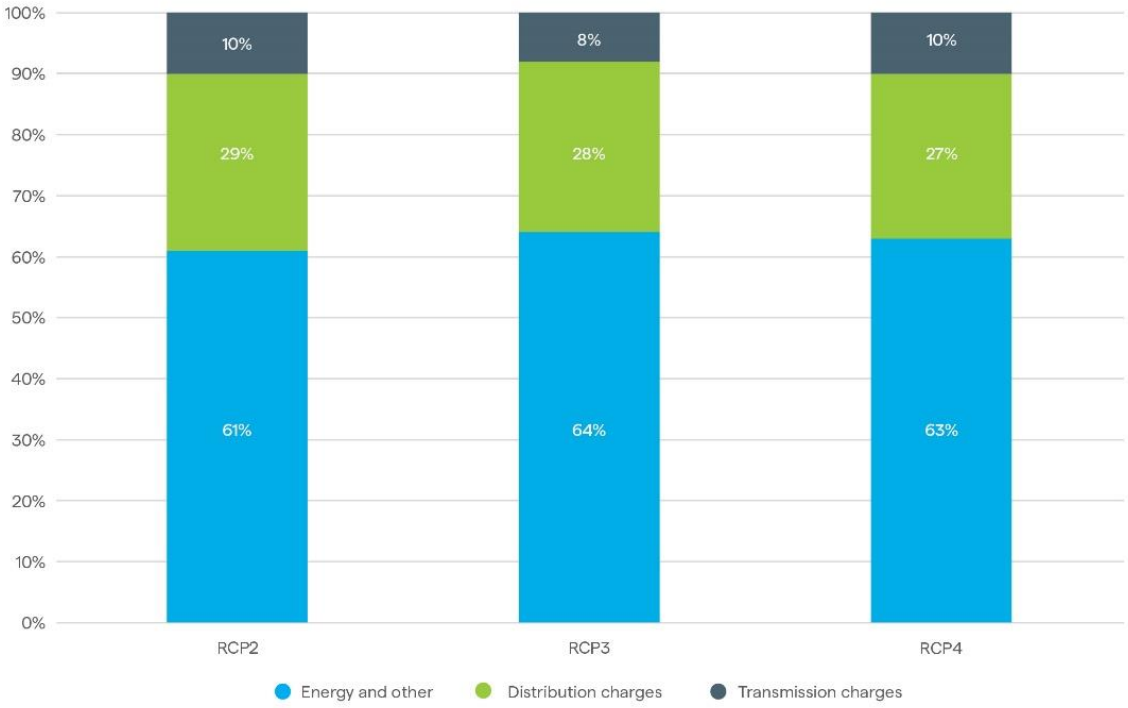
We have calculated aggregate indicative charges for customers based on our forecast revenue. These are provided in the RCP4 Indicative Transmission Charges.[10] Actual charges will be based on the value and location of the investments made during RCP4 (and during the remainder of RCP3). Therefore, charges will change between now and when they are notified to customers for each pricing year.

For a typical domestic or small business consumer, transmission currently makes up around 8 per cent of their bill. We are forecasting that this proportion will go up slightly in RCP4 to around 10 per cent, based on the assumptions that retail and distribution costs do not increase and average

[9] Please refer to our Guide to the Transmission Pricing Methodology for more detail.
[10] Note, we will publish updated indicative charges when pricing year 2024 is finalised in December 2023.

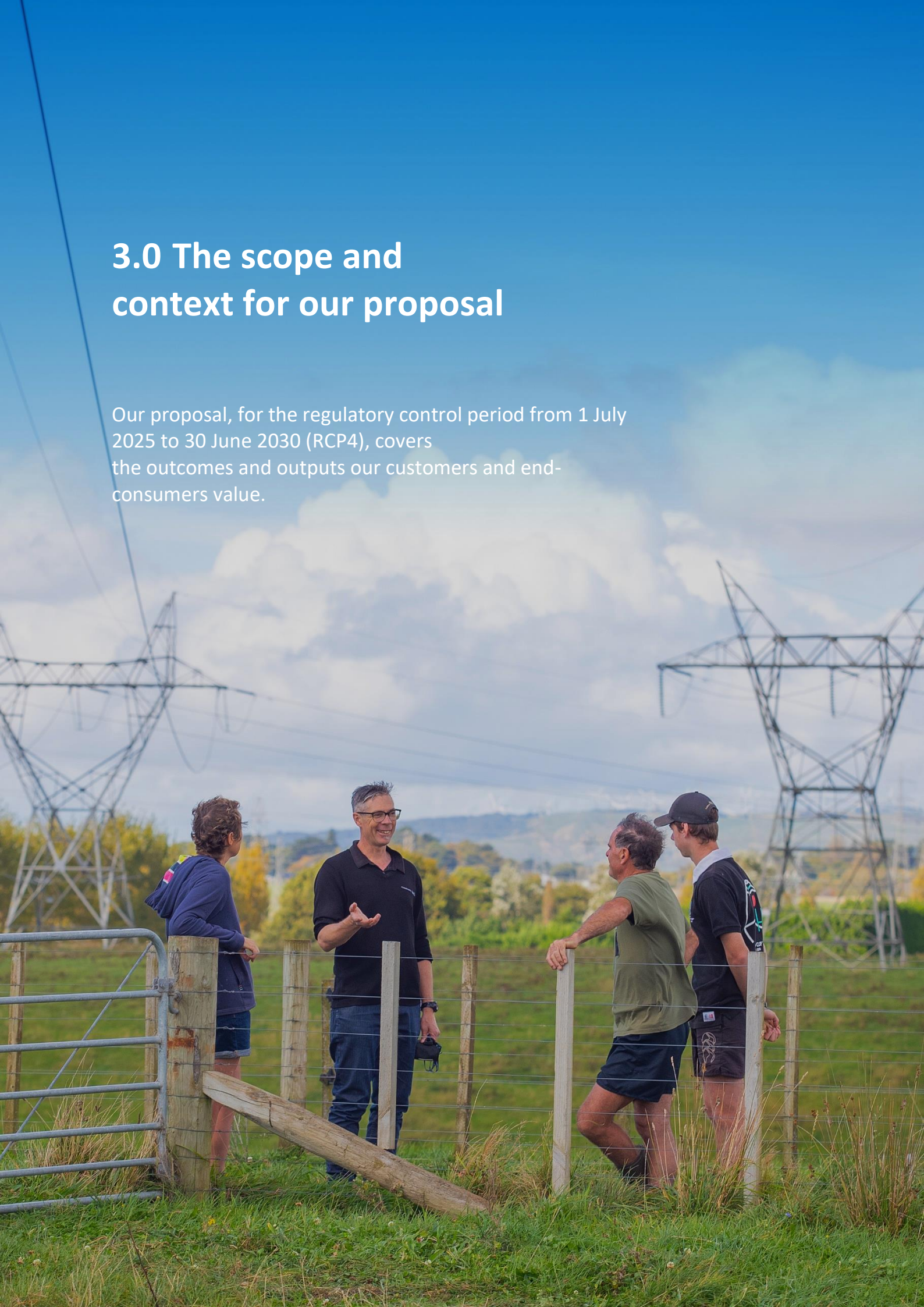
household consumption stays the same. The split of costs across the components that make up a household's bill is shown in Figure 10.

Figure 10: Breakdown of a residential electricity bill



3.0 The scope and context for our proposal

Our proposal, for the regulatory control period from 1 July 2025 to 30 June 2030 (RCP4), covers the outcomes and outputs our customers and end-consumers value.



3.1 RCP4 scope

Our proposal, for the regulatory control period from 1 July 2025 to 30 June 2030 (RCP4), sets out our proposed expenditure to deliver the outcomes and outputs our customers and end-consumers value. The proposal includes the following:

1. service measure targets and performance incentives
2. our proposed investments in:
    - asset replacements and refurbishment
    - resilience
    - ICT
    - enhancement and development
    - maintenance
    - asset management and operations
    - business support.

This document provides a complete, standalone explanation of our RCP4 proposal, including the forecast revenue requirements and indicative customer pricing. This document is supported by others that provide more in-depth information. The published suite of proposal documents is shown in Figure 11. These are available here.

Figure 11: RCP4 published suite of documents

3.1.1 Proposal expenditure coverage

The regulatory framework we operate under has different processes to approve our expenditure based on the driver of the work (e.g. demand growth, enabling new generation, asset replacement,

etc.) and the value of work. The RCP4 approval process covers our 'base' expenditure; it does not include:

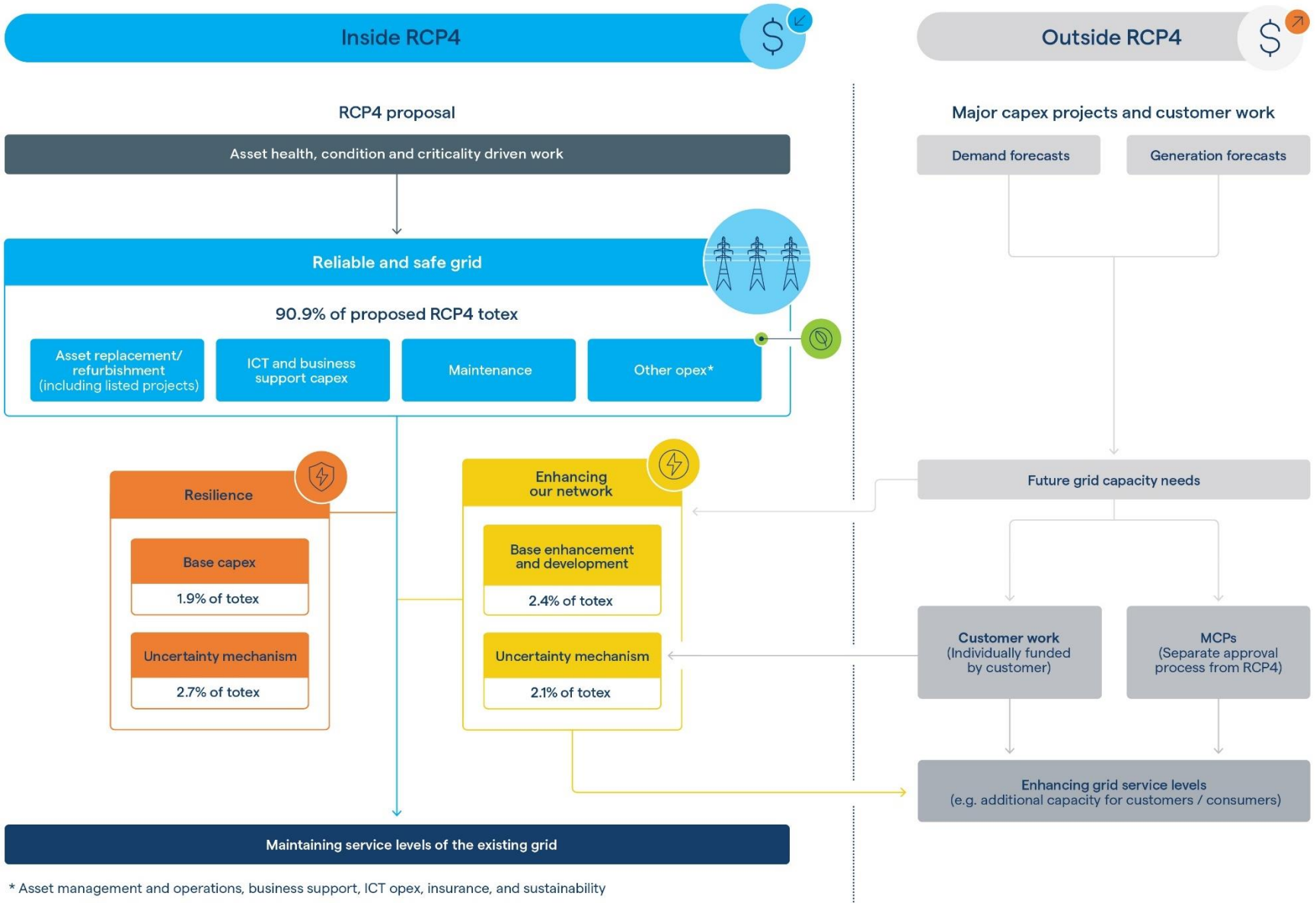
- **system operator service** costs, which are covered under a separate contract with the Electricity Authority
- **customer- and third-party-funded work**, which includes adding new grid connections for customers or modifying existing connections to improve their individual service levels, as well as moving or modifying our existing lines and assets to enable other new infrastructure developments
- **major capex projects** that are related to enhancing the network and are over a certain spend threshold (currently $20 million). Major capex projects have their own consultation and approval process separate from our RCP proposals.[11]

While demand and generation forecasts play a critical role in Transpower's future work, most of the associated expenditure to support demand growth falls outside of our RCP4 proposal.

We have illustrated this in Figure 12. As can be seen, the majority of the RCP4 spend is driven by the need to replace, refurbish, or maintain our existing assets. This split in work is discussed further in Chapter 9.0.

[11] These projects can be found on our website: Projects | Transpower.

Figure 12: Scope of RCP4



We are incentivised to be efficient and innovative to reduce the cost of the transmission service to customers and consumers. If we overspend, our shareholders bear a proportion of the cost associated with the overspend (i.e., they receive a lower return), and if we underspend, our shareholders receive a benefit.

Our proposal complies with the requirements of the Commission's Transpower input methodology and capex input methodology and an information gathering notice issued by the Commission under section 53ZD of the Commerce Act on 4 September 2023.

3.2 Structure of our proposal

Our proposal is structured as follows.

- Chapter 4.0 sets out:
    - an overview of how the regulatory framework has changed over time and how we have responded to these changes and opportunities
    - our key achievements over RCP3
    - the key drivers for RCP4.
- Chapter 5.0 sets out:
    - the customer and consumer engagement that helped inform our RCP4 proposal
    - the challenge and verification process to ensure our RCP4 expenditure plans are prudent and efficient
    - a high-level description of our methods for forecasting our expenditure requirements.
- Chapter 6.0 sets out:
    - our workforce planning
    - our approach to deliverability and procurement
    - how we incorporate innovation and efficiency in our planning.
- Chapter 7.0 sets out our proposed service measures and incentive for RCP4. Please also refer to the Service Measures Report 2023.
- Chapter 8.0 sets out our forecast expenditure requirements to renew and maintain our asset base, including ICT and the staff and functions required to support the delivery of transmission lines services. Please also refer to the Asset Management Plan 2023.
- Chapter 9.0 sets out our forecast expenditure to proactively improve the resilience of our network regarding reduction, readiness, response, and recovery. Please also refer to the Asset Management Plan 2023.

- Chapter 10.0 sets out:
    - our approach to planning for changes in demand and generation, and how these fit with our base enhancement and development capex, major capital projects, and direct customer-funded work
    - the key drivers of enhancement and development and customer work
    - our base enhancement and development capex proposal
    - our proposed uncertainty mechanism to support customer connections
      Please also refer to the Transmission Planning Report 2023.
- Chapter 11.0 sets out our strategy and approach to becoming a sustainable network. Please also refer to the Asset Management Plan 2023.
- Chapter 12.0 sets out:
    - our overall expenditure proposal
    - our forecast revenue requirements.

4.0 RCP4 context

Since the first RCP began in 2011, Transpower has worked hard to improve our service performance, asset planning, and efficiencies.

We have evolved over the last 10 years as we developed our internal processes and responded to changing regulations and expectations, and we consider ourselves to be in a strong position to meet RCP4's challenges and opportunities. Figure 13 illustrates key developments in the regulatory framework, our responses to these and our own internal opportunities.

Figure 13: Evolving expectations and our focus

The sections below discuss our key developments in RCP3, the key drivers for our RCP4 proposal, and how we intend to continue to improve through RCP4.

4.1 RCP3

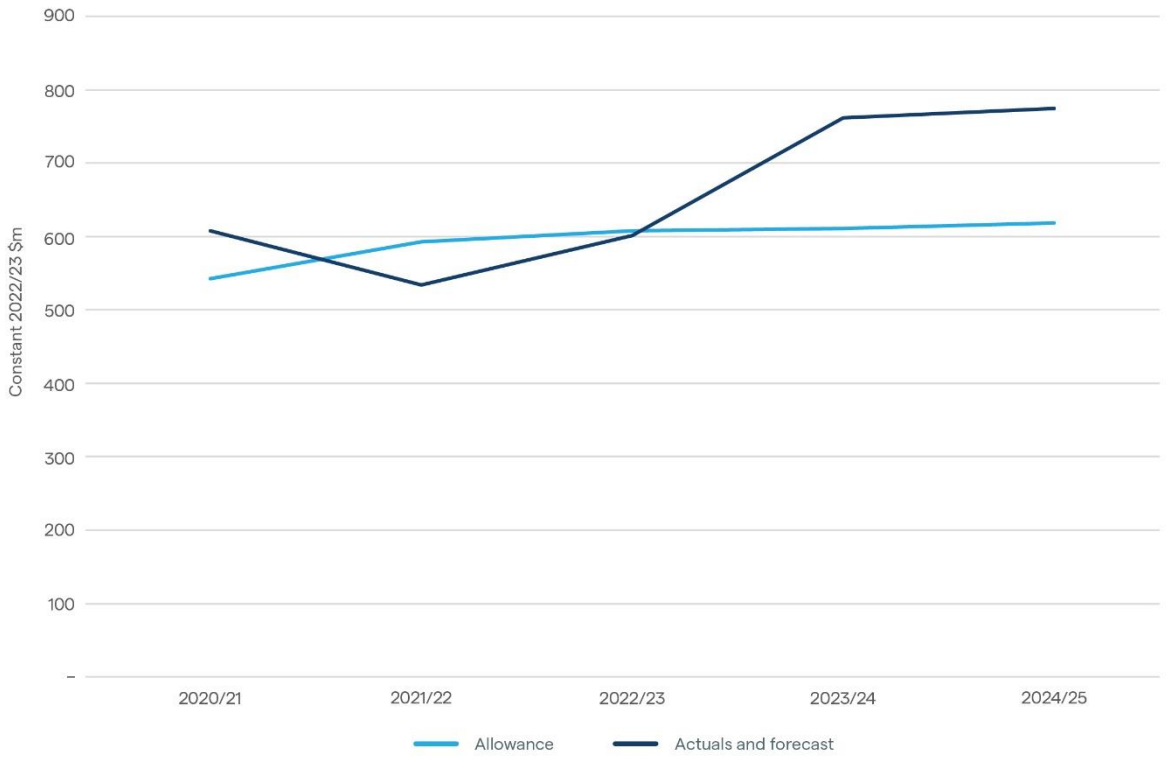
During RCP3, our focus has been on life-extension work to enable option value while we increased our certainty around the interventions required to maintain and improve the grid, as the impact of electrification to address climate change on the grid became clearer. This approach did not affect

our service quality, as we are delivering relatively low levels of interruptions and durations of interruptions.

We have worked hard to maintain our service levels through the challenges of the COVID-19 pandemic and the associated disruptions to our supply chains. We have delivered against our asset health quality standard and, as noted above, have delivered relatively low levels of interruptions, after taking account of extreme weather events.

We are now forecasting to spend over and above our RCP3 allowance in order to continue to deliver our work programme and build capability for RCP4 and beyond.

Figure 14: RCP3 expenditure versus allowance (constant 2022/23 $m)



During RCP3, we have implemented or are continuing to implement a range of initiatives to improve our services and efficiency. These include the following.

- **A new customer engagement plan**.[12] We have worked to embed our customer engagement strategy across our business. Key outcomes have included the development of individual engagement plans with each of our customers. These plans include identifying touchpoints across our business and our customers and upcoming projects and longer-term planning. Further

[12] *Customer Engagement Plan*

details are provided in Section 5.1. We have made good progress on customer engagement and continue to improve our engagement activities.

- **Continued the maturing of our asset management planning approach**.[13] This is reflected in improvements we have made in our asset health and network risk. Maturity of our asset health modelling and network risk analysis improves our forecasts of the volume of work required to deliver our target risk profiles. Maturity of these models can lead to decreases or increases in the volume of work required. An independent review of our progress concluded that we are progressing well against our maturity journey.[14] Further details are provided in Section 8.1.
- **An end-to-end review of our business process from need identification to delivery in 2019/20**. This work built on the grid operating model that we introduced in RCP2. The review identified several initiatives to streamline our process and improve how our grid development and delivery divisions work together. These initiatives are implemented alongside efficiency and service delivery gains and put us in a good position to grow our delivery programme to support electrification.
- **An enhanced strategy for ICT,** to maximise the advantages derived from digitisation at the onset of RCP3. We integrated advancements in data and analytics into our proactive roadmap for the future. We have already realised benefits from this through our use of drones to help monitor the condition of our lines and the innovative, award-winning analytical tools that support this. Further details are provided in Section 8.3.
- **A focus on workforce growth**. We have put in place several initiatives to support our, and our service providers', workforce growth. We are investing now to be able to deliver our RCP4 work programme. Further details are provided in Section 6.1

4.1.1 Tracking benefits

We pursue a range of initiatives to deliver more cost-effective services. These cover capex and opex, as well as a range of activities from large strategic initiatives over multiple years to small specific initiatives within an individual project.

Our standardised benefits management framework provides a common way of capturing value across our strategic investments. It tracks, monitors, and reports on benefits internally as well as to our consumers and our customers. We used the framework to track benefits over RCP3 and have used this experience to estimate net benefits of slightly under $200 million. Selected initiatives are shown in Table 2.

[13] *AHNR Development Roadmap 24 Nov 2020*
[14] *Expert Opinion Progress Review Report*

Table 2: Selected benefits tracking (2022/23 $m)

Initiative	Realised and forecast benefits over RCP3
Intelligent conductors Total $76 million over RCP3 (deferred value)	Realised benefits of $46 million to date, with a further $30 million forecast over RCP3 in deferral value We safely deferred over 120 circuit kilometres of reconductoring during RCP3 through the intelligent conductor initiative We have completed drone inspections on all conductors identified for possible reconductoring during RCP4. The specific projects proposed in RCP4, along with the longer-term volume forecasts of reconductoring, were validated using this information. We confirmed that the volume of reconductoring is significantly less than initial RCP3 estimates. To date, the intelligent conductor initiative has approximately halved the future investment forecast without compromising asset health or network risk
Tower-to-pole strategy Total $67 million over RCP3 (deferred value)	Realised benefits of $24 million to date, with a further $42 million forecast over RCP3 The towers-to-pole strategy involves structures that have reached their paint intervention date that can be managed through to replacement by inclusion in the towers-to-poles workstream. The average cost of painting a tower is $101,000 During RCP4, we expect to defer $57.3 million of capex. This is based on the RCP3 proposal to paint 3,292 towers in RCP4 compared with our new plan that paints 2,725 towers over the same period
Implement best practice end-to-end Total $30 million over RCP3	Realised benefits of $21 million to date, with a further $9 million forecast over RCP3 There are 42 initiatives during RCP3 that target our end-to-end processes. These include changing designs to be more cost effective with no change in risk (value engineering), tendering review, and challenge and procurement procedures
Data analytics Total $11 million over RCP3	Realised benefits of $3 million to date, with a further $8 million forecast over RCP3 The data and analytics programme will embed the data and analytics operating model, and modernise the current technology, taking it from a constrained on-site data warehouse to a fully scalable cloud-based data platform. The aim is to deliver an intelligent eco-system for speedy, sophisticated, fact-based decision making that supports our wider strategic initiatives This programme will enhance our data management, data quality, and data discovery capabilities while delivering data and intelligence products. Initiatives to date have enabled benefits such as optimisation of service provider response to sulphur hexafluoride (SF_6) alarms, additional asset health models, automation of business processes, and problematic alarm rationalisation
Digital switch management Total $6 million over RCP3	This programme will introduce automation to outage planning and management. The benefits are avoided costs in nature. The programme will limit the need to increase resource in order to cover the increased outage planning necessary with an increasing work plan. Further benefits will include reduced value of lost load through reduced unplanned outages

Initiative	Realised and forecast benefits over RCP3
Building information model Total $4 million over RCP3	Realised benefits of $0.5 million to date, with a further $3 million forecast over RCP3 The digital engineering programme will embed the building information model and related practices on our grid delivery projects. This will allow us to better obtain and use 3D data and information. Benefits will be realised through more efficient project delivery, avoided costs, and reduced risk. The required enterprise software platforms allow the wider business and supply chain to use our 3D spatial data at a heightened quality during projects and beyond, maximising the benefit of this investment

4.2 Key drivers for RCP4

We now have better information about the most efficient approach for both short-term and longer-term, replacement, refurbishment, and maintenance needs of our assets. To meet these needs, we must increase our investments for RCP4 (and beyond) compared with RCP3.

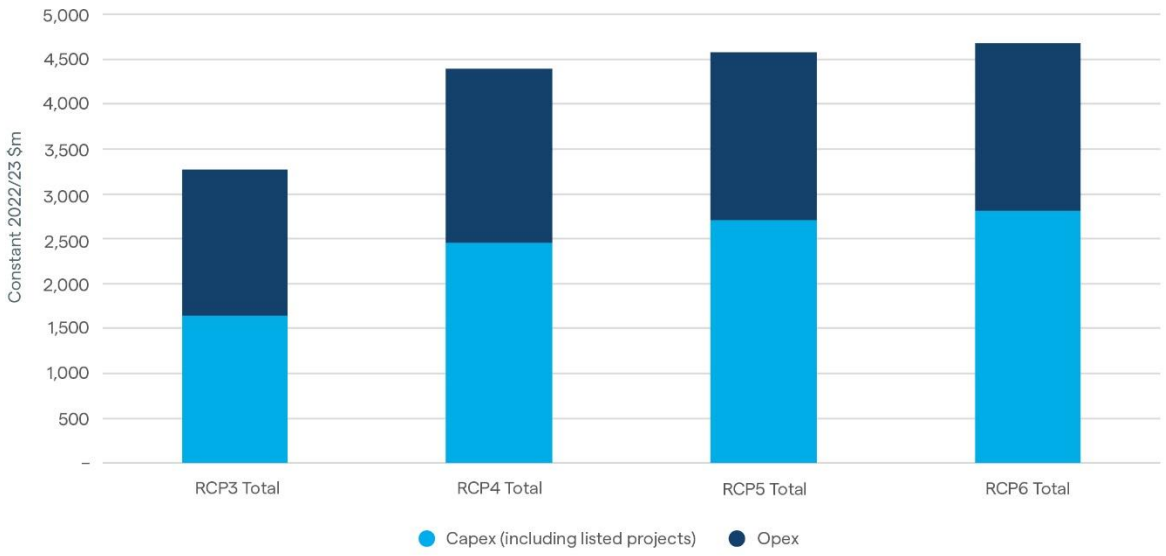
The following key factors drive our RCP4 outcomes and expenditure.

- **Ageing assets**. The majority of the grid was constructed more than 60 years ago, and our average conductor is 54 years old. While we continue to implement life-extension approaches developed during RCP3, over RCP4 and future RCPs, we need to replace or refurbish a significant proportion of the grid. This is required to continue to deliver the quality of service expected by customers and consumers.
- **Workforce and deliverability.** To deliver our base capex and opex work, alongside our major capital projects and customer works, we need a significant increase in our workforce. In previous RCPs, we have made a 'deliverability' adjustment to reflect workforce constraints. We no longer consider this sustainable. Starting in RCP3, we are making a considerable investment in increasing our workforce and establishing the expectation that our service providers invest in their workforce, while we support them to meet growth demands.
- **Resilience**. We have better information on how major hazard events, of all types, can impact the grid. Climate change is also changing the likelihood of some of those events happening. We need to undertake targeted spending on an ongoing basis to improve resilience, in line with customer and consumer expectations. A trend toward more extreme weather was noticeable across RCP3, with the loss of the transmission line over the Rangitātā River in 2019 and the 2023 Auckland Anniversary Day floods. It was highlighted by the impact of 2023's Cyclone Gabrielle on our assets and those of our customers, particularly Firstlight Network (formerly Eastland Networks) and Unison.
- **Input cost pressures**. We have felt inflationary pressures across all areas of our business. While some input prices are trending at or below the CPI, the cost of many of the materials and equipment we use has gone up significantly. This reflects factors such as: the impact of COVID-19 on supply chains, the war in Ukraine, and the increase in demand for transmission equipment. For example, we have seen power transformer costs increase significantly above CPI over the last 3 years.

- **Electrification**. We are seeing the impact of national commitments to decarbonise Aotearoa New Zealand in the step changes in demand forecasts from electricity distribution businesses and the volume of connection requests we are receiving. This includes step changes for electrification of process heat and transport and new investments in solar and wind generation. While most of the expenditure related to these impacts is outside of RCP4, it does emphasise the need to be responsive in RCP4 to customer requirements, and to ensure our existing assets are in the right condition to support electrification. We heard from our customers that a deterioration in performance could undermine consumer confidence in relying on electricity as their primary energy source.

We are not forecasting RCP4 to be a one-off increase, rather our modelling indicates that we will need a sustained base capex and opex programme over the next 15 years, and likely beyond.

Figure 15: Long-term expenditure forecast



4.3 Continual improvement plan

To ensure we can deliver on our RCP4 outcomes, including our targeted efficiency gains, and build for RCP5, we have a continual improvement plan embedded throughout the business. This ensures that opportunities to improve are identified, prioritised, and managed.

Our continual improvement plan has four overarching themes.

- **End-to-end process improvement across value streams**. This will focus on improvements in delivering customer work, procurement, and stakeholder management. Improvements to these services will be enabled by ICT initiatives such as customer engagement tools, asset management, and business capability. We are making a strategic shift by implementing a modular enterprise business capability platform. This will empower us to respond effectively to internal and external changes, including managing the evolving business landscape.

- **Workforce planning and capability development**. We will continue to develop and use our resource planning tools to identify and manage the risk of critical skill shortages and to support our workforce through ongoing improvements to our competency frameworks, training, and progression pathways.
- **Modern data practices and decision tools**. Our RCP4 focus will be to simplify how we combine data across value streams, which will generate greater insights and enhance decision-making capability. We will use our investment in data and digital technology to accelerate our organisational effectiveness.
- **Innovation for cost-effective service delivery.** Innovation in both new grid technology and new ways of working. The aim is better solutions, better practices, avoided costs, and improved reliability and resilience. The way we approach and manage change is key to delivering value. We will continue to:
    - develop our change management capability to improve our execution of new technology and ways of working
    - work with our service provider and engineering consultant partners to develop and deliver innovation initiatives.

5.0 Developing our proposal

Our proposal covers our outcomes for RCP4 and our output incentives for network performance and asset health and presents our best view of prudent and efficient levels of opex and capex to deliver these.

We have developed our proposal to comply with the requirements of the Commission's Transpower input methodology (for general accounting requirements), capex input methodology (for information requirements specific to capital expenditure), and an information gathering notice issued by the Commission under section 53ZD of the Commerce Act on 4 September 2023 (for opex and revenue calculations).

The Commission will evaluate and consult on our proposal as part of determining the capex and opex allowances that will apply to transmission services from 1 April 2025 to 31 March 2030. The Commission will also set our revenue path, based on our forecasts and other inputs such as an allowed rate of return (which is not an input into our proposed expenditure). The Commission is required to reach a final decision by August 2024. We will then determine transmission charges before advising customers and the public of the charges in late 2024.

The key feature of our approach to our RCP4 planning was to test the assumption that customers are happy with the levels of service they currently receive and do not want the risk of service interruptions to increase materially. We focused on whether customers are willing to trade-off services, or other outputs, or create more flexibility around some expenditure. In our consultation with our customers, it was also clear that we are expected to enable electrification of a more resilient grid.

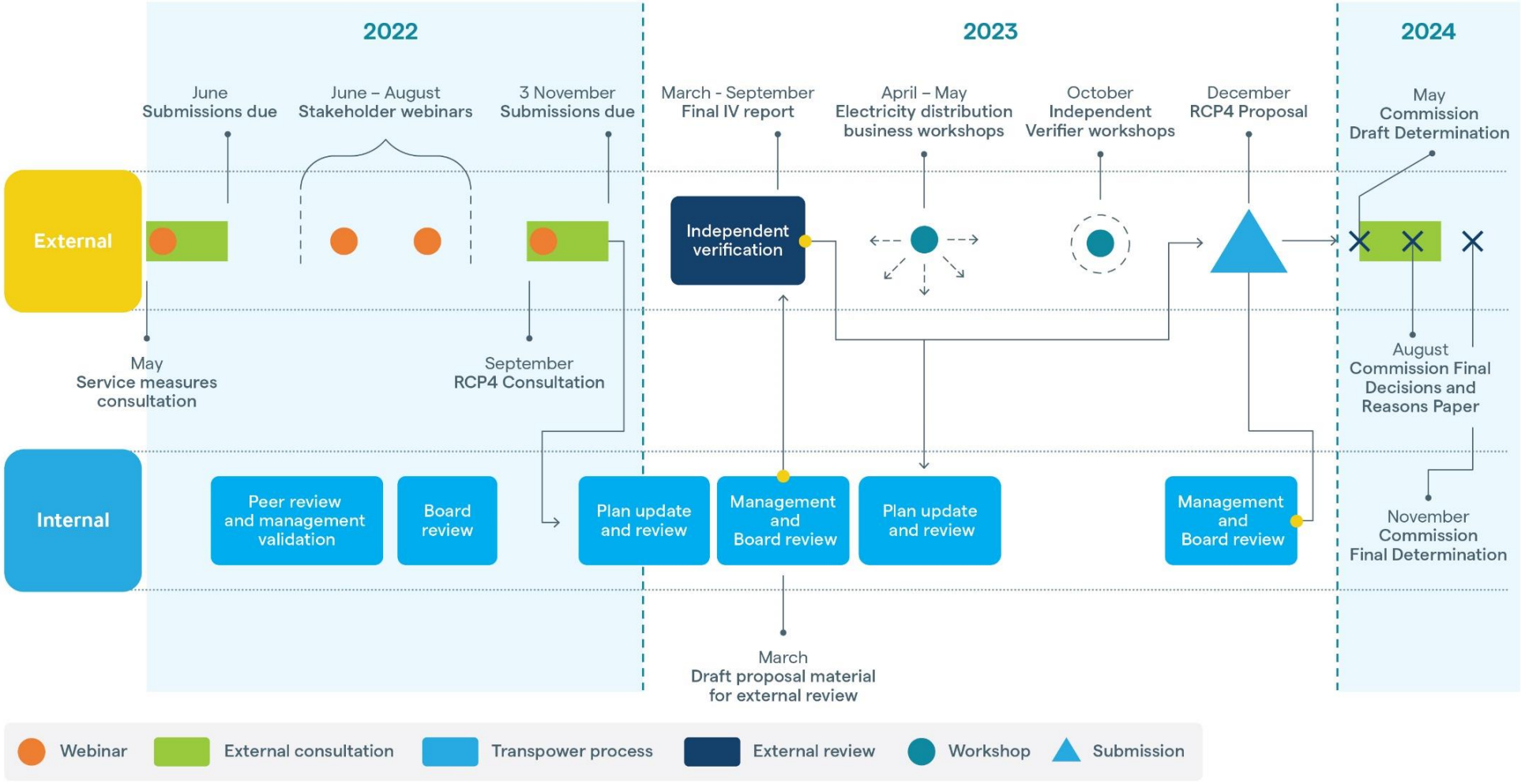
Table 3: RCP4 key stakeholder engagements

June/July 2022	Engagement
March 2022	Consumer advisory panel – understanding consumer priorities
May 2022	Grid service engagement paper published for consultation
June 2022	Consumer advisory panel – proposed service measures and resilience
30 June 2022	Stakeholder submissions due
September 2022	Consumer advisory panel – proposed RCP4 outcomes
30 September 2022	Draft plan issued for consultation
3 November 2022	Stakeholder submissions
November 2022	Consumer advisory panel – update on RCP4 and consultation responses
April/May 2023	Electricity distribution business workshops
September 2023	Verifier report published

June/July 2022	Engagement
April/May 2023	Electricity distribution business workshops
October 2023	Open workshops with stakeholders with the verifier
1 December 2023	Publication of our proposal and submission to the Commission
May 2023	Publication of the Commission's draft decisions for consultation
August 2024	Commission final decision on RCP4 plan

We also challenged our planning internally and took account of verifier feedback before submitting our proposal to the Commission. Figure 16 explains the process for consulting on the RCP4 plan, and how these feed into our own internal review process.

Figure 16: Process for our RCP4 plans



The rest of this chapter is structured as follows.

- Section 5.1 sets out our RCP4-specific and ongoing engagement with our customers and consumers.
- Section 5.2 sets out our internal and external challenge processes for developing our proposal; this includes a summary of the verifier's report.
- Section 5.3 sets out our methodology for forecasting our RCP4 expenditure and provides further information on our workforce and deliverability planning and efficiencies.

5.1 Customer and consumer engagement on our proposal

5.1.1 Ongoing customer and consumer collaboration

Across the business, we engage actively with our customers. Engagement occurs as part of the development of strategy, longer-term transmission planning, and annual business planning, for major and base capex proposals, listed projects, and outage planning, and as part of our regular customer relationship management activities, including the day-to-day operating of the grid.

Customer engagement is guided by our overarching Customer Engagement Plan and is operationalised through individual engagement plans that reflect the unique factors of each customer's business. These plans set out the activity required to deliver on customer service levels and to manage the effective development, operation, and maintenance of grid assets to deliver service at target levels while considering asset health and criticality. These plans are developed and agreed in collaboration with customers and are reviewed annually. For example, with our larger customers, we typically have:

- **monthly meetings between our customer team and their liaison**: these will cover existing projects, investigations, and planned projects over the next 10 years. Each meeting will go through each of the grid exit points or grid injection points we have with our customers
- **regular meetings between our grid divisions and customer asset planning and strategy teams**: these meetings will focus on identifying upcoming changes in the use of the grid and solutions to meet customers' needs
- **quarterly general manager meetings**: where broader strategies, issues, and challenges will be discussed
- **chief executive to chief executive interactions**: occur annually and as required.

We have a proportionate approach, so our smaller customers are likely to need fewer meetings. However, all our customers have well-defined touch points within Transpower, which are set out in the individual engagement plans.

The ongoing engagement we have with our customers feeds directly into our asset planning process. This is most clearly demonstrated in our Transmission Planning Report 2023 and is reflected in our short- and long-term planning.

To support our understanding of end-consumer needs, we formed a consumer advisory panel.[15] The panel provides an independent voice for consumers and a connection between Transpower and the wider community.

The panel meets four times a year and is made up of representatives from business and consumer advocacy groups. Our panel is a broad and diverse group of people that help us better understand the needs, issues, and opportunities for New Zealanders as the country transitions to a low-carbon economy.

5.1.2 RCP4-specific customer engagement

For our RCP4 proposal, we presented our customers with multiple engagement opportunities both face to face and online. We also provided support information and opportunities to discuss questions or concerns with our teams.

We recognise that our existing and traditional customer base is changing, and to that end we sought engagement and conversation with potential future customers, through the Independent Electricity Generators Association. We also sent links and information to our customer teams database, which includes potential new customers such as offshore wind developers.

The focus of our communications material was on ensuring information was clear and explained well and that timeframes for engagement were reasonable. We provided several opportunities for our customers to hear about our proposal as we developed it, in preparation for formal consultation on the draft. Engagement with our customers involved:

- presenting to our consumer advisory panel on a number of occasions to explain elements of the proposal and seek feedback
- undertaking specific, targeted engagement activities regarding the grid service measures
- undertaking 'deep dive' workshops on how we plan and build up our forecast expenditure
- establishing a customer representative forum with representative bodies: Electricity Networks Association, Electricity Retailers Association of New Zealand, Independent Electricity Generators Association, and Major Energy Users' Group
- consulting on the draft plan in September and October 2022, with a focus on the intended outcomes of the proposed expenditure
- conducting regional workshops with electricity distribution businesses (see Section 5.1.3.2)
- communication to our stakeholders through our website, media releases, monthly customer newsletter, webinars, a specific RCP4 mailbox for enquiries, and a survey through targeted emails to potential future customers
- scheduled conversations with customers and industry groups by request
- formal written consultation on our draft RCP4 proposal.

We anticipate hosting further information sessions or industry webinars following publication of the verifier's report later in 2023.

[15] Consumer Advisory Panel | Transpower

Our ongoing engagement with customers is the most critical engagement we have to identify as part of our short- and long-term investment requirements. Our RCP4 consultation focused on making sure our strategic planning around the service levels, resilience, approach to support electrification, and sustainability were appropriate. We consider that the verifier and the Commission are best placed to assess whether our underlying expenditure plans are prudent and efficient to deliver these outcomes.

5.1.3 What we heard from customers on RCP4

5.1.3.1 October 2022 consultation

We received feedback on our October 2022 RCP4 consultation paper from eight submitters. Feedback on our proposal is an important step in the RCP4 process. It ensures we remain transparent and accountable across the sector. It is also a useful part of our planning process – as our forthcoming work will require us to work closely with our industry peers. We sent a notification of our consultation publication to a broad range of customers and stakeholders and held a webinar. We received submissions from Mercury, Vector, Major Energy Users' Group, Euroclass, Fonterra, Electra, Electricity Retailers Association of New Zealand, and Meridian.[16] A summary of the feedback is provided in RCP4 Consultation Summary. Because we only heard from two electricity distribution businesses, we went out to these stakeholders in specific consultation workshops in April and May 2023.

Most submitters support our approach to targeting expenditure levels to maintain the current level of service performance. We also received strong support for resilience solutions, with one submitter noting that extended periods of outages may undermine the shift to electrification. Some submitters provided detailed feedback on our consultation questions, whereas some provided more high-level comments. A summary of our responses to some key points and how these have fed into our proposal is outlined below.

[16] We met with or sent letters to all submitters to explain our work in response to their feedback and gain a better understanding of submitters' positions.

Table 4: Customer feedback on RCP4 proposal from November 2022

Feedback issue	Detail	How it feeds in
Addressing the energy trilemma	Transpower should address the affordability and efficiency of supply to end-users	We are very conscious of the increases in costs we, our customers, and consumers are facing. However, our RCP4 proposal is about maintaining current service levels in RCP4 and beyond. If we do not invest, service levels are at risk of deteriorating. The detrimental impact on customers from the increased risk of interruptions outweighs the increase in our investments We consider the best way to address the affordability issue is to increase grid usage and generator competition. This will lower consumers' overall energy costs as the country shifts away from fossil fuels We are also identifying investments that will deliver net electricity market benefits. These sit outside our RCP4 proposal as they are major capex projects
Service measures	Support for proposed service measures A suggestion that measures need to more closely reflect future expected demands on the grid with more renewables	We met individually with submitters who raised specific concerns with our proposals. Based on the feedback, we have adjusted our proposal so more major event outages are included in the measure
Resilience	There was strong support for investments to ensure the resilience of the grid to major hazards	Following the two cyclones in early 2023, we refocused efforts on identifying resilience work that we can bring forward into RCP4. This is set out in more detail in Chapter 9.0 We have added a new section to our annual Asset Management Plan, focusing on our resilience programme. We have also proposed a specific end-of-RCP4 report on the outputs and expenditure of our resilience programme

Feedback issue	Detail	How it feeds in
Uncertainty mechanisms	Uncertainty mechanisms were supported in principle One respondent suggested a transparent process for anticipatory connection asset capacity, with engagement required to access funds	We have proposed access to a fund of $25 million to allow us to add anticipatory connection asset capacity. We consider our proposed uncertainty mechanism reflects the potential materiality of anticipatory connection asset capacity We note the Commission has proposed some amendments to the input methodologies to incorporate transparency around anticipatory connection asset capacity. The Commission's position is to include this expenditure in base capex or requested via a reopener mechanism We encourage stakeholders to submit on the Commission's draft RCP4 decision to provide specific feedback
Distributed energy resources and other innovations	Question raised whether there are opportunities to innovate and be more flexible to get more out of existing assets before further investment Support for digital interfaces to tools Encourage exploration of grid support technologies to manage peak demand	As discussed in Section 6.4, we have set ourselves a challenging opex productivity target of 0.5 per cent per year. This is an increase from our 0.3 per cent productivity target for RCP3 Our ICT programme for RCP4 includes several investments to further integrate new technologies. This includes offering more digital interfaces for our customers to access grid data during RCP4. We will investigate whether we can provide our Asset Management Plan in an interactive regional-based form, similar to our transmission planning report[17] As the grid owner, we actively look for economic solutions that reduce constraints on the grid and deliver net electricity market benefits. This is an integral part of our options assessment process
Environment programme costs	Stakeholders considered that there should be a balance between achieving sustainability objectives and costs being passed on to consumers	We have reduced our proposed amount for meeting sustainability objectives outside of our ongoing workplan. We will focus on being fast followers and preparing for a larger sustainability programme during RCP5

[17] Envision

Feedback issue	Detail	How it feeds in
More information needed	Better link-up to the broad range of information we make available regarding drivers for expenditure increases	We ran four regional workshops for our electricity distribution customers. This is discussed in the following section We have also provided more links throughout this proposal to supporting information, including our Asset Management Plan 2023, our Transmission Planning Report 2023, and our Service Measures Report 2023
Workforce planning	Support for Transpower's investment in attracting and training people to grow the workforce	We have put in place plans to increase our workforce. This is an industry-wide issue. We are working closely with our colleagues in various organisations to create and sustain more pathways into our sector. Our plans are set out in more detail in Section 6.1

5.1.3.2 Electricity distribution business workshops – April to May 2023

Electricity distribution businesses are key Transpower customers. Following on from the minimal feedback from these customers we received during our October 2022 consultation, we decided to run four regional workshops in Christchurch, Wellington, Hamilton, and Auckland.

The aim was for electricity distribution businesses to better understand the drivers for the increase in expenditure from RCP3 to RCP4 and to:

- provide specific information on our regional base capex plans for RCP4
- seek input on the outcomes we want to achieve through investment in each region, including:
    - maintenance and replacement spend
    - resilience approach and spending
    - supporting electrification of the economy
- get electricity distribution businesses' views on any gaps in our RCP4 plan, where our plan is not clear, or could be improved.

We received feedback on the day and also asked for written responses to specific questions.

We heard that our customers needed more clarity around where expenditure sits in relation to the RCP4 proposal, major capital projects and customer work, and what the key drivers were. To address these concerns, we have provided more graphical information of what is in and what is out of the scope of the RCP4 proposal in Figure 12. We have also included more links to supporting information that gives detail on the increases and their drivers.

Table 5: Electricity distribution businesses' feedback on April–May 2023 workshops

Feedback issue	Detail	How it feeds in
Regional plans	Population growth, increasing use of electric vehicle (EVs), new-generation connection requests, and other specific projects	Some electricity distribution businesses did not understand the drivers behind the increase in our investment plans from RCP3 to RCP4, and we are committed to making this clearer We pointed out the key driver of RCP4 expenditure was replacement, refurbishment, and maintenance of assets to maintain service levels in response to aspects of our asset base approaching the end of their useful lives. We consider the detrimental impact on customers from the increased risk of interruptions to outweigh the increase in our investments This information was generally already included in asset management plans, but we have worked to ensure the links are more transparent. As noted above, we will investigate where we can digitise our Asset Management Plan to improve customers' engagement with our planning process. We welcome specific feedback on the type of engagement individual customers are seeking
Peak demand	Electricity distribution businesses were concerned their efforts in reducing peak demand were not recognised	Electricity distribution businesses' forecasting is included in our scenario forecasts. We engage annually with these customers to construct these forecasts. We are keen to hear more across those engagements to ensure we have an accurate understanding of expectations We pointed out the key driver of RCP4 expenditure was replacement, refurbishment, and maintenance of assets to maintain service levels in response to aspects of our asset base approaching the end of their useful lives. We consider the detrimental impact on customers from the increased risk of interruptions to outweigh the increase in our investments These requirements are set out in our Asset Management Plan 2023. We are investigating digitalising this document to improve customers' engagement with our planning process

Feedback issue	Detail	How it feeds in
Resilience	Strong support for a resilience programme Need to understand specific regional needs Affordability a concern for consumers Less consumer tolerance for being off supply	We are committed to a collaborative approach between Transpower and electricity distribution businesses, particularly as, under the new transmission pricing methodology, our customers are allocated costs for interconnection assets based on an estimation of their benefits from the investments. Customers whose connection assets are affected will be part of the project Our proposed resilience plan would add approximately 26 cents per month per consumer connected on distribution networks[18]
Deliverability	Concern about whether we have the resources to deliver on the forecast investments	We discussed our resourcing plan; this included our initiatives to grow our workforce and our work with service providers to increase the base of work We invited the distribution businesses to feed back on our plans via the Commission's consultation on our RCP4 proposal in May 2024

Most of what was discussed at the project level was known through our ongoing engagement; however, there were two pieces of specific feedback that have been incorporated into our planning:

- Orion clarified that the Norwood enhancement and development project we had in our initial 2022 transmission planning report was no longer needed
- we have accelerated a power transformer replacement project at Waiotahi (Horizon connected customer) in order to help realise an integrated project solution between ourselves, Horizon, and a generation connection. This avoids the installation of additional grid assets and realises project delivery efficiencies.

In addition to this, electricity distribution businesses highlighted the importance of continuing their regular, ongoing collaboration with Transpower. Many also said there was high value in investing in a collaborative approach to risk assessment and mitigation development. They emphasised that resiliency is front of mind for them and the communities they connect.

5.2 Challenge and verification process

To ensure we manage our assets appropriately, we align all our work with good electricity industry practice. In relation to electricity transmission, this is defined as good practice that would reasonably be expected from a skilled and experienced asset owner engaged in the management of a transmission network in any country.

[18] This does not account for how the resilience spend would end up being allocated based on the location of the investments and the transmission pricing methodology simple method allocation.

Good electricity industry practice means the exercise of that degree of skill, diligence, prudence, foresight, and economic management, as determined by reference to good international practice, which would reasonably be expected from a skilled and experienced asset owner engaged in the management of a transmission network under conditions comparable to those applicable to the grid consistent with applicable law, safety, and environmental protection. The determination is to take into account factors such as the relative size, duty, age, and technological status of the relevant transmission network and the applicable law.[19]

We have an internal review process to challenge our proposed plans and to check that we have taken account of customer feedback.

In addition, the verifier has assessed, and the Commission will assess, our plans and expenditure for RCP4 against good electricity industry practice. This means an assessment of whether the proposed expenditure is:

- **prudent**, i.e., are the volumes of work and/or project proposed justified against a need?
- **efficient**, i.e., are the proposed unit costs, rates, and cost levels the least cost for the solution and quality proposed?

[19] *Electricity Industry Participation Code 2010*

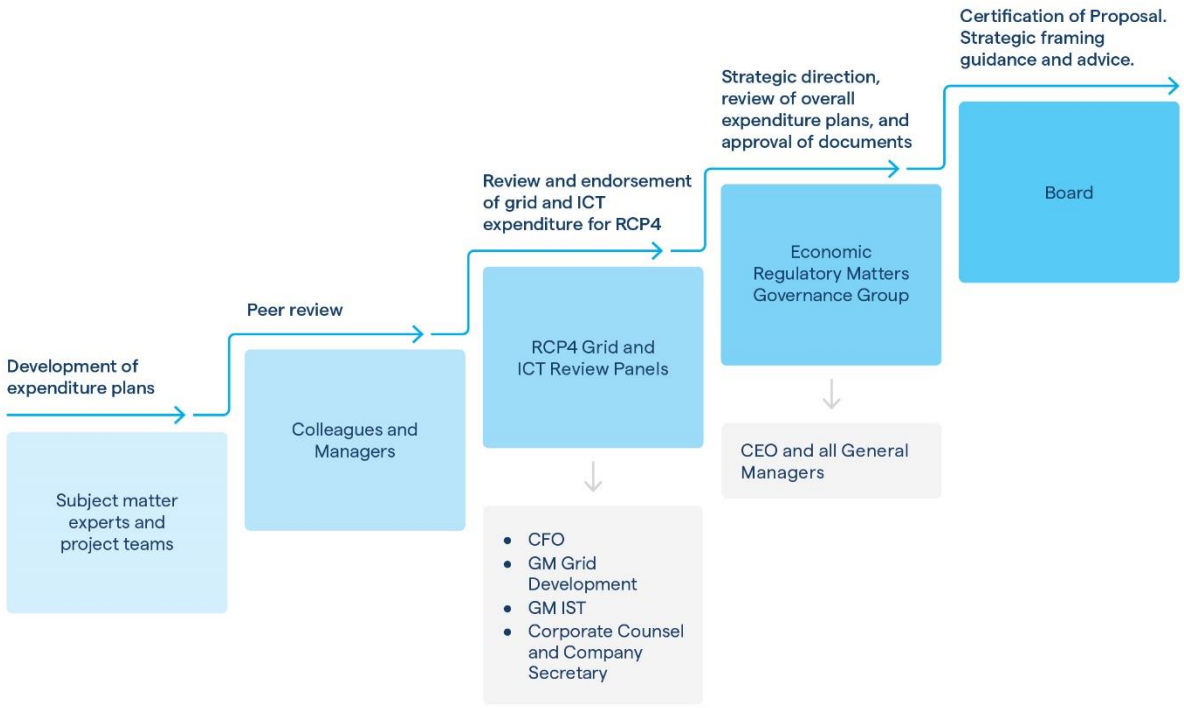
5.2.1 Internal challenge process

Forecasting our expenditure requirements up to 8 years in advance is challenging. This is complicated as we are incentivised on both the outputs we deliver and the expenditure required. To ensure the robustness of our forecasts out to 2030, the proposed expenditure for asset classes, divisions, and functional areas went through a multi-stage internal review process. This uses a variety of approaches, including internal peer review and management validation. We also engaged with our board throughout the process.

Throughout the development of RCP4, we have provided regular updates and information sessions to our own people through a variety of communication channels to support their understanding and their ability to have informed conversations with industry peers.

The internal challenge process was repeated as needed as we updated our plans for new information, customer and consumer feedback, and the independent verification process. Figure 17 outlines the process.

Figure 17: Internal challenge process



During RCP4, expenditure will be subject to Transpower internal approval processes and delegated financial authority policy. For capital expenditure, we have different timings in terms of the business case approval depending on the nature of the work. For grid capex we have two approval processes depending on the complexity of the work. This determines how the work is managed with our service providers.

5.2.2 Independent verification

We agreed with the Commission to use independent verification of our RCP4 proposal as an additional measure alongside our internal challenge process and the Commission's review.

This involved engaging an independent expert to scrutinise our proposal and provide a report to assist the Commission in streamlining and targeting its evaluation. Independent verification is required for customised price-quality path applications. The terms of reference were tailored to fit with our individual price-quality path regulation and were agreed with the Commission in early 2023.

We engaged GHD Advisory (GHD), working in partnership with Castalia, as our verifier. Under a tripartite deed between Transpower, the verifier and the Commission, the verifier has a duty to act as an independent expert and with reasonable care. The verifier assessed our plans and expenditure for RCP4 against good electricity industry practice.

5.2.2.1 Independent verification process

The independent verification process operated in parallel with our challenge process and the further engagement with our electricity distribution business customers.

Key milestones included an introductory workshop in March 2023, a week-long series of detailed workshops in mid-March, and follow-up workshops in May. The workshops complemented regular meetings, documentation sharing via an electronic data room, and written information requests and responses during March to July. We shared more than 200 documents and responded to over 30 detailed information requests.

The verifier's draft report, received at the beginning of July 2023, was shared with the Commission. The aim was to allow the Commission to provide early comments on the format and coverage of the report to increase the usefulness of the report as an input to its evaluation.

In September 2023, we published the Verifier Report to provide our stakeholders with an early view of the verifier assessment of our plans. Transpower and the verifier also held workshops in person and online in Christchurch, Wellington, and Auckland in October 2023 to provide an opportunity for stakeholders to hear directly from the verifier and ask questions.

We consider the verification process has added value to our preparations. We expect it to provide reassurance to stakeholders and assist the Commission to operate an effective and efficient evaluation.

"Overall, we find that the proposed expenditure amounts that we reviewed and accepted are consistent with an expenditure outcome which represents the efficient costs of a prudent electricity transmission services supplier having regard to [good electricity industry practice] and the evaluation criteria."
– the verifier

It is important to note, the verifier reviewed our expenditure forecasts from a point in time, mid-February 2023, when our expenditure was based on 2021/22 constant prices. For our proposal, we have updated our expenditure to 2022/23 prices, made changes to our workplan based on the verifier's feedback, and made refinements to our workplans to take account of new information. Therefore, the expenditure in our proposal does not exactly match the expenditure assessed by the verifier. Outside of the CPI adjustment, we have provided an explanation for the differences in our outcome chapters.

5.2.2.2 Summary of outcomes of independent verification

The verification report summarises the status of expenditure areas using a two-part classification:

- verified – indicates the verifier has tested the expenditure area
- satisfies good electricity industry practice – indicates the verifier is satisfied the expenditure area meets the expenditure outcome, which includes considering whether forecasts are consistent with good electricity industry practice.

The independent verification covered almost all of our base capex and opex proposal. It did not review our expenditure forecast for capitalised leases or six (small) ICT investment cases. The verifier took a proportionate approach with a greater emphasis on the identified programmes.

The verifier reviewed 96.6 per cent of Transpower's proposed base capex for RCP4 and all the proposed RCP4 opex. They considered that all but $41.4 million (2.1 per cent) of the proposed RCP4 base capex and 100 per cent of the proposed base opex represents the efficient costs of a prudent electricity transmission services supplier. Overall, the verifier concluded that:

- 93.6 per cent of the base capex it reviewed is verified and meets good electricity industry practice; 3.4 per cent was not reviewed, 0.9 per cent was verified but needed recategorisation, and 2.1 per cent was reviewed and not accepted
- 100 per cent of the uncertainty mechanism capex it reviewed is verified and meets good electricity industry practice
- 100 per cent of the opex it reviewed is verified and satisfies good electricity industry practice.

The verifier verification included the following.

Independent verification feedback
Strategy development and implementation. The verifier concluded that Transpower's relevant policies and governance processes are directed towards the expenditure outcome that represents the efficient costs of a prudent electricity transmission services supplier having regard to good electricity industry practice and the evaluation criteria.
Asset health and network risk modelling. Transpower's existing asset management practices, after considering the recent development in asset health modelling, impact modelling, criticality, and risk-based decision-making frameworks, demonstrated good electricity industry practice.
Expenditure forecast governance and review. Transpower's frameworks provide a consistent, repeatable, risk-based approach for investment planning decisions. The top-down challenge process allowed oversight by general managers to review and agree appropriate trade-offs between expenditure portfolios and ensure appropriate consideration of customer feedback.
Service levels. Transpower is targeting a level of performance consistent with maintaining existing service levels.
Capex/opex trade-offs. Transpower demonstrated that their frameworks aim to embed the capex/opex trade-off considerations. Transpower provided examples of where capex/opex trade-off decisions had been made.

Independent verification feedback
Cost estimation. Transpower's cost estimation framework meets all the evaluation criteria, including good electricity industry practice.
Electricity demand forecast. We have verified Transpower's demand forecasting approach against the evaluation criteria and consider it sound. Nevertheless, we consider the bottom-up modelling that incorporates electricity distributor-provided step changes could be further improved.
Stakeholder consultation. The extent and effectiveness of Transpower's consultation and engagement with its stakeholders is compliant with the relevant input methodologies and terms of reference evaluation criteria. Overall, Transpower's stakeholder consultation for RCP4 significantly improved upon that for RCP3. Though the consultation process is ongoing, we expect Transpower to continue engaging with stakeholders at a high standard as the RCP4 process continues.
Deliverability. Transpower has implemented several recruitment and training initiatives. However, the verifier was concerned about Transpower's ability to recruit approximately 200 additional staff (often in specialised areas) over the next 3-year period required to deliver the expected programmes. They suggested regular reporting on the status of its specialist workforce before and during RCP4.

The verifier also concluded that our proposed uncertainty mechanisms – the resilience use-it-or-lose-it mechanism and the enabling customer electrification use-it-or-lose-it mechanism – met the evaluation criteria it used.

5.2.2.3 Detailed verification feedback

We made several refinements to our RCP4 proposal as a result of the verifier's feedback. There were also a small number of areas we disagreed with the verifier's conclusions. Our responses are summarised in Table 6.

Table 6: Independent verification feedback

Independent verification feedback	Our response
Replacement and refurbishment of alternating current (AC) substations. 5.7 per cent of forecast expenditure ($25.4 million) was not accepted. This was because the verifier felt insufficient evidence was provided for two transformer replacements and the 'other station equipment' asset class to explain the increase in funding requested. They recommended Transpower needed to clearly identify the two transformers for replacement and be clearer on the quantum of asset and cost estimate basis for the proposed solutions	This expenditure related to improving our transformer bunding and oil containment, roof and wall bushings and substation lighting. Based on the feedback from the verifier, we have included more detail within our portfolio management plan that outlines how we have determined the scope of work during RCP4 and the expected costs

Independent verification feedback	Our response
Buildings and grounds maintenance. 10.7 per cent of forecast expenditure ($13 million) was accepted, but the capex associated with meeting the potential applicable drinking water supply compliance standard needed recategorisation using the uncertainty mechanism	We accept that there is some level of uncertainty around the precise scope and costs to meet our obligations under the Taumata Arowai drinking water regulations. We put in a conservative estimate for RCP4 based on our understanding of the requirements and our buildings and grounds portfolio We are not against the expenditure being in an uncertainty mechanism but note that none of the existing uncertainty mechanisms are appropriate
Enhancement and development. 5.1 per cent of forecast expenditure ($5 million) for the corridor management programme was accepted but needed to be recategorised as opex	We disagree with this conclusion. We are following generally accepted accounting principles, and have received tax and accounting advice to confirm this, and we consider that our work to maintain our corridors should be capitalised as the effects of our work create an asset that lasts for multiple years
Business support capex. 37.1 per cent of forecast expenditure ($16 million) relating to an upgrade of the Wellington office was not accepted and needs its own investment plan and business case	Following the verifier feedback, we have removed this expenditure from our RCP4 plan. We may need to seek this funding in RCP5
Electricity demand forecast. The verifier suggested a review to understand any systematic trends that may show a predictable lag between the distributor-estimated timing of demand step changes compared with when those step changes tend to occur	While we understand the verifier's proposal, we do not see material value in it. We use sensitivity analysis to identify where and when constraints may arise on our network
Deliverability. The verifier was concerned about Transpower's ability to recruit approximately 200 additional staff (often in specialised areas) over the next 3-year period required to deliver the expected programmes. They suggested regular reporting on the status of its specialist workforce before and during RCP4	We agree that it will be a challenge to increase our resourcing levels as proposed; however, we consider that we have the plan in place to do this We are happy to update the Commission on our recruiting throughout the RCP4 determination process. However, while we have no issue doing it, we see less value in reporting during RCP4

Independent verification feedback	Our response
Uncertainty mechanisms. The verifier suggested: • for the Resource Management Act reopener (and other reopeners), Transpower consider proposing an expenditure-based materiality threshold test grounded in the likely costs of undertaking the reopener process • setting an approved expenditure allowance for insurance premiums based on forecasts and towards a recoverable cost approach • that, while Transpower evidenced the rapidly rising insurance costs it faces, it did not demonstrate that there was sufficient volatility to require an uncertainty mechanism	The Commission's draft input methodologies decisions[20] proposed reducing the threshold for change events to $5 million. We support this change and, if this is the final decision, we no longer propose the change to the threshold We note the verifier acceptance that the insurance cost increases have become steeper, and we accept the verifier's opinion that it did not find sufficient evidence to move away from the current approach. Therefore, we have not proposed an insurance premium uncertainty mechanism for RCP4
Asset performance measures. The verifier's opinion was to: • maintain the current approach for AP1, which allows the full incentive per event • not support the removal of the AP2 and asset health quality standard, but to support pooling over categories (for asset health) and years (for AP2 and asset health)	We still consider that limiting the impact of one-off large events for AP1 is appropriate. This would preserve the incentive on Transpower to maximise availability but would not distort annual performance for large events. However, in response to their concerns we have proposed an increase in the cap for one-off events We disagree with the verifier's opinion that the quality standards should remain for AP2 and asset health. We consider the risk of false negatives (i.e. non-compliance) with the quality standards and the associated time and cost of a compliance investigation is not in the best interests of consumers. Quality standards would still apply to interruptions (GP1 and GP2), the primary indicator of customer and consumer service, and the Commission can still seek further information if it has concerns about our performance without a quality standard

5.2.3 Audit and assurance

The RCP4 proposal must be certified by two members of Transpower's board of directors for, and on behalf of, all directors.

[20] Part-4-IM-Review-2023-Draft-decision-CPPs-and-In-period-adjustments-topic-paper-14-June-2023

The board must also provide assurance to the Commission that our RCP4 proposal meets RCP compliance requirements and is "... derived from and accurately represents, in all material aspects, the operations of Transpower", and that:

- the base capex proposal complies, in all material respects, with the requirements of clause 7.3.1 of the capex input methodology and the information requirements set out in the 53ZD information notice; and
- the information presented as part of the submission was derived from and accurately represents in all material respects, the operations of Transpower.

To provide Transpower directors with appropriate information for their RCP4 proposal certification, we implemented a management representation process and engaged independent assurance advice. Complementing our ongoing quality and sign-off processes, senior managers briefed their respective general managers on the activities undertaken. This ensures the information in the proposal represents Transpower's operations and complies with regulatory requirements. In addition, general managers provided letters of representation to the chief executive, and the cChief executive provided an overall letter of representation to the board.

The board has also been through an extensive education process on RCP4, with information provided over 24 months and at 15 meetings. At the end of this process, the board undertook a half-day workshop outlining the key aspects of the proposal and were given access to the full suite of documents.

PwC provided independent assurance to directors on the RCP4 proposal, as follows:

- a review providing an opinion confirming that the proposal documentation (other than the revenue modelling) is compliant with regulatory requirements and represents Transpower's operations
- a review of our revenue modelling, providing confirmation that it is compliant with relevant regulatory requirements and represents Transpower's operations.

In addition, many of the systems and processes used to produce the information in our proposal are subject to regular assurance processes.

5.3 Our approach to developing forecast expenditure

In this proposal, we generally show annual information up to the end of RCP4 (2029/30). Given the long-term planning horizons involved in prudently managing the grid, we also show longer-term forecasts grouped into 5-year periods up to RCP6 (2034/35 to 2039/40).

5.3.1 Conventions

Throughout this proposal, we present forecast expenditure using the following conventions.

- **Financial years**: Expenditure is shown by June financial year. For example, 2022/23 refers to the year 1 July 2022 to 30 June 2023; our financial year aligns with the disclosure year under our regulatory arrangements.

- **Constant prices**: Unless otherwise stated, expenditure is presented in constant 2022/23 prices. This means historical figures are adjusted to 2022/23 prices, and figures for future years are not adjusted for forecast cost escalation or general inflation. This presentation enables the comparison of trends over time.
- **Spend basis**: Opex and capex is presented on a spend basis to align with regulatory arrangements.
- **Cost allocation**: Costs are presented after applying cost allocation consistent with our regulatory arrangements (e.g. we exclude costs allocated to our system operator service).
- **Cost capitalisation**: Forecasts are consistent with our current approach to capitalising internal costs; this includes distinguishing between project costs booked directly to capital projects and indirect costs transferred out of operating costs and charged to capital projects.
- I**nterest during construction**: Project financing costs are recognised by accruing interest during construction, up to the point an asset is commissioned. All capex in the proposal includes interest during construction.

5.3.2 Forecasting approaches

Our RCP4 forecast is based on a suite of forecasting approaches that we have been continuously developing since RCP1. Our grid and non-grid capex forecasts are generally developed using bottom-up approaches (combined with top-down planning frameworks).

Table 7 provides an overview of the approaches we applied to each expenditure category in our RCP4 proposal. We discuss the forecasting in more detail in the relevant chapters.

Table 7: Forecasting approaches used to produce our RCP4 forecasts

Expenditure category	Forecast approach
Refurbishment and replacement capex	Asset health in combination with criticality; condition assessment where asset health models are unavailable
ICT capex and opex	Bottom-up based on programme, investment type and category, and base-step-trend approach
Business support capex	Bottom-up (in combination with top-down planning frameworks)
Enhancement and development capex	Scenario-based forecasting based on bottom-up and top-down assumption
Resilience capex	Bottom-up based on assessed need
Maintenance opex	Bottom-up and base-step-trend

Expenditure category	Forecast approach
Asset management and operations opex	Base-step-trend
Business support opex	Base-step-trend
Insurance opex	Based on expert actuary and broker information

Our cost estimates are based on a P50 (probability that outturn costs are 50 per cent above or 50 per cent below the forecast). None of our cost estimates included a 'blanket' contingency to account for uncertainty.

Below, we provide further information on bottom-up cost estimation, as implemented in our grid capex forecasting and base-step-trend forecasts. For other expenditure categories, refer to the relevant chapters of our proposal.

5.3.3 Bottom-up cost estimation

The bottom-up cost estimates used in our grid capex renewal forecast are based on historical costs, suitably tailored to forecast scope. We broadly distinguish between volumetric and non-volumetric cost estimates.

5.3.3.1 Volumetric works

Volumetric works are relatively low value (<$1 million), generally routine (i.e. they do not require individual investigation), and are relatively uniform with consistent scope and consistent delivery methodology. Estimates for these works use building blocks, which are based on an average rate and an assumed scope of work.

5.3.3.2 Non-volumetric works

Non-volumetric works are generally high value and require a project-specific and tailored investigation. For these projects, we prepare customised cost estimates tailored to the project-specific scopes of work.

5.3.4 Base-step-trend

For most of our opex forecasts, we have adopted a base-step-trend framework. Base-step-trend forecasting is generally appropriate for expenditure that is recurring and assumes that historical 'revealed' expenditure provides a suitable starting point for a forecast requirement. This revealed expenditure approach works alongside the incremental rolling incentive scheme that the Commission imposes. It is designed to ensure we are incentivised to innovate and implement efficiencies as they are identified. This provides confidence to the Commission and stakeholders that our base year is efficient.

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

- **Base year:** identifying an efficient base year, typically the most recent year for which actual opex data is available. This includes assessing the extent to which the base year is relatively efficient. The base year is adjusted for any atypical cost items.

- **Step changes**: required to meet the needs of the network or to allow for external requirements, and that are not already captured within the scope of the base amount.
- **Trends**: these reflect expected changes in cost due to output growth and can also include adjustments for ongoing productivity and/or cost efficiency.

5.3.5 Identified programmes

The intention of identified programmes is to allow the Commission to target its evaluation. The selected identified programmes are required to cover most of our expenditure.
We are required to provide more in-depth qualitative and quantitative information on identified programmes. Table 8 lists the identified programmes (capex) in the RCP4 proposal. Together, the identified capex programmes make up over 80 per cent of our proposed RCP4 capex.

Table 8: RCP4 identified programmes

Expenditure group	Asset class	Identified programme
Refurbishment and replacement	AC substations	Power transformers
		Outdoor switchgear, including outdoor circuit breakers, instrument transformers, and disconnectors and earth switches
	Transmission lines	Structures and insulators, including pole, tower, and paint
		Conductor and hardware
	Buildings and grounds	Buildings and grounds
	High-voltage direct current (HVDC) and reactive assets	HVDC
		Reactive assets, including dynamic reactive power, capacitors and reactors, and HVDC synchronous condensers
	Secondary assets	Protection, battery systems, and revenue meters
		Substation management systems (SMS)
Enhancement and development	Enhancement and development base capex	Enhancement and development base capex

Expenditure group	Asset class	Identified programme
ICT	IT telecoms, network and security services	TransGO Refresh
	Maintain services	Maintain assets

Table 9 lists the identified programmes (opex) in the RCP4 proposal. Together, the identified opex programmes make up over 85 per cent of our proposed RCP4 opex.

Table 9: RCP4 opex identified programmes

Identified programme
Preventive maintenance
Predictive maintenance
Asset management and operations
ICT opex
Business support

5.3.6 Uncertainty mechanisms

We are proposing additional uncertainty mechanisms in RCP4 to provide flexibility to respond to customers' needs during the regulatory period while ensuring that risks are balanced between Transpower and our customers.[21]

Uncertainty mechanisms allow the Commission and Transpower to take account of the uncertainty around the need for investment in some areas in the future, for example, around the level of work we need to undertake to respond to climate change, and the speed and regional impact that the transition to a net zero economy will have. Uncertainty mechanisms help

[21] The current regulatory framework allows for asset replacement and refurbishment projects to be included in uncertainty mechanisms. There is also an enhancement and development reopener uncertainty mechanism.

protect consumers by ensuring only costs that we are certain of are included in our base capex and opex.

There are already several uncertainty mechanisms within our regulatory framework.[22]

- **Major capex projects**. For large enhancement and development (costs > base capex threshold, currently $20 million).
- **Listed projects**. For large replacement and refurbishment projects (> $20 million) that have significant timing uncertainty at the time of the regulatory determination.
- **Enhancement and development reopener**. This covers enhancement and development projects (< $20m) that were unforeseen or highly uncertain at the time of the regulatory determination.
- **Low incentive rates**. Transpower can seek a low incentive rate for projects that meet certain criteria.
- **Catastrophic events, regulatory change events, and error events**. The event must cost Transpower at least 1 per cent of the MAR.

We consider that these mechanisms should remain for RCP4. We intend to use several of these during RCP4. We note that the Commission has proposed changes to these mechanisms in its draft input methodologies decisions.[23] This includes increasing the base capex threshold to $30 million and adjusting the event reopener threshold to be $5 million. We support both these changes.

We are proposing two new mechanisms, based around a use-it-or-lose-it mechanism, to support:

- our resilience programme.
- adding connection capacity for our customers.

The proposed mechanisms would provide us access to funding if we:

- undertake specific resilience workstreams
- add anticipatory capacity at connection points
- bring forward asset replacements.

The expenditure allowance would not be in our base capex or opex, and our revenue requirements would only increase if we spent against these categories. We consider our proposed uncertainty mechanisms:

- retain the incentive for us to reduce our costs and share the cost savings with consumers
- are designed to allocate risk to whoever is best placed to manage it
- provide flexibility and optionality to facilitate whole-system solutions within the price control period
- allow funding to adjust to reflect changes in externally driven requirements
- are a way to seek specific project funding for projects that are currently uncertain or unknown.

Further details on our proposed new mechanisms are set out in Section 9.3 and Section 10.4.

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[22] Based on the input methodologies in force at the time of this submission.
[23] Commerce Commission – *2023 Input Methodologies Review*

6.0 Delivering our proposal

Completing the RCP4 work programme will require significant growth of the electricity workforce as well as resilient supply chains and inventory.

During the development of our RCP3 proposal, we used option value to refine the work programme and efficiently defer some work by extending the life of assets. This means we now have increased certainty around the interventions needed to maintain and improve the grid. We have more robust information to inform the RCP4 work programme and beyond, as it relates to the impacts of electrification. Forecast growth is expected to continue through RCP4, RCP5, and RCP6.

To complete the RCP4 work programme, we will require significant growth of our own workforce as well as active support to encourage the growth of engineering consultants, service providers, and specialist contractors from offshore. We also need resilient supply chains and inventory to ensure we have the required material and equipment as we need them.

Although our RCP4 proposal excludes customer and major capital project work, we consider removing these elements from the evaluation of deliverability excludes a significant and important component of our services. The forecast growth in major capital projects and customer work is pronounced.

In RCP3, we made a top-down adjustment for deliverability reasons. We have not made one for RCP4. With an ageing asset base, increasing customer work, and a need to reinforce the grid for increasing electrification, we consider that it is now time to spend to develop our workforce capabilities rather than defer work to future RCPs.

We acknowledge this will be challenging; however, we consider we have a plan in place that will support our forecast RCP4 workload and that aligns with what a prudent and efficient transmission operator would do.

This chapter is structured as follows.

- Section 6.1 describes our workforce planning.
- Section 6.2 sets out how we are increasing our service providers' capacity to deliver our work programme across RCP4.
- Section 6.3 describes our procurement approach.
- Section 6.4 explains how efficiency and innovation support our RCP4 proposal.

6.1 Workforce planning

A competent, motivated, and stable workforce is an essential prerequisite to our provision of a reliable and safe network and excellence in customer service.

To complete the RCP4 work programme, we will require significant growth of our own workforce while actively supporting the recruitment of engineering consultants, service providers, and specialist contractors from offshore.

The forecast increase in workload is the result of an ageing asset base and the rapid electrification of our economy to meet necessary decarbonisation goals. Changing legislation and consenting requirements will affect all our work in the field and require a step change in our resourcing. We expect the increase in grid work to be a long-term challenge. Coincidental increases in demand for

these resources across the industry will compound the challenges and will likely put upward pressure on resourcing costs.

We know that our workload will continue to ramp up during RCP4, and beyond. If we defer any of this work, resourcing constraints are likely to incur higher costs for customers and consumers in the long run. This means we need to start investing now in the resource and capability to maintain a reliable network and to enable Aotearoa New Zealand to meet its decarbonisation commitments.

The increase in engineers, project managers, and field workers to deliver an increasing programme of capital works will also require a significant uplift in business support resources. This will cause an increase in operating costs on top of the growing capital budget.

6.1.1 Internal workforce

We have estimated the additional staff requirements using our knowledge of the historical relationship between staffing levels and our investment programme, alongside feedback from an independent expert on our modelling of the forecast workforce required. While confident in our plan, we are open to using uncertainty mechanisms in this area if the Commission is not confident of our ability to hire sufficient resource. This would provide us with access to funds while protecting our customers.

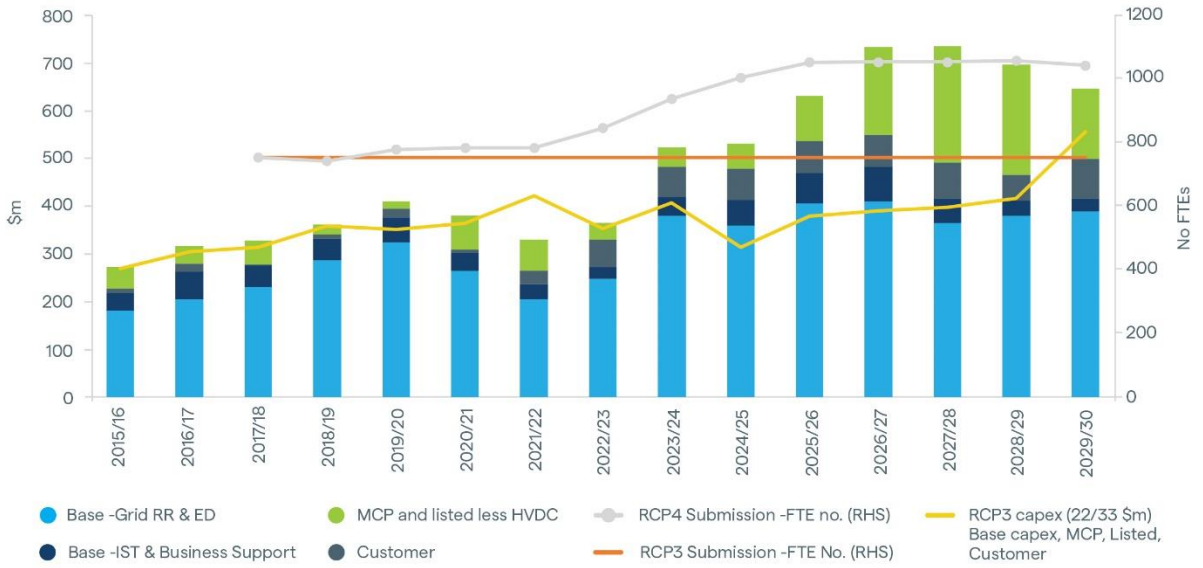
Transpower has established and hired a head of sector workforce development to drive the development of the initiatives and establish the governance and reporting approach.

The principal challenges with recruiting to enable us to deliver the necessary services are:

- promoting our employee value proposition in order to maintain a robust recruitment pipeline
- integrating new employees into the organisation
- developing the appropriate organisation design, practices, and processes to enable employees to be productive.

Figure 18 shows the projected workforce growth in terms of the full-time equivalents (FTEs), required to deliver our current and forecast work programme. In addition to the workforce growth, we account for attrition, which, based on turnover, is currently 10 per cent.

Figure 18: Indicative growth of FTE forecast to 2030 (excluding attrition)



We provide more detail on the staff we are adding into RCP3 and those we are forecasting we need for RCP4 and future RCPs in sections 8.5 and 8.6.

We forecast that we will add 92 FTEs to our 2023/24 baseline. Our annual turnover is forecast to be under 11 per cent. This means that we need to recruit approximately 190 roles during 2023/24. We have achieved hiring levels in line with this previously. As at the end of September 2023, we have recruited 38 staff against the planned 92 increase. An additional 41 staff have been recruited to replace staff turnover.

6.1.2 Current initiatives

We have undertaken initiatives to support workforce growth as part of the RCP3 work programme; these will support the RCP4 work programme. They include the following.

- A service providers panel reset in FY21/22, with a focus on the growth required to deliver the work programme for RCP3, RCP4, and beyond. A rolling 2-year work programme, People Plan, and a registration of interest process was included, enabling service providers to undertake workforce planning.
- An engineering consultant panel reset in FY21/22 included improving the sharing of longer-term work programme forecasts, working with consultants to optimise their workload (workload balancing), and assessing how consultants could assist in short-term capacity pinch points within Transpower.
- The summer internships and graduate programmes have been developed to extend programme numbers in each. The summer internship programme number was 23 in 2022/23 and scheduled to be up to 31 in 2023/24. The graduate programme has been redeveloped, and an intake of 15 graduates will be undertaken from 2023. This is a 2-year programme. In addition, 21 associate-level roles have been created across the business in the functions of project management, software application development, and regulatory economics. Progression pathways have also been defined for the practice areas of engineering, project management, application

development, and business analysis. These support the career progression of staff as well as succession.

- Addressing material/equipment supply challenges through standardising and rationalising equipment choice to simplify sourcing options. We also increased the pre-purchase of equipment and are investing in warehousing capacity to ensure that delivery timeframes will not delay work.
- Improving productivity through adopting a management operating system, better use of data and analytics for decision-making, and increasing ICT investment with digital switch management, digital substations, and real-time systems management (some of these initiatives will have more impact in RCP4).
- Investing in reconductoring equipment to improve project delivery.
- Investment in workforce planning as part of the business planning process, including the development of a transmission sector workforce plan to promote, attract, develop, and retain the sector workforce.

1.1.1 Planned initiatives

We are also proposing several additional initiatives to support the growth of resources to deliver the RCP4 programme, these include:

- increasing investment in the promotion of Transpower and the transmission sector as a place of employment and for a career
- improving productivity through the modern workplace initiative (ICT) programme to enhance digital workplace practices
- incentivising service providers to invest in increased numbers of trainees
- investigating and developing alternative approaches to service provider trainee supervision
- investing in the grid skills training centre to train a larger volume of service provider workers
- expanding the capacity of the heavy wiring panel.

Table 10 sets out the costs of our proposed initiatives in RCP4. These costs are captured in their relevant cost centres, which are described later in this proposal.

Table 10: Total cost of initiatives to increase our capacity (2022/23 $m)

Description	Outcome	RCP4 opex
Promote Transpower and the transmission sector	Increasing the funnel (pool of potential candidates) for potential employment in Transpower and the service providers. This is incremental to the baseline funding as it focuses on: • sourcing more candidates in a resource-constrained environment • attracting a more diverse range of candidates • attracting a broader range of skills • building awareness of Transpower's employment brand • reviewing our flexible working progress to enable retention of older workers (including alumni) This initiative starts in RCP3 with $1.2 million budgeted	1.5
Internship	We have expanded our internship programme, where we fund fees for interns in exchange for a 2-year commitment to work for Transpower (in our graduate programme or other entry-level roles) This initiative was piloted in RCP3 and will be further developed, with $0.4 million budgeted	1.5
International recruitment	To increase our workforce at the required rate, we will need to expand our offshore recruitment This initiative starts in RCP3, with $0.9 million budgeted	1.2
Accelerated onboarding	To adjust the hiring policy to enable the hiring of duplicate good candidates Recruitment costs and training costs for this initiative are already extrapolated with the increase in headcount and will be funded out of existing budget	0
Workforce planning	We will further invest in the Transpower workforce planning processes and implement initiatives as part of a transmission sector workforce plan, defining an integrated approach to attracting and developing the sector workforce (in partnership with our service providers). This will be funded out of existing budget	0

The growth in our resources will be challenging but achievable. Developing an integrated approach to the balancing of the work programme, workforce capacity, and budget will be a key enabler of deliverability.

While we have used a bottom-up and top-down approach to assess the efficient level of resources required to deliver on our RCP4 work programme, we have also applied a 0.5 percent per year opex productivity challenge. These productivity gains are also driven by our capital investments. For example, improvements in data analytics enables increased pace and improves the information set used in decision making.

6.2 External service providers

The growth in the work programme for RCP4 creates a challenge for our service providers. We have modelled the increase in the capacity required to deliver the work programme as a ~54 per cent increase in service provider revenue and associated uplift in workforce required to meet delivery demand of base, customer, and major capital projects work. To test the sensitivity of service provider capacity, we also modelled a potential high case based on 20 percent increase in the MCP work category and a 50 percent increase in the customer work category. Under this scenario, the growth in service provider revenue is 67 per cent, equivalent to 11 per cent per year. The purpose of these estimates is to determine the scale and phasing of the capacity uplift.

The key trades that require growth are line mechanics and power technicians. Our service providers are developing policies, processes, and initiatives to assist in lifting their workforce capacity. We are also proposing initiatives that will enable their workforce growth, including a contribution towards funding for our service providers' field workforce growth initiatives.

6.2.1 Engineering consultants and service provider workforce growth

Engineering consultants play an important role in the delivery of our work programme. We estimate the need for a 50 to 60 per cent growth in engineering consultants to undertake the RCP4 work programme. We recognised this requirement for growth when we reset our engineering consultant panel.

Similarly, the RCP4 work programme will require an increase in our service providers' field workforce. We identified shortfalls in line mechanics, protection technicians, and maintenance technicians. This capacity will be required to support our longer-term (15-year) investment plans.

Our modelling indicates that service provider revenue will need to grow (on average) by between 54 per cent (base scenario) and 67 per cent (high scenario) between RCP3 and RCP4. Table 11 outlines forecast workforce growth for our service providers. These figures are based on the growth (from FY22/23) required to meet the RCP4 work programme and are based on growth from FY23/24 through to the end of the RCP4 period.

Table 11: Resource growth for service providers forecast to 2030 (excludes attrition)

Category	Total growth (percent)	Total growth (number of people)	Months to 'ready to work'
Line mechanics	70 to 85 percent	~145 to 185	18
Power technicians	40 to 45 percent	~30 to 35	42
Substation maintainers	40 to 45 percent	~75 to 85	18
Tower painters	45 percent	~80	18
Maintenance switchers	To grow in line with other trades		18

At the same time as our service providers need to grow capacity, they will also be managing an ageing field workforce and increased attrition due to the attraction of working offshore. Their current attrition rate is approximately 7 percent per year. Our service providers are developing approaches and processes to assist in succession and attrition management, particularly for their field workforces. We continue to work with our service providers to assist them where we can.

It is difficult to quantitively assess the ability of service providers to grow in the current macro-economic environment with low unemployment levels. Service providers are currently able to maintain their delivery capacity through a mix of offshore recruitment and the training of new employees from Aotearoa New Zealand. Based on our experience of the growth in RCP2 and the initial period of RCP3, it is our expectation that substantial (greater than 5 per cent per year) growth will be challenging without a step change in approach.

6.2.2 How we will support the growth required

We consider that, without our planned interventions, our service providers will not be able to grow to meet the challenge of the RCP4 work programme. Table 12 outlines specific initiatives to enable service provider growth.

Table 12: Initiatives and total RCP4 costs forecast to enable service provider growth (2022/23 $m)[24]

Description	Purpose	RCP4 capex	RCP4 opex
Funding service provider uplift in capacity	The volume of work forecast in RCP4 will drive an increase in service provider capacity. A significant proportion of the uplift will be provided through an uplift in trainees We will work with the service providers to co-design a plan to enable this uplift. The forecast costs for this workstream are based on an estimate of the number of trainees This initiative starts in RCP3, with $5.6 million budgeted	-	14.6
Supervision capacity and productivity	There will be an increased proportion of trainees in the workforce, which will put pressure on the current trainee supervision model At the same time, offshore work opportunities are becoming more attractive to service provider supervisors. These factors create a challenge in retaining a workable trainee supervision model The purpose of this workstream is to co-design a workable model with our service provider partners to account for the increased supervision requirement and enable retention of key staff The costs in this workstream support an uplift in supervisor numbers and/or an uplift in the pay scale for a supervisor	-	3.2
Upgrade to grid skills training centre facilities to increase capacity	To facilitate the growth in trainee numbers, grid training will need to expand its capacity. A programme of work has been scoped to optimise the training footprint based on expected demand	9.2	-
Additional training costs	With the uplift in numbers of trainees and physical training capacity, the teaching capacity of grid skills will require an increase. The cost of the additional trainers is included in our workforce plan. However, there are also additional variable costs (e.g. course costs, travel, and accommodation for trainees) that will be incurred This initiative starts in RCP3, with $1.6 million budgeted	-	5.1

[24] Only RCP4 costs are included; in some instances there will be additional expenditure in RCP3.

Description	Purpose	RCP4 capex	RCP4 opex
Grow number of panel members	If the volume of large new line and reconductoring projects increases as forecast, it may be necessary to introduce a third panel member to the heavy wiring contestable works panel. We do not anticipate this resulting in a direct cost for Transpower	-	-
Offshore line mechanics	Work with service providers on large MCP-funded transmission lines projects to use an overseas workforce. This could be done in the Aotearoa New Zealand summer period, which coincides with lower productivity periods in places like the UK and Australia. Overseas crews could be flown in for a discrete (and short) period of time to complete large sections of lines and compress outages There are obvious cost/benefit implications of this approach	-	-

6.2.3 ICT delivery

We have conducted a similar deliverability assessment for our ICT projects and programmes. Transpower's information services and technology (IST) division has a service delivery framework that covers the entire lifecycle of a project, from pipeline to closeout/realisation. During RCP3, we spent more on ICT than the Commission had approved in order to deliver required ICT projects.

Looking forward, our deliverability assessment identified a need to increase the number of internal Transpower employees to support project delivery. This includes staffing that would ramp up and then ramp down for TransGO Refresh. This is set out in more detail in Section 8.3.3. We have profiled our overall ICT build to reflect what we consider is deliverable year-on-year (excluding TransGO Refresh).

6.3 Procurement

Our procurement and supply chain function is organised to support the delivery of best value procurement and supply chain management services as follows.

- **Procurement services**: provide and promote procurement expertise, governance, policy and process improvements, and effective systems and tools.
- **Category management**: perform end-to-end supply chain management and strategic sourcing in our major direct expenditure areas, including assets and equipment, technical services, ICT, and corporate indirect spend.

- **Strategic commercial management**: ensure our key outsourced grid support and maintenance services and project works contracts are commercially sound, we manage risk appropriately, and ensure the overall sustainability of Transpower's relationships with our grid service providers.
- **Inventory management and purchasing**: provide overall management of inventory levels, systems, and information as well as the inventory purchasing activity.
- **Logistics**: manage our warehousing and logistics, ensuring materials are stored appropriately and delivered nationwide in support of our grid project, fault restoration, and maintenance activities.

We actively manage procurement risks through our procurement rules, centre-led procurement model, dedicated category managers, and our continued education around appropriate commercial negotiation and contract management techniques with our people.

The events of the COVID-19 pandemic and its effects on global supply chains have necessitated closer management of the performance and sustainability of our key suppliers due to increased supply risk. During COVID-19, our resources were fully committed to ensuring continuity of supply in an environment of increasing pressure on manufacturers, supply shortages of raw materials and input components, and logistics challenges in the transporting of goods to Aotearoa New Zealand. We focused on ensuring the sustainability of key suppliers during this time. This included monitoring their health and aiding in their viability where it was deemed necessary, for example by supporting local suppliers with weekly payments until normal work practices were allowed.

Feedback from one of our small local suppliers was that the actions Transpower took during the pandemic to ensure their sustainability saved their business.

A continuing challenge is the international competition for materials and equipment required to decarbonise. This requires our procurement approach and team to be agile and flexible in our processes and commercial approaches.

There is increased emphasis on supplier relationship management to seek to gain a space in full manufacturing schedules. We are further enhancing our supplier relationships and management frameworks as we recognise from a global perspective that we are a small customer far away from most markets and that it is important we manage our supplier and partner relationships well to maximise the commercial arrangements under which we procure and the timely delivery of equipment and materials.

To further support this, we are modernising our digital procurement and supply chain systems to reduce risk, improve operational efficiency, and simplify supplier engagement by making it more efficient to interact with Transpower. These system improvements will increase delivery timeliness and success by improving the monitoring and mitigation of supply chain risks, enabling near real-time risk management, and improving collaboration with suppliers. To provide further resilience, warehouse capacity and inventory holdings are being increased to buffer for supply chain uncertainty.

Recognising the growing risks of increasing supply chain disruptions, we have recently undertaken a supply chain resilience review. The outputs include a roadmap to deliver supply chain resilience and other planned improvements over coming years.

6.4 Efficiencies

We have embedded efficiencies within our RCP4 plans. This means our opex and capex forecasts reflect the savings of past and future efficiencies. We are not seeking a generic innovation fund for unidentified or risky innovation projects. We have identified and quantified benefit-driven investments to ensure they deliver net benefits to consumers over the longer term.

For our RCP4 proposal, we have incorporated efficiency in four different ways.

- **Improving our end-to-end planning and delivery**: during RCP3 we completed a review of our end-to-end planning and delivery processes. The review focused on identifying efficiency gains and improvement opportunities, and the initiatives carried out to date have enabled us to streamline our planning and delivery process. We embed efficiency savings in our planning. For example, we have found substantial savings in our reconductoring work using new models.
- **Modern data practices and decision tools**: we identify areas where future investments in ICT will help us avoid costs, improve our outputs, reduce risk, and drive future efficiency savings. This will be seen particularly when using modern data practices and decision tools. A key focus for us is modernising our systems so customers and consumers benefit from digitalisation (e.g. fewer interruptions through remote switching, avoided costs through improved asset data and modelling, etc.).
- **Competitive procurement for services**: we use service providers to deliver our grid work and some of our ICT projects. The competitive procurement process, which includes a material amount of contestable work, delivers us the most efficient price for our work delivery, and this is reflected through adjustments in our expenditure forecasts. For grid work, we use a mix of contestable panels and regional service providers. We use the revealed prices of our regional service providers to benchmark prices on an ongoing basis.
- **Opex productivity challenge**: we have sought independent advice from the New Zealand Institute of Economic Research (NZIER) on what a productivity target would be for Transpower to achieve across our operating costs for RCP4. The advice we have received indicates a challenge target range for Transpower is between 0.3 per cent and 0.6 per cent per year. NZIER has recommended, and we have used, the mid-point of 0.5 per cent. This compounds each year. This target is based on StatsNZ productivity estimates for relevant industries. This challenges us to reduce costs across our asset management and operations and business support divisions.

It is important to note that StatsNZ labour productivity estimates reflect investments in ICT and other capital. This means the productivity estimates it produces were only achievable through those investments. In practice, this means we need to avoid double counting productivity gains from our strategic investments, embedded efficiency, and the opex productivity challenge.

7.0 Our services

This chapter sets out the key transmission lines services we provide to our customers, including grid reliability, grid availability, event communications, and grid access. The Commission incentivises and monitors our current and future performance using various arrangements.

This chapter sets out the key transmission lines services we provide to our customers. We measure these services in different ways. The measures help us and the Commission track our performance and ensure our expenditure is linked to services that our customers and end-consumers seek. They also ensure we balance our efforts to be cost effective by incentivising us to maintain service quality.

The key services are:

- **grid reliability (grid performance)**: keep interruptions to a very low level and restore supply quickly when there is an interruption
- **grid availability**: keep a high level of availability to minimise the impacts of system constraints for generators and consumers, so the lowest-cost generation can be offered into the market
- **event communications**: communicate with our customers when supply is interrupted so we can achieve the best outcomes for end-consumers
- **grid access**: work with customers to connect their assets to the grid and plan and deliver changes to their connections.

The Commission incentivises and monitors our current and future performance using various arrangements.

- **Quality standards**: some of our service measures have quality standards. If we breach these, the Commission will investigate why we have failed to meet them and may prosecute us.
- **Financial incentives**: some measures also have financial incentives, i.e. if we perform better than the target, we receive a financial reward; if we perform worse, we lose money. Ideally, the incentive strength should reflect the value to customers and consumers from improvements in the service levels.
- **Monitoring (no financial incentive)**: we have additional measures that the Commission monitors without being linked to quality standards or financial incentives. These can be trial measures or measures that provide useful performance information but are unsuited to financial incentives or quality standards.

Engagement with our customers, end-consumers, and wider stakeholders during 2022 and 2023 showed our customers are satisfied with the level of service we are currently providing.

The rest of this chapter is structured as follows.

- Section 7.1 provides an overview of our approach to reviewing and refreshing the service measures for RCP4.
- Section 7.2 provides an overview of our proposed grid performance measures for RCP4, including a summary of our proposed changes from RCP3 and feedback.
- Section 7.3 provides an overview of our proposed grid availability measures for RCP4, including a summary of our proposed changes from RCP3 and feedback.
- Section 7.4 provides an overview of our proposed asset health measures for RCP4, including a summary of our proposed changes from RCP3 and feedback.
- Section 7.5 provides an overview of our new proposed customer service measures for grid performance measures for RCP4, including a summary of feedback.

- Section 7.6 provides an overview of the measures we are proposing to discontinue for RCP4, including the reasons for discontinuing them.
- Section 7.7 provides an overview of our proposed revenue at risk, revenue incentives, and quality standards.

More information

Additional detail on our proposed service measures for RCP4, including targets, financial incentives, and quality standards, is provided in our Service Measures Report 2023.

7.1 Review and refresh for RCP4

Our proposed service measures for RCP4 are based on consultation and feedback, the Commission's regulatory requirements, and our experience with service measures during RCP2 and RCP3.

During 2022, we undertook a targeted review and refresh of the current service measures in preparation for RCP4. This refresh built on the substantial work and extensive engagement with our stakeholders we did in developing our RCP3 service measures.

We consider the majority of the RCP3 measures set by the Commission achieve their intent. We identified some that may not incentivise our performance in the way the Commission intended. We also identified areas where we are keen to test new (pilot) measures.

The refresh focused on measures with known issues or improvement opportunities while remaining open to wider feedback over two main rounds of engagement with our customers.[25]

We are proposing 10 service measures for RCP4, as set out in Table 13. Four are revenue linked and six are non-revenue linked.

[25] Grid Service Measures Engagement Paper, published in May 2022, and the second Grid Service Measures Engagement Paper, published in September 2022 as an annex to the main consultation document.

Table 13: Overview of RCP4 proposed service measures[26]

RCP4 code	Quality standard	Revenue linked	RCP4 performance measure
Measures of grid performance (grid reliability)			
GP1	Yes	Yes	Number of unplanned interruptions greater than 1 minute across six supply and generation point-of-service sub-categories during a disclosure year
GP2	Yes	Yes	Average duration of unplanned interruptions greater than 1 minute, across six supply and generation point-of-service sub-categories during a disclosure year
GP3	No	No	Energy (MWh) not served across 4 supply point-of-service sub-categories
Asset performance measures (grid availability)			
AP1	Yes	Yes	HVDC capacity availability (%) of the inter-island HVDC system using monopole and bipole outages
AP2	No	Yes	Average percentage of time selected high-voltage AC (HVAC) assets are available during a disclosure year
AP3	No	No	Return-to-service time: measures the extent to which Transpower meets planned return-to-service times for planned outages of selected HVAC assets that are returned to service 2 or more hours after Transpower's planned return-to-service time
AP4	No	No	Return-to-service time communications: measures the extent to which Transpower communicates delays to affected parties of planned outage return-to-service times of selected HVAC assets: • the percentage of outages that Transpower gives 1.5 hours or less notice to market (or industry) participants in the event assets are going to be returned to service later than the original planned return-to-service time • the extended return to service time

[26] Note, for the purposes of the capex input methodology determination 2012, we are only proposing GP1, GP2, AP1, AP2, and asset health as grid output measures.

RCP4 code	Quality standard	Revenue linked	RCP4 performance measure
Asset health measure			
AH	No	No	A measure of the percentage of assets that are defined as being in 'poor' health (an Asset Health Index score of 8 or more). There are sub-categories for seven asset classes, and some asset classes use a weighted criticality approach
Customer service measures			
CS1	No	No	A measure of overall customer satisfaction, based on a question in our annual customer survey (average percentage)
CS2	No	No	Reporting on how we are delivering new or enhanced grid connections across five sub-categories representing different elements of the connection process

7.2 Grid performance measures

Our three grid performance measures (GP1 to GP3) report unplanned interruptions. These aim to incentivise Transpower to provide a reliable transmission service by minimising interruption and restoring services quickly.

We report grid performance measures against various point-of-service sub-categories. The point-of-service categorisations are based on the level of security, whether it is a supply or generation point of service, and if the supply connection is of material or high economic consequence, as set out in Table 14. These sub-categories enable us to better target our performance to our customers' needs.

Table 14: Point-of-service categories for GP1, GP2, and GP3

Category	Sub-category	GP1	GP2	GP3
N-1 security[27]	High economic consequence	✓	✓	✓
	Material economic consequence	✓	✓	✓
	Generator	✓	✓	-
N-security	High economic consequence	✓	✓	✓
	Material economic consequence	✓	✓	✓
	Generator	✓	✓	-

7.2.1 GP1 and GP2 – unplanned interruptions

GP1 and GP2 measure the yearly number of unplanned interruptions (GP1) and the yearly average duration of unplanned interruptions greater than 1 minute (GP2). Both measures assess grid reliability and relate to our ability to provide a reliable uninterrupted transmission service to our customers.

Our customers have told us they are satisfied with the current level of reliability in the network. We have planned our RCP4 expenditure to maintain, at an organisational level, a similar risk level as we have for RCP3; this means our RCP4 GP1 and GP2 targets are similar to our RCP3 targets.

These measures and targets are largely the same as in RCP3, apart from minor updates to the point-of-service list to ensure it is current and to the point-of-service categorisation method. We are using forecast load, rather than historical load data, to update the allocation of points of service into the sub-categories due to the rapid pace of change within the electricity industry. Our stakeholders support this approach.

We also propose to retain the RCP3 approach for setting the quality standards for GP1 and GP2 in RCP4. It includes pooling across disclosure years and sub-categories, which are assessed against annual quality limits,[28] as outlined in our Service Measures Report 2023.

[27] N-security is where the system is such that a single fault event can lead to a service interruption. N-1 security is where the system is built such that a service interruption will only occur if there are concurrent outages.

[28] Referred to as 'point-of-service sub-category limits' in RCP3.

The verifier agreed with our proposals for GP1 and GP2. The verifier suggested we should consider setting targets that are not linked to historical averages as there is a risk of this method resulting in deteriorating targets over time. The verifier suggested that, when exploring quality standards for the future, we look at setting defined minimum performance levels acceptable to stakeholders. Given our customers have expressed their satisfaction with the current level of reliability in the network, we consider the settings appropriate for RCP4.

The rate of unplanned interruptions to transmission service continues to trend down over the long term. The 2022/23 year saw the fifth best performance in 25 years, with 59 unplanned interruptions (excluding Cyclone Gabrielle-related interruptions).[29] The long-term improvement in service performance is mostly due to fewer interruptions caused by equipment failures and human errors. Our asset management improvements in asset health, maintenance regimens, system enhancements, and risk mitigations during outages have contributed to this trend.

Figure 19 and Figure 20 show our historical performance for GP1 and GP2 since 1999 and our aggregated targets for the rest of RCP3 and RCP4 (forecast). The targets, caps, and collars are set at sub-categories.

[29] This excludes automatic under-frequency load shedding, customer-caused, and momentary interruptions.

Figure 19: Historical performance for GP1 and our forecast targets for RCP4

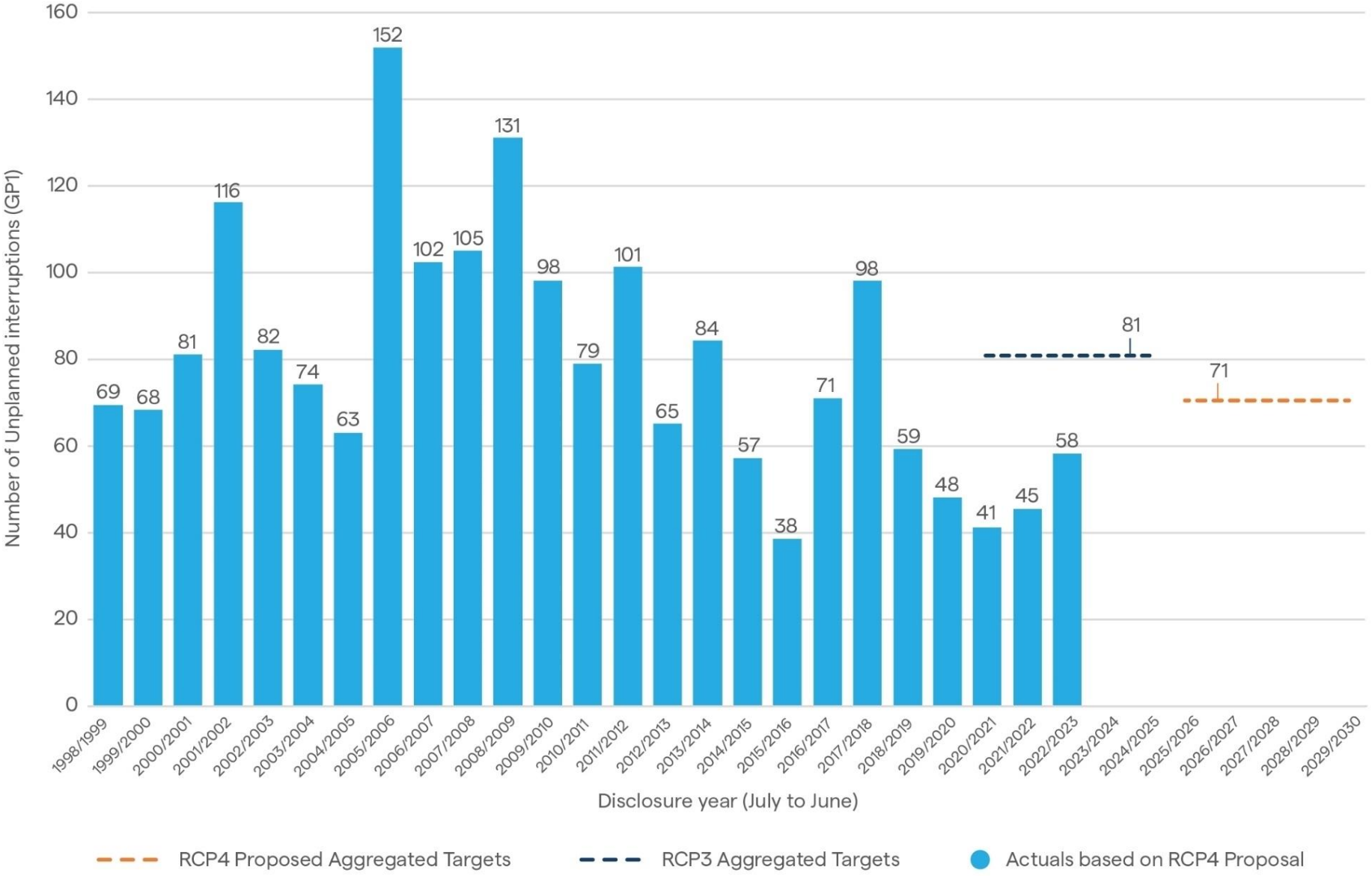
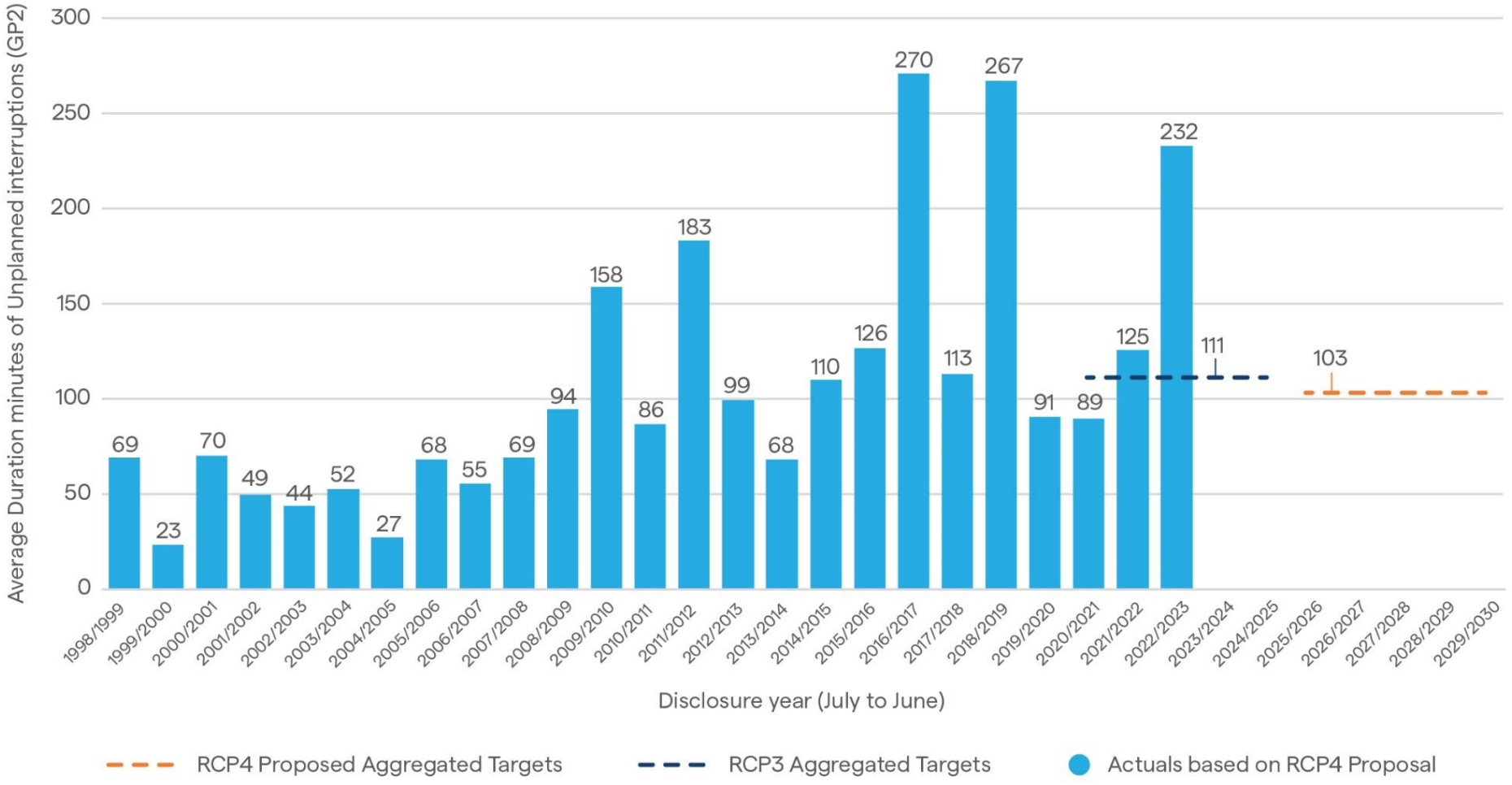


Figure 20: Historical performance for GP2 and our forecast targets for RCP4



7.2.2 GP3 – energy not served

In RCP4, we propose to introduce a new, non-revenue-linked, trial measure. GP3 will measure *energy not served*, which is the amount of energy demand that is not supplied due to a transmission interruption to supply.[30]

We consider this measure a good indication of the overall performance of the grid. It essentially provides a combined view of GP1 and GP2 measures and economic consequence. Our customers want us to avoid widespread transmission interruptions with a large impact.

We will report against four supply points-of-service categories as set out in Table 14 (above).

The verifier supported our proposal to introduce this measure.

As this is a new trial reporting-only measure for RCP4, and we do not currently model or predict this performance at an aggregate level, we have not forecast an outturn level of energy not served.

7.3 Grid availability measures

Our four proposed asset performance measures (AP1 to AP4) assess asset availability and aim to reduce the impact of transmission constraints from planned or unplanned outages on the electricity market. These measures relate to our ability to maintain availability, manage planned and unplanned outages, and communicate changes to customers.

7.3.1 AP1 – HVDC capacity availability

AP1 measures the HVDC capacity availability (percentage) of the inter-island HVDC system through monopole and bipole outages. Higher levels of availability increase the ability of generators to sell to a wide range of end-consumers in the electricity market and allow end-consumers to benefit from this competition. There are also reliability benefits of having the HVDC available when generation shortfalls exist on either island. Revenue and quality standards on AP1 incentivise us to minimise outages, and therefore unavailability, on HVDC pole 2 and pole 3. The planned outages are required to undertake work on HVDC pole 2 and pole 3 and reduce the risk of longer or more frequent unplanned outages. Our proposed RCP4 base capex and opex are intended to achieve the proposed level of AP1 HVDC capacity availability during RCP4.

We propose to:

- exclude the impact of associated outages from all major capex projects and listed projects involving HVDC pole 2 and pole 3; these projects can have significant outage requirements, and there is often uncertainty about scope and timing until they are approved
- exclude the impact of planned resilience work to harden HVDC towers against wind and flood damage; this work has significant outage requirements and uncertainty (similar to major capex projects and listed projects)

[30] We consulted on this measure as 'NR – network risk'.

- set targets for the measure based on our workplan using the method set out in our Service Measures Report 2023
- include a threshold limit to mitigate the impact of major unplanned outages to ensure that no single unplanned event can have a disproportionate impact on the overall performance against the measure in a year
- introduce annual quality limits that are pooled across several disclosure years for the quality standard, as outlined in our Service Measures Report 2023 (similar to settings for GP1 and GP2); using a pooled approach would mitigate the risks of false negatives from annual breaches.

Submitters supported excluding major capex projects and listed projects, provided industry stakeholders are specifically consulted on these projects and our annual outage plan process.

Most submitters did not provide feedback on our proposal to mitigate the impact of major unplanned outages by either introducing a threshold limit or by excluding all unplanned outages. However, two submitters and the verifier did not support this proposal.

The verifier supported the proposed related changes set out in the 2022 consultation.

Based on this feedback, we have included unplanned outages and increased the threshold limit to cap larger events with a disproportionate impact. We still consider there are merits to a threshold limit and disagree that this would negate the incentive to uphold HVDC capacity availability.

The resilience work was not consulted on during 2022. However, customers will have an opportunity to share their views on this approach during the Commission's consultation.

7.3.2 AP2 – HVAC selected assets availability

AP2 measures the average percentage of time selected HVAC assets are available. Like HVDC availability, increased availability of selected HVAC assets can improve market outcomes for generators and consumers.

The planned outages allow us to undertake work on the selected HVAC assets and reduce the risk of longer or more frequent unplanned outages. Our proposed RCP4 base capex and opex are intended to achieve the proposed level of AP2 selected asset HVDC capacity availability during RCP4. We propose to:

- limit the scope of planned outages included in this measure to unavailability caused by our maintenance and base replacement and refurbishment works that are funded from the RCP4 allowance (excluding listed projects)
- exclude unavailability caused by certain work types (major capex projects, listed projects, base capex enhancement and development projects, and customer-funded work) where scope and timing:
    - are subject to greater uncertainty
    - are largely driven by factors beyond our control due to dependencies on external factors
    - involve additional customer engagement
- include a threshold limit to mitigate the impact of major unplanned outages, to ensure that no single unplanned event can have a disproportionate impact on the overall performance against the measure in a year

- update the list of selected HVAC assets based on our latest system security forecast[31] and upcoming enhancement and development work to ensure that the list appropriately reflects anticipated constraints on the electricity market during RCP4.

Significantly, we propose to remove the quality standard. The measure would remain revenue linked. Key considerations supporting removal of the quality standard include:

- increasing workload and electrification may see more outages on the selected HVAC assets and more variability in future outage plans
- outage planning and regulatory outage protocols are already in place to minimise market constraints (AP2 is a proxy for impact on the electricity market, and most outages on these assets are planned for times that do not lead to market constraints)
- managing a quality standard may lead to perverse outcomes, e.g. we may be incentivised not to undertake customer work to avoid breaching the quality standard
- managing a quality standard has increased the regulatory burden for both the Commission and Transpower.

If the Commission wishes to retain the quality standard for AP2, we have outlined an alternative in our Service Measures Report 2023. This includes introducing annual quality limits that are pooled across several disclosure years.

There was support from submitters for excluding major capex projects and listed projects, provided we continue to seek engagement from industry stakeholders on these projects and our annual outage plan process. There were no objections to excluding enhancement and development projects and customer-funded work.

The submitters did not support:

- the use of the system security forecast
- mitigating the impact of major unplanned outages, either by excluding unplanned outages or by introducing a threshold limit.

Based on this feedback, we have chosen to include all unplanned outages and introduce a threshold limit to cap larger events. We still consider there are merits to a threshold limit and disagree that this would negate the incentive to uphold the HVAC selected asset availability. We also consider the system security forecast provides strong relevance to updating the list of selected HVAC assets.

The verifier supported all our proposed changes to this measure, except for the removal of the quality standard. Removal of the quality standard was not consulted on during 2022. However, customers will have an opportunity to share their views on this approach during the Commission's consultation.

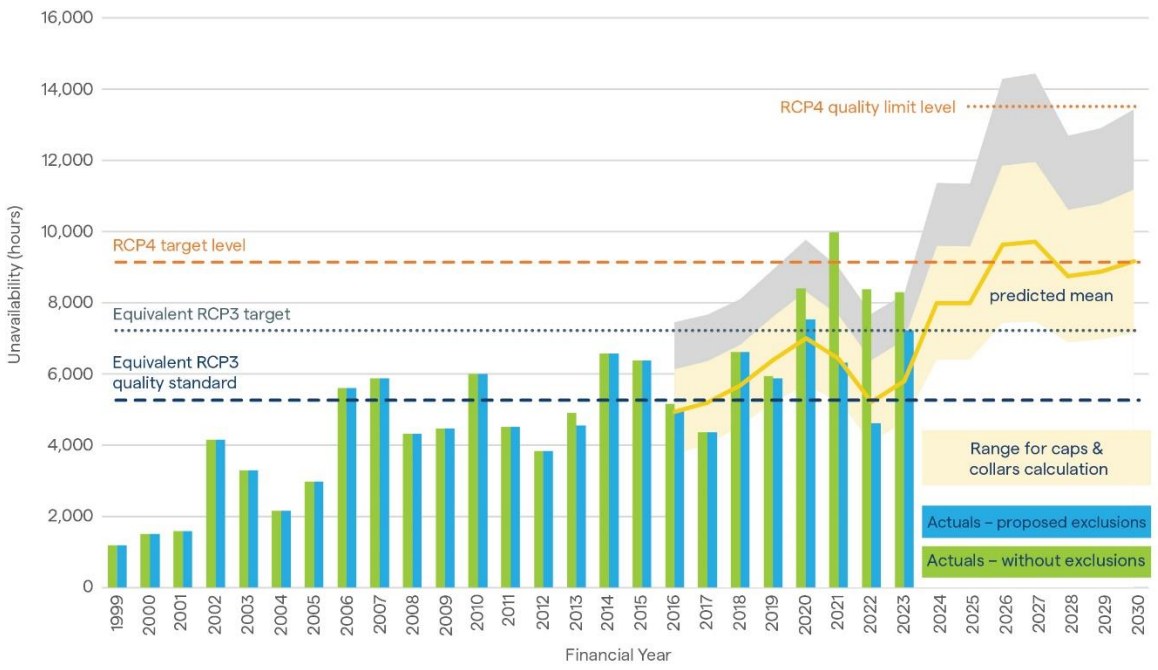
Figure 21 shows our historical performance for RCP3 between 1999 and 2023. It illustrates our modelling to develop and propose targets, caps, and collars (and quality standard, if retained) that reflect the forward workplan.

The thick yellow line shows the mean model prediction used to develop the target. The yellow shaded area shows the range used to develop the caps and collars. The grey shaded area shows the

31 System Security Forecast and related documents

range used to develop a possible quality limit. These forecasts exclude major, listed, customer, and base capex enhancement and development projects.

Figure 21: AP2 historical and planned unavailability (hours) – RCP4 selected assets



7.3.3 AP3 and AP4 – planned outages return to service

AP3 measures the number of planned outages of selected HVAC assets returned to service 2 or more hours after the original planned return-to-service time. AP3 assists our customers by improving certainty around the return to service of certain transmission assets (delays on returning these assets to service can affect the electricity market).

AP4 measures the number of outages where a delay to the planned, or extended, return-to-service time was communicated with 90 minutes or less notice, against the total number of planned outages. AP4 helps market (or industry) participants by requiring us to provide timely communication about delays to those assets being returned to service.

Both measures are for reporting only. We are not proposing any changes to these measures. Both the submitters and the verifier supported the retention of these measures.

7.4 Asset health

Asset health is a key part of our asset management planning. Asset health indicates the health of selected assets throughout a regulatory control period. Our approach to asset health and network risk is discussed in more detail in Chapter 8.0 and our Asset Management Plan 2023. The Asset Management Plan 2023 provides a forecast of the asset health profile for selected asset classes with and without investment during RCP4.

We propose to:

- expand the reporting of asset classes from two to seven – including tower protective coatings, tower grillage foundations, insulators, conductors, and protection relays, as well as the existing asset classes of power transformers and outdoor circuit breakers. All these asset classes have a material impact on the reliability of the grid, and we have improved the capability of our asset health modelling for these assets
- combine the asset classes into one overall asset health measure with sub-categories
- weight the measure by criticality where suitable for the asset class (this change is based on feedback from our stakeholders). Criticality weighting can reflect risk-based strategies, e.g. we may have a different appetite for the number of assets in poor health where their criticality is low compared with where criticality is high

The key change we propose is to remove the quality standards that apply to asset health. The key considerations supporting this change include:

- asset health is a leading indicator for reliability, and reliability is already captured under the quality standards for GP1 and GP2
- we will release our RCP5 proposal in the middle of RCP4, providing a timely opportunity for the Commission to review our asset health performance and practices
- similar to AP2, performance against our asset health measure may also be impacted by prioritisation or phasing of replacement and refurbishment work, customer-funded work, and enhancement and development work during RCP4

If the Commission wishes to retain the quality standard for asset health, we have outlined an alternative in our Service Measures Report 2023. This includes annual quality limits that are pooled across several disclosure years and multiple sub-categories.

The verifier supported the proposed asset health measure, other than the removal of the quality standard. For the reasons set out above, we still propose to remove the quality standard.

This approach is different to the details we consulted on with customers and wider stakeholders during 2022. However, customers will have an opportunity to share their views on this approach during the Commission's consultation.

7.5 CS1 and CS2 – new customer service measures

We are experiencing large year-on-year increases in the number of enquiries for connecting renewable generation projects to the grid, particularly solar generation, and new or upgraded demand connections. To support our customers, and ensure they are aware of the scale of new connection enquiries and their locations, we have created additional guidance material on the connection process and launched a web dashboard. The latter provides location-based information on the type and volume of connection enquiries we receive.

We are proposing two new, non-revenue-linked, trial measures to provide our customers and the Commission with better information on our customer service. These measures focus on continually

improving the experience of our customers (CS1) and new and enhanced connections to the grid (CS2).

- CS1 will measure the average level of overall customer satisfaction (percentage) based on responses to a direct question in our annual customer engagement survey.
- CS2 will be broken down into five reporting sub-categories, with the aim of using reputation to incentivise:
    - fair allocation of resource to customer-driven projects that add energy demand and energy supply capacity
    - continual improvement of our connection process.

Submitters supported the introduction of more measures related to customer service. Based on feedback from our initial engagement, we added CS2 as a trial measure.

Submitters also expressed a desire for more information. We address this desire beyond these service measures, e.g. by engaging with our customers throughout the year as appropriate and conducting post-interruption surveys with customers after significant unplanned interruptions. From 2023 onwards, we will provide a more granular breakdown of summary results from the annual customer engagement survey in our annual individual customer engagement plans.

The verifier supported the CS1 and CS2 customer service measures we propose. They noted that, while customer satisfaction and measuring service related to delivery of new and enhanced connections are not traditional measures of network performance, they are, in their opinion, important indicators of whether Transpower is performing well as an organisation.

7.6 Discontinued measures

We are proposing to discontinue:

- asset performance measure AP5 (N-security reporting), as we consider this measure provides neither a leading indicator of grid deterioration nor assistance in mitigating risks associated with an outage
- grid performance measure GP-M (momentary interruptions reporting), as we do not consider this measure provides a useful indication of our service performance at an aggregate level.

7.6.1 AP5 – N-security reporting

AP5 measures the extent to which Transpower has placed customers on a reduced level of supply security due to an outage; referred to as N-security.

The AP5 service measure is a non-incentivised measure for RCP3. It was introduced by the Commission in RCP2 as it considered that time on N-security could be a leading indicator of deterioration of the grid. The Commission also noted the potential for significant impact on customers if they are placed on N-security without adequate warning.

Key considerations supporting removal of AP5 are:

- it records historic information and does not assist our customers in mitigating risks associated with an outage
- better outage information is provided to our customers. We consider our outage notification protocols ensure our customers receive sufficient warning when their security is reduced to N-security, allowing them to assess and understand the level of risk. We also provide an annual outage plan, a planned loss of supply and N-security outage report, up-to-date outage information (shared as part of the planned outage coordination process), and notifications of planned outages that are not in the annual outage plan
- our customers have told us that our reporting of AP5 does not provide valuable information for them
- this information does not drive or support internal Transpower business decisions and can be limited or misleading
- it is time-consuming for us to compile, which would be reasonable if the value to our customers outweighed this burden, but we consider it does not
- all submitters support discontinuation of AP5.

On balance, the verifier supports discontinuing this measure.

7.6.2 GP-M – momentary interruptions reporting

GP-M measures the yearly number of momentary unplanned interruptions, with a duration of less than 1 minute.

Momentary interruptions are brief disruptions to service that are due to temporary faults in the system, such as those caused by lightning strikes. They are not included in GP1 and GP2 and, for most customers and end-consumers, have a low overall impact.

An increase in the number of momentary interruptions does not necessarily indicate a poor, or deteriorating, level of service. In fact, an increase can indicate an improvement in performance.

Submitters supported our proposal, stating that they do not use the GP-M reports but could see the benefit of specific data being available in their annual individual engagement plan. In RCP4, we intend to provide information relating to momentary interruptions in those plans. The verifier supported our proposal to discontinue this measure and include specific data in annual engagement plans.

7.7 Proposed revenue at risk, revenue incentive, and quality standard settings

We have developed incentive settings to align with regulatory requirements and the service performance and asset health targets included in our consultations.

7.7.1 Revenue at risk

Our total revenue at risk under the four revenue-linked measures proposed for RCP4 is 1.4 per cent of our total forecast revenue, or $90 million. This percentage is the same as the Commission set for RCP3.

We consulted on 1.4 per cent, and no alternative amounts were proposed.

7.7.2 Revenue incentives and quality standards

Table 15 shows a summary of the targets, caps, collars, incentive rates, revenue at risk, quality limits, and quality standards for the relevant RCP4 service measures. We carefully considered the mix of measures that are revenue linked and those with a quality standard. We consider our proposal for revenue-linked service measures appropriately targets those which are the priorities for customers and consumers. Similarly, our proposal for service measures with quality standards align with services where customers and consumers expect minimum standards to be met while balancing the risk of false-negative compliance breaches.

We are proposing to apply 'pooling' for all quality standards, similar to the design of GP1 and GP2 for RCP3. Pooling takes the performance over a group of sub-categories and considers the performance over several years. Using a pooled approach recognises that a quality standard should be looking for a clear trend of poor performance across reporting sub-categories and years and can help to manage volatility associated with these measures. Pooling is specific to each measure and is described further in our Service Measures Report 2023.

As mentioned above, our preference is to remove the quality standards for AP2 and asset health for RCP4. However, we have prepared alternative quality limits and standards for these measures, which are set out in our Service Measures Report 2023.

Table 15: Incentive and quality standard summary

Measure and sub-category	Point-of-service/ asset count	Cap	Target	Collar	Incentive rate	$ at risk	Quality limit	Quality standard
GP1: Number of unplanned interruptions					**$ per event**			
N-1 security high economic consequence	37	0	5	10	725,003	3,625,017	10	Pooling
N-1 security material economic consequence	105	5	24	43	157,717	2,996,627	43	
N-security high economic consequence	9	0	2	4	170,394	340,789	4	
N-security material economic consequence	26	6	22	38	53,241	851,862	38	
N-1 security generator	41	5	10	15	50,000	250,000	15	
N-security generator	10	7	12	17	50,000	250,000	17	
GP2: Average duration of unplanned interruptions (mins)					**$ per min**			
N-1 security high economic consequence	37	23	73	123	72,500	3,625,017	123	Pooling
N-1 security material economic consequence	105	27	74	121	63,758	2,996,627	121	
N-security high economic consequence	9	15	66	117	6,682	340,789	117	
N-security material economic consequence	26	0	104	208	8,191	851,862	208	
N-1 security generator	41	30	225	420	1,282	250,000	420	
N-security generator	10	0	123	246	2,033	250,000	246	

Measure and sub-category	Point-of-service/ asset count	Cap	Target	Collar	Incentive rate	$ at risk	Quality limit	Quality standard
AP1: HVDC capacity availability (%)					**$ per 1%**			
AP1: HVDC capacity availability (%), excl. project allowances	-	99.00	98.00	97.00	500,000	500,000	96.00	Pooling
Project allowances: Project K – pole 2 refurbishment project Combined thyristor control unit and HMI software upgrade HVDC cable maintenance	-						-	-
AP2: HVAC availability (%)					**$ per 1%**			
Option 1 (preferred): AP2: HVAC availability (%) – no quality standard	62	98.63	98.25	97.87	2,658,537	1,000,000	None	None
Option 2: AP2: HVAC availability (%) – with quality standard	62	98.63	98.25	97.87	2,658,537	1,000,000	97.45	Pooling
AH: Asset health (see our Service Measures Report 2023)	-	-	-	-	**N/A**			**None**

8.0 Reliable and safe network

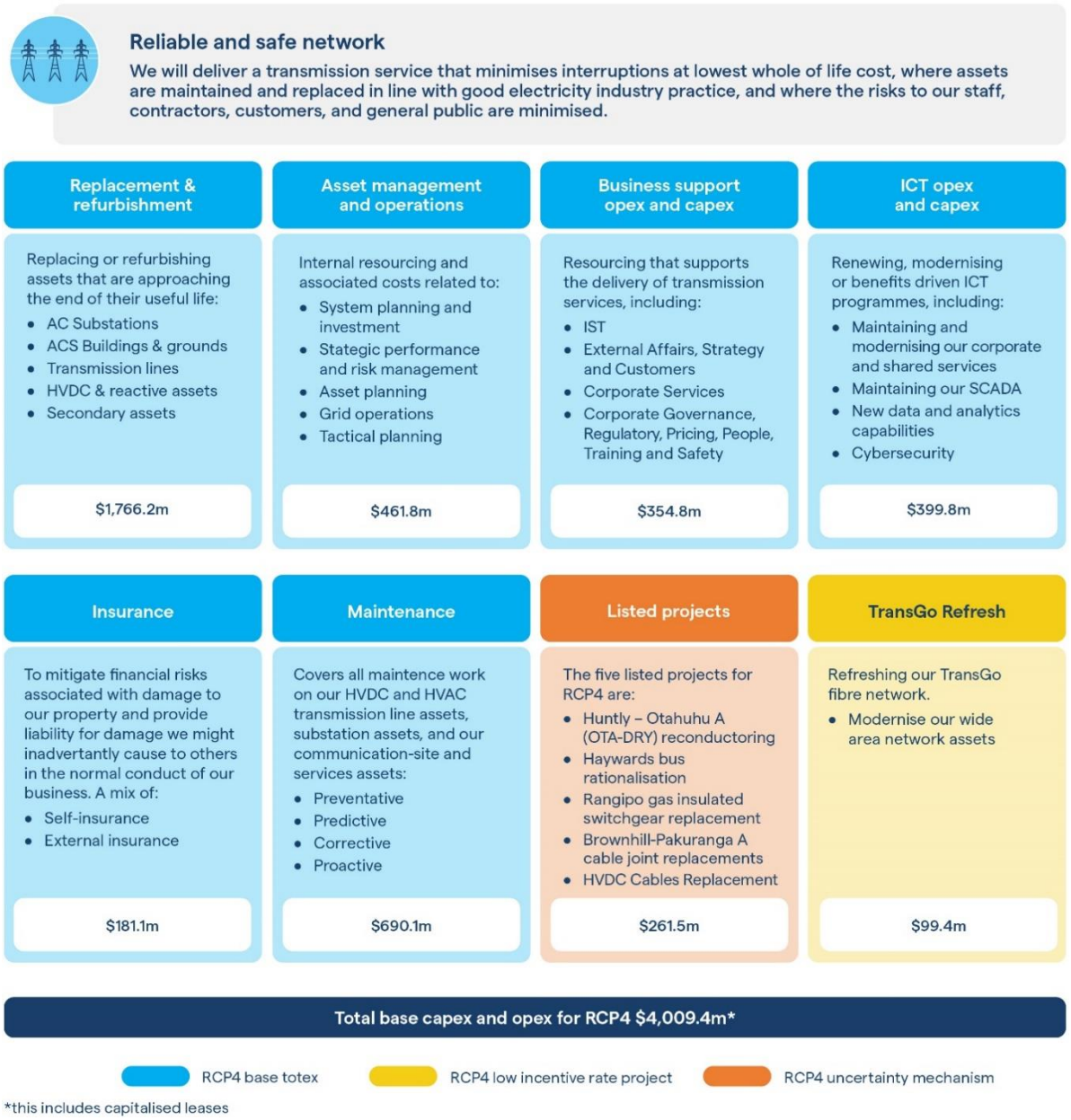
We manage our assets to ensure our network is resilient and safe and provides the level of reliable service our customers expect.

Our expenditure on the grid is about ensuring we maintain the service levels our customers want and need. Our customers have supported the continuation of this level of performance. Our base capex and opex forecast on reliable and safe network outputs for RCP4 is $4,007.2 million; this is an increase of 25 per cent over RCP3.

More information

In the sections below, we set out our expenditure areas by major delivery portfolio and activity. Additional detail on how we have developed our plans for these areas is provided in our Asset Management Plan 2023.

Figure 22: Delivering a reliable and safe network



While we have different categories of expenditure to deliver a reliable and safe network, these all interact, for example, when we make capex/ opex trade-offs between replacement or maintenance. ICT expenditure is not separable from our long-term asset planning as it is fundamental to delivering and improving our services and/or achieving efficiency gains. Without our asset management and operations and business support functions, we would not be able to plan, deliver, or finance the work on our assets.

Even with the increase in replacement volumes from RCP3 to RCP4, we expect the average age of several of our asset classes to increase during RCP4, which will require additional maintenance to defer capital replacement.

We are increasing our proposed maintenance spend alongside our increasing capex programme. While this may seem counterintuitive, some of this is due to trade-offs (i.e. our capex would be even higher if we do not increase our opex) but also reflects increasing costs of maintenance work and the increasing volume of assets we need to maintain as new assets still require routine maintenance work.

Our planning links our overarching Transmission Tomorrow strategy to the outcomes and services we need to deliver for customers and end-consumers. We use our asset and ICT strategies to guide our planned expenditure. Our planning processes allow us to deliver efficiency improvements and, where possible, explore transmission alternatives.

Our expenditure on the reliability and safety of the grid is not substantially affected by demand and generation forecasts. This is largely captured in our customer work and/or major capital projects. When assets need replacement or renewal, we engage with our customers and take their needs and usage forecasts into account and ensure they are given the chance to make price-quality choices where appropriate.

The rest of this chapter is structured as follows.

- Section 8.1 provides an overview of our grid asset management approach.
- Section 8.2 provides an overview of our replacement and refurbishment activities.
- Section 8.3 provides an overview of our ICT spend.
- Section 8.4 provides an overview of our maintenance activities.
- Section 8.5 provides an overview of our asset management and operations division.
- Section 8.6 provides an overview of our business support division.
- Section 8.7 provides an overview of our insurance forecasts.

8.1 Our grid asset management approach

To deliver the safe and reliable transmission service our customers expect, we use our grid asset management system. This ensures line of sight from our strategy, Transmission Tomorrow, through to how we plan, design, build, operate, and maintain the grid assets that deliver these services.

The operation and maintenance of the grid provides a significant contribution to the reliability and safety of our services, as does the way in which we deliver new assets and look after our existing ones. Reinvestment into the grid to manage the risk of condition-based or age-related asset

failures is essential. We rely on our customer engagement strategy (see Section 5.1) for feedback on our planning and service levels.

Our asset planning decision framework provides a consistent, repeatable, risk-based approach for planning decisions. The principles apply to all grid capital and relevant grid operating expenditure. The decision framework uses key inputs to identify investment needs. The option analysis for investment needs is guided by the asset class strategy on the timing and type of intervention. The decision framework allows us to make decisions that balance cost, risk, and performance for our customers.[32] Section 4 of our Asset Management Plan 2023 sets out our decision framework in detail.

8.1.1 Asset health

For most of our assets, we identify investment needs using our asset health models. An asset health index is an indicator that represents an asset's proximity to the end of its useful life. This index, along with an assessment of an asset's criticality, may trigger an intervention such as a replacement or a refurbishment to extend life.

During the planning process, we actively seek alignment of work across refurbishment and replacement, resilience, enhancement and development, customer-driven projects, and sustainability and environmental needs. We do this to achieve prudent and efficient outputs and to ensure the best outcomes at each site or customer connection.

The volumes of work and associated costs in this document are what is required, based on our underlying asset strategies, to deliver against our proposed service measures. We have worked throughout the submission and independent verification process to challenge our strategies, volumes of work, and costs across all areas of our expenditure.

During RCP3, we have developed a further nine asset health models to increase coverage across asset classes and have also recalibrated 10 existing models. Many of these models use international leading practice. They are key to understanding our long-term risk profiles and how we can balance cost and risk.

A dedicated team drives improvement plans in our asset health and criticality modelling. The ongoing calibration and model refinement uses several techniques:

- observed failure rates for different types/models
- analysis that rewards high-performing asset types/models
- modelling components to identify refurbishment options
- degradation analytics to improve forecasted health

[32] We do not target a specific number of interruptions or length of outage, rather we use the data we have on asset performance to set strategies that should deliver the risk profile that aligns with the service level targets.

- data quality improvements and automations
- hind casting to test prediction accuracy.

Continual refinement and updating of these models with current data ensures that we can refine our long-term view of risk and investments for 15 years and beyond, as well as our short-term needs when asset condition or reliability can change unexpectedly.

8.1.2 ICT

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. Spend on ICT encompasses both capex and opex and is found in Section 8.3 of this chapter.

8.1.3 Deliverability

Our proposals for deliverability are in Chapter 6.0. We have adjusted our work programme for work phasing to ensure the efficient allocation of resources.

8.2 Replacement and refurbishment

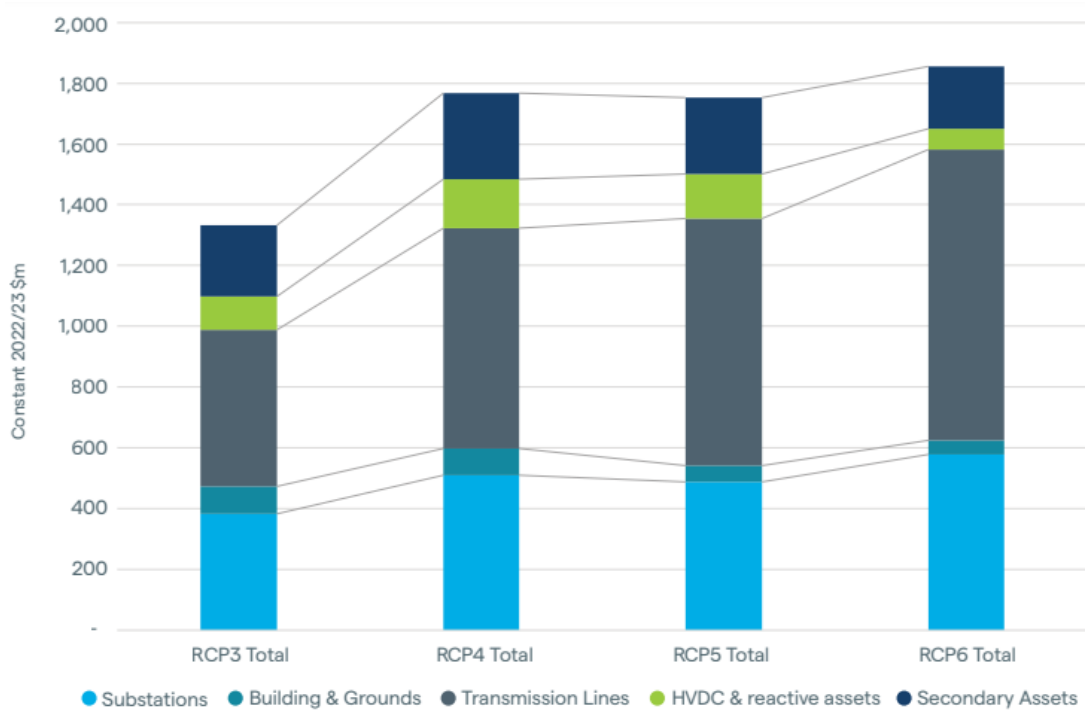
Replacement and refurbishment capex is our largest single expenditure category. It covers all replacement and refurbishment expenditure on grid assets (excluding ICT). We split replacement and refurbishment expenditure into the following asset categories.

- Section 8.2.1 examines our AC substations expenditure.
- Section 8.2.2 looks at our plans for our buildings and grounds.
- Section 8.2.3 details the planning for transmission lines.
- Section 8.2.4 contains information about our HVDC and reactive assets spend.
- Section 8.2.5 goes through the plans for our secondary assets.

Our proposed RCP4 base replacement and refurbishment capex of $1,766.2 million is 33 per cent higher than RCP3. The primary driver for the increase is a growing proportion of our assets that, despite being well maintained, require replacement based on their asset health and risk profiles. Most of our assets were built in the 1950–70 period. The results of our condition assessments and modelling of asset health and risk mean we need to increase our investments to maintain the level of service we provide to customers and consumers.

When considering replacement or renewals, we also consider our customers' views and the drivers for investment such as condition, electrification, and resilience to optimise intervention timing and maximise network availability. Overall, there is an increase in expenditure in RCP4, 5, and 6 compared with RCP3. This is shown in Figure 23.

Figure 23: Renewals expenditure (forecast)



We present an overview of each of these asset categories below. Resilience expenditure is excluded from renewal expenditure. Resilience expenditure is covered in Chapter 9.0.

8.2.1 AC substations

Our AC substations category comprises all the primary assets within the substation boundary. They:

- enable safe operation of the grid
- transform transmission voltages
- are the points of connection to transmission lines, generating stations, lines companies, and direct connect users.

The primary asset classes within AC substations are:

- **power transformers**: this asset grouping encompasses power transformers operating at system voltages of 11 kV and above, as well as supply and interconnector transformers in the main AC transmission network and the small auxiliary earthing and local service transformers
- **indoor switchgear**: an integrated assembly of circuit breakers, instrument transformers, and busbars that provide switching and control functions for the grid
- **outdoor switchgear**: this portfolio consists of outdoor circuit breakers, outdoor instrument transformers, and outdoor disconnectors and earth switches; for avoidance of doubt, all outdoor switchgear in HVDC converter stations, or associated with synchronous condenser and dynamic reactive power, are excluded from this asset portfolio
- **structures and buswork**: these assets provide critical connections within substations as they support, transport, or protect electricity flow between individual components inside an outdoor substation

- **power cables**: high-voltage (HV) cables provide transmission services in urban areas where the use of overhead lines is not practicable for a range of reasons; our HV power cables have operating voltages from 66 kV to 220 kV (this excludes our HVDC submarine cables)
- **other AC substation equipment**: these assets are essential for supporting the operation of primary assets, maintaining reliability of supply to customers, and ensuring public and site safety. This asset class portfolio consists of a diverse range of assets that do not warrant an individual asset class or fit naturally within any of the existing asset class portfolios
- **outdoor 33kV switchyards**: provide an interface point between our HV transmission network and medium-voltage distribution customers. All our outdoor 33 kV switchyards were constructed before 1985. 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.

More information

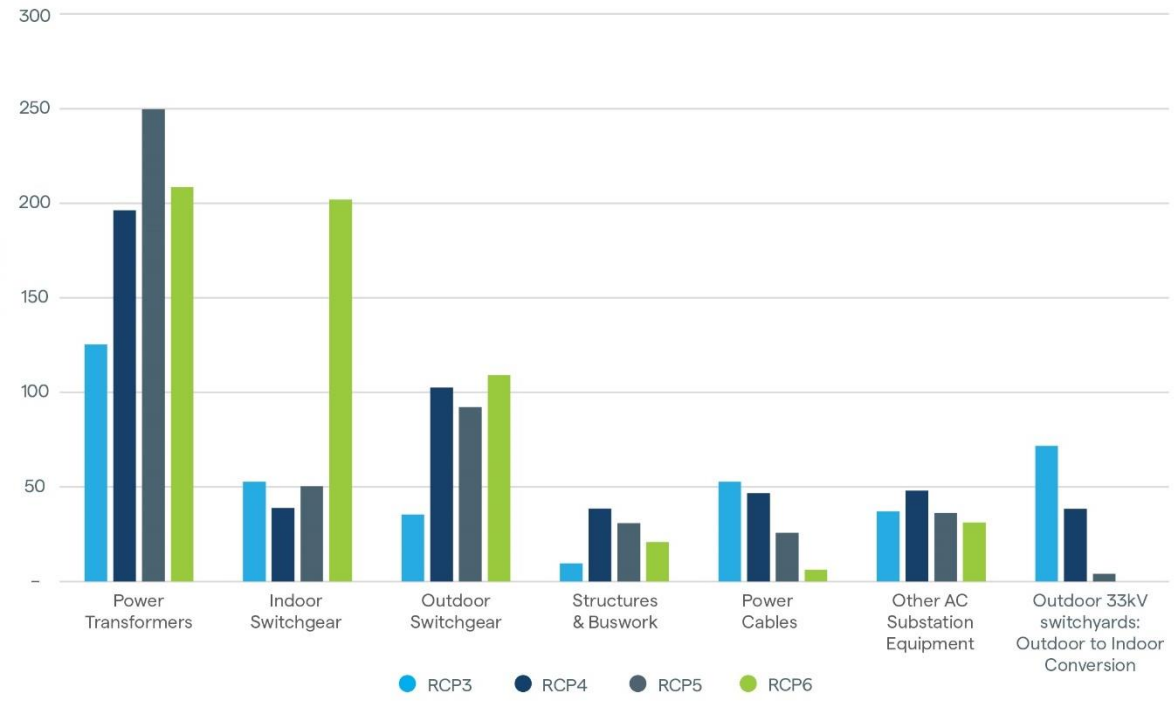
Please refer to Section 4.1 of our Asset Management Plan 2023.

Key drivers for the changes in our RCP4 substation compared with our RCP3 expenditure are as follows.

- Our risk analysis has indicated that we need to replace additional power transformers compared with RCP3 (replacing 22 in RCP4 compared with 14 in RCP3).
- Increase in replacement volumes of outdoor switchgear based on asset health following significant life-extension benefits realised in RCP2 and RCP3.

Figure 24 shows our longer-term expenditure trends from RCP3 to RCP6. We are forecasting our expenditure on AC substations to continue to grow from RCP3 through to RCP6. This reflects the long-term need to renew our ageing assets.

Figure 24: Comparison of substations forecast expenditure over RCPs (2022/23 $m)



In Table 16, we set out an overview of the intended outputs from our proposed RCP4 expenditure, the activities we will undertake, and the measure we will use to track the effectiveness of our spend. This excludes any listed projects (these are discussed in Section 8.2.6).

Table 16: Substations overview

Output	Activity	Measure	RCP4 capex (2022/23 $m)
Power transformers With investment, at the end of RCP4, 20.3 per cent of transformers assets will be in fair condition, 8.7 per cent in poor condition, and 3.9 per cent in very poor condition Without investment, 21.9 per cent will be in fair condition, 12.3 per cent in poor condition, and 5.8 per cent in very poor condition	Replace or install approximately: 20 power transformers 33 bushings	Unplanned outage rate Winding failure rate	196.2

Output	Activity	Measure	RCP4 capex (2022/23 $m)
Indoor switchgear We aim to reduce or maintain risk by prioritising replacements using a criticality ranking and understanding the consequences for severe failure across sites	Our approach of identifying and managing operational defects achieves the maximum possible life from the existing installations We will replace approximately four switchboards	66 kV–220 kV: No more than one unplanned outage per year of any indoor circuit breaker (excluding protection, supervisory control and data acquisition [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 Sulphur hexafluoride (SF_6) emissions from all indoor switchgear remain less than 0.3 per cent of their total nameplate quantity per year	38.8

Output	Activity	Measure	RCP4 capex (2022/23 $m)
Outdoor switchgear: outdoor circuit breakers With investment, by the end of RCP4, 4.2 per cent of our outdoor circuit breakers will be in fair condition, 1.7 per cent in poor condition, and 1.5 per cent in very poor condition Without investment, we predict 8.6 per cent will be in fair condition, 3.2 per cent in poor condition, and 2.4 per cent in very poor condition Approximately 90 per cent of our outdoor circuit breakers use SF_6 interrupters	We start to see increased asset replacements occurring during RCP4, along with the replacement of the remaining bulk oil circuit breakers; however, this is curtailed slightly by the implementation of our SF_6 strategy We will replace approximately 101 outdoor circuit breakers We will be undertaking proactive circuit breaker pole replacements in lieu of asset replacements 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	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	42.0
Outdoor switchgear: instrument transformers With investment, by the end of RCP4, 6 per cent of our outdoor circuit breakers will be in fair condition, 1.9 per cent in poor condition, and 3.7 per cent in very poor condition Without investment, we predict 10.3 per cent will be in fair condition, 3.8 per cent in poor condition, and 5.1 per cent in very poor condition	The early retirement of assets with known issues will commence at the start of RCP4 We will replace 173 current transformers, 49 voltage transformers, 14 capacitor voltage transformers, and 5 neutral current transformers	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 (no more than approximately one such failure every 2 years)	34.3

Output	Activity	Measure	RCP4 capex (2022/23 $m)
Outdoor switchgear: disconnectors and earth switches We aim to reduce or maintain risk by prioritising replacements using a criticality ranking and understanding the consequences for severe failure across sites Investment in disconnector headgear life-extension restorations will see all equipment restored to as-new condition over the next 15 years The remote switching capability investment is required to prepare for our RCP5 proposal	We will replace: 66 disconnectors and earth switches 325 disconnector headgear units	Fewer than 10 unplanned outages per year caused by outdoor disconnectors or earth switches at lowest whole-of-life cost	26.3
Power cables Replace based on risk assessment, taking into account the consequences of failure	Along with other power cable replacement and refurbishment activities, we will replace: 18 cable joints 48 terminations	Fewer than two unplanned outages per year caused by defects or failures of HV power cables (66 kV and above) or supporting infrastructure Fewer than three unplanned outages per year for MV power cables (below 66 kV)	46.7
Structures and buswork Replacement or refurbishment of assets in poor or very poor condition Using drone-based inspection to target the highest priority assets	Condition-based investments in line with strategy	Fewer than five unplanned outages per year arising from defects or failures of structures and buswork assets	38.5

Output	Activity	Measure	RCP4 capex (2022/23 $m)
Other AC substation This includes low-voltage AC (LVAC) assets and power cables	21 LVAC units replaced, 30 LVAC units refurbished Finishing Brownhill–Pakuranga B cable repair Other cables, cable joins, and cable terminations as needed	Fewer than two unplanned outages per year caused by defects or failures of HV power cables or supporting infrastructure Fewer than three unplanned outages per year for MV power cables Zero unplanned outages of primary grid equipment caused by defects or failures of low-voltage distribution systems	48.0
Outdoor 33kV switchyards: outdoor-to-indoor conversion Conversion of most of the remaining 33kv outdoor switchyards	Six outdoor-to-indoor conversions	Number of fault and forced outages caused by outdoor 33 kV equipment reduced to fewer than five per year by 2025	38.3
TOTAL			**509.1**

8.2.1.1 Changes since our consultation

We did not receive specific feedback on our RCP4 plan for the AC substation portfolio during our October 2022 consultation. The workshops we held with electricity distribution businesses highlighted a few projects for further engagement, including Waitotahi, where we are combining work with Horizon Networks and Far North Solar for solar farm development, transitioning the site from 11 kV to 33 kV working in with planned transformer replacements.

Feedback from the verifier was largely positive, and it verified most of our expenditure (94.3 per cent); however, it had concerns with the following:

- $10 million for two power transformer replacements that were not explicitly linked to the asset health identified power transformer. We initially included these in our portfolio as our experience has shown we typically do two additional power transformers in an RCP over what we have identified.
- $15.4 million for other AC substation equipment was rejected as lacking supporting information.

In response to this feedback, we have removed the expenditure for these two power transformers. We have also increased the information around the AC substation equipment. We consider that our proposed uncertainty mechanism will give us sufficient flexibility to deal with power transformers that may be identified as needing replacing during RCP4.

We have also undertaken a full review of project prioritisation using the latest available condition and asset health information. This has resulted in two replacements being accelerated into RCP3 from RCP4 and five being brought forward from RCP5 into RCP4. Overall, we expect to deliver 22 power transformers in RCP4 compared with the 19 proposed in our draft proposal in 2022. We have also experienced material price and/or scope changes in 2022/23, over the CPI, identified minor timing, scope, and volume changes, and updated our expenditure forecasts in constant terms to 2022/23 values.

Table 17: Change in AC substations expenditure since our consultation (2022/23 $m)

	Consultation forecast (September 2022)	Verifier review	Proposal
AC substations	474.1	459.4	509.1

8.2.2 Buildings and grounds

Our buildings and grounds assets provide accommodation, services, and physical security for critical grid equipment and systems. Our objective is to ensure substation primary and secondary network assets are properly secured against physical and environmental risks, at the least whole-of-life cost.

Assets include buildings, site infrastructure, building services, and access ways to our substation sites. The asset class covers the physical buildings containing AC substations, warehouses, leased depots, and our national operating centres. Our buildings and grounds comprise approximately 670 buildings across 200 sites.

More information

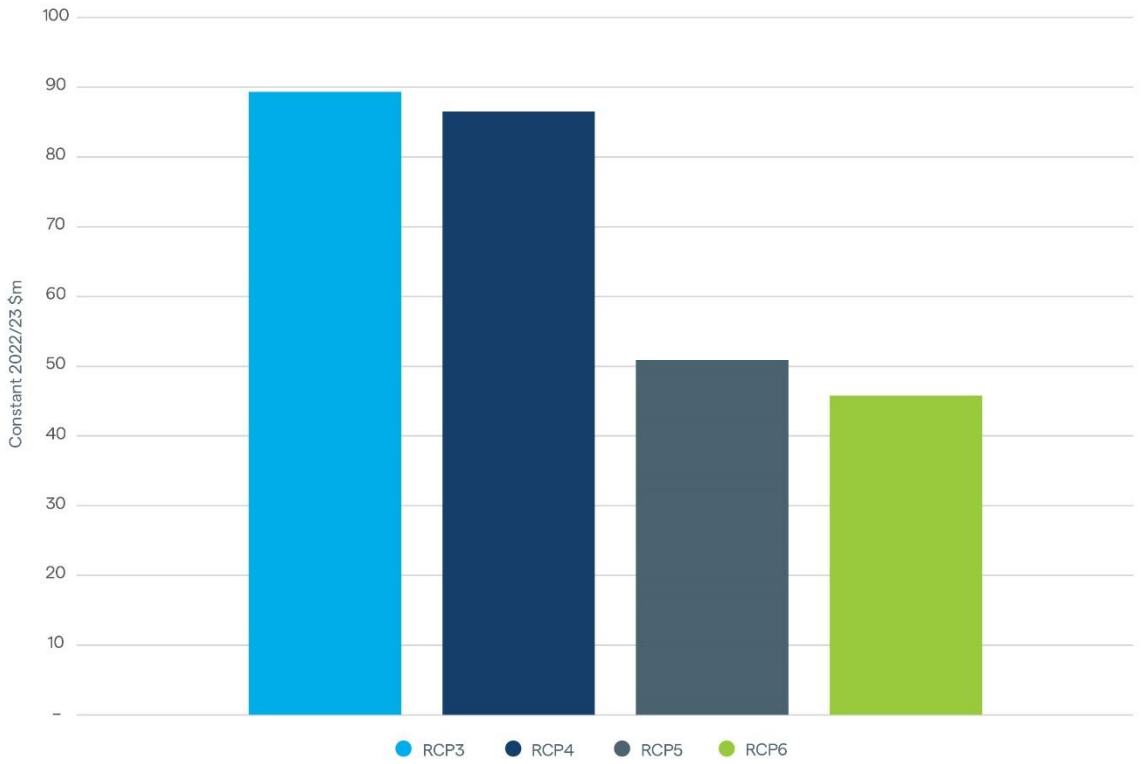
Buildings and grounds is the only asset class within this asset category. For more information, please refer to Section 4.2 of our Asset Management Plan 2023.

Key drivers for the changes in our RCP4 substation expenditure from RCP3 are:

- increase in warehouse expenditure to support the growing work programme
- water sanitation requirements to comply with Taumata Arowai drinking water reform compliance requirements.

Figure 25 shows the change in expenditure across RCPs. Our RCP4 expenditure forecast is similar to RCP3, while we are projecting a drop off in expenditure in RCP5 and RCP6.

Figure 25: Comparison of buildings and grounds forecast expenditure ($ million)



The RCP4 expenditure below does not include expenditure for added resilience. In Table 18, we set out an overview of the intended outputs from our proposed RCP4 expenditure, the activities we will undertake, and the measure we will use to track the effectiveness of our spend.

Table 18: Buildings and grounds overview

Output	Activity	Measure	RCP4 capex (2022/23 $m)
Sites are functional, resilient, and compliant with legislation A new warehousing strategy that supports our longer-term work plan and resilience Physical security at substations prevents or deters unauthorised access to restricted areas Ensure the safety of workers and visitors to all our buildings and grounds infrastructure	Warehouse facility upgrades to support growing work programme Fencing, accessway resurfacing, prevention of building water ingress, air conditioning, and upgrading sites where infrastructure related to potable, sewage, and wastewater needs to be upgraded Maintain building warrant of fitness compliance in accordance with the requirements of the territorial authority	Zero unplanned outages of grid equipment arising from failures of buildings and grounds assets that occur within the design envelope for natural hazards Zero serious health and safety incidents caused by defects or failures of buildings and grounds assets	89.3

8.2.2.1 Changes since our consultation

We did not receive specific feedback on our RCP4 plan for the buildings and grounds portfolio during our October 2022 consultation.

Feedback from the verifier was largely positive, and it verified all our expenditure in this portfolio; however, it had concerns with the following:

- $13 million for our drinking water supply sanitation compliance programme. The verifier considered that there was significant uncertainty around this work and that it should be included in an uncertainty mechanism.

We agree with the verifier that there is significant uncertainty around the work, but there is no uncertainty mechanism available for this work and, given the relative magnitude of the expenditure, we are not proposing a new mechanism.

This proposal still includes the expenditure required to enable our compliance with drinking water requirements within our base capex. We note, however, that if this expenditure is excluded from base capex, a potential change to the input methodologies could allow us to apply for cost recovery of the expenditure.[33]

[33] Part-4-IM-Review-2023-Draft-decision-CPPs-and-In-period-adjustments-topic-paper-14-June-2023.pdf (comcom.govt.nz), refer to 'change event' reopeners.

The increase in expenditure between the September 2022 consultation forecast and the verifier review was due to the:

- addition of the drinking water supply sanitation compliance programme
- transfer of line corridor fencing from transmission lines access to buildings and grounds
- yearly 15-year plan update through the analysis of life cycle asset management software information.

A small reduction between the verifier review forecast and our proposal is a result of changes within larger projects, work being brought forward into RCP3, or cancellation of work that is no longer required.

In addition to the above, we have identified minor timing, scope, and volume changes and updated our expenditure forecasts in constant terms to 2022/23 values.

Table 19: Change in buildings and grounds expenditure since our consultation (constant 2022/23 $m)

	Consultation forecast (September 2022)	Verifier review	Proposal
Buildings and grounds capex	62.9	94.1	89.3

8.2.3 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.

Transmission lines is our largest aggregate asset class portfolio of spend and captures a range of different asset groupings as follows.

- **Structures and insulators**: this covers poles and towers, paint, and insulators.
    - Transmission line structures consist of steel lattice towers; concrete, wooden, and steel poles; and components including attachment points.
    - We maintain the structural integrity and performance of our steel transmission towers primarily through our paint programme. Paint coatings help protect steel from the corrosive environment. The alternative approach is to replace small towers with poles when practical and cost effective. Our tower-to-pole replacement programme started in RCP3 and continues to grow through RCP4.
    - Insulators support and separate electrical conductors from the supporting structure without allowing current through.
- **Conductors and hardware**: conductors and their associated hardware enable electricity to flow from generators to consumers along transmission lines.

- **Grillage**: direct buried steel (grillage) tower foundations.
- **Foundations and access:** 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 includes foundation interfaces, which are the connection between the buried foundation and above-ground structure. 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 respond quickly and safely to faults or events on our transmission lines.

More information

Please refer to Section 4.3 of our Asset Management Plan 2023.

Overall, there is an increase in expenditure forecast for transmission line assets over the next 15 years, primarily due to the increase in number of assets reaching the end of their life.

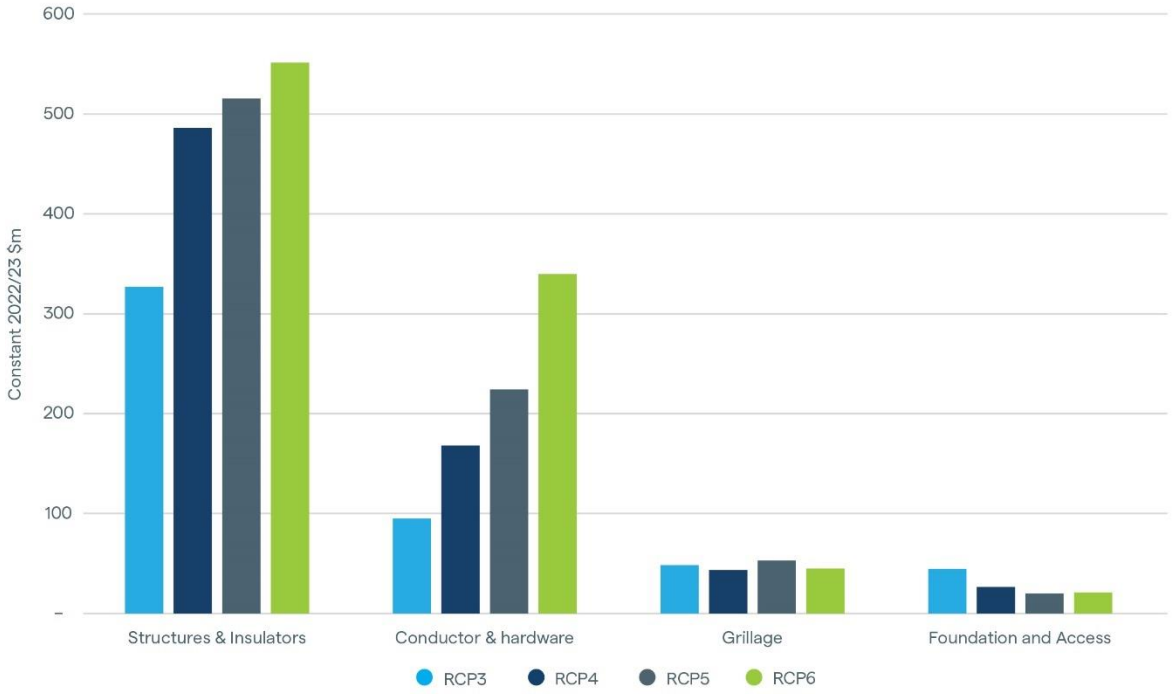
The primary driver for investment across this portfolio is asset health. Assets are planned for replacement considering their asset health score and the bundling of related or similar maintenance or replacement activities together, where economic. This enables us to minimise landowner interruption, prevent 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 how we prioritise work as constraints arise.

Innovation within our transmission programme includes work to review corrosion degradation rates applied within asset health models, and our tower painting economic models.

Maintenance operating expenditure is a key enabler to support the long-term refurbishment programme through the collection of condition assessment data, management of defects, and targeted life-extension interventions, that allow replacement work to happen in future RCPs. From FY24, we have started capitalising attachment points, this contributes around $27 million to the increase in structure and insulators but leads to an associated reduction in maintenance.

During RCP3, we began our tower-to-pole initiative as an alternative to tower painting. This is now our preferred option on many of the smaller or lightly loaded towers. Tower painting remains the preferred option for larger towers that would be more complex and expensive to replace.

Figure 26: Comparison of transmission lines forecast expenditure over RCPs (2022/23 $m)



In Table 20, we set out an overview of the intended outputs from our proposed RCP4 expenditure, the activities we will undertake, and the measure we will use to track the effectiveness of our spend. This excludes any listed projects (these are discussed in Section 8.2.6).

Table 20: Transmission lines overview

Output	Activity	Measure	RCP4 capex (2022/23 $m)
Structures and insulators: pole 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	Poles and pole arm structures are replaced based on asset health assessment We will replace approximately 1,311 pole structures	Unplanned outages caused by pole or cross-arm failures	62.7

Output	Activity	Measure	RCP4 capex (2022/23 $m)
Structures and insulators: tower Replace smaller tower structures with a modern equivalent steel pole structure instead of painting when practical and cost effective	Our tower-to-pole replacement programme will complete approximately 79 replacements of towers with poles We will replace approximately 10 towers	Tower failure rate	50.0
Structures and insulators: paint With investment, at the end of RCP4, 18.0 per cent of tower protective coating will be in fair condition, 14.7 per cent in poor condition, and only 5.4 per cent in very poor condition Without investment, 19.0 per cent will be in fair condition, 15.4 per cent in poor condition, and 12.8 per cent in very poor condition	To maintain asset health, we will paint approximately 2,725 towers We will replace smaller tower structures with a modern equivalent steel pole structure instead of painting when this is practical and cost effective	Paint towers based on optimal condition assessment scores and condition forecasting for each corrosion code	324.2
Structures and insulators: insulators With investment, at the end of RCP4, 18.1 per cent of our insulators will be in fair condition and 4 per cent in poor condition, with none in very poor condition Without investment, 19.0 per cent will be in fair condition, 7.7 per cent in poor condition, and 3.9 per cent in very poor condition	We intend to replace approximately 5,708 insulator sets Significant recalibration of the health models and corrosion zone updates have been done over past years, which is showing an increase in volumes from the RCP3 period in order to maintain the asset health of the fleet due to the increasing number of insulators forecast to be in poor condition in the future. This includes the re-insulation to harden the insulators, which are susceptible to volcanic ashfall, as part of the resilience programme	Average annual unplanned outage rate	49.0

Output	Activity	Measure	RCP4 capex (2022/23 $m)
Conductors and hardware With investment, at the end of RCP4, 2.9 per cent of our conductors will need intervention Without investment, 4 per cent will need intervention Our improvements in condition assessment using drones have seen an enhancement in our asset health modelling and allowed us to halve forecast reconductoring volumes compared with RCP3	Replacement of approximately 265 circuit kms of conductor	Average annual unplanned outage rate for all causes[34]	168.1
Grillage Maintain our transmission line foundations in perpetuity at least lifecycle cost, to ensure the integrity and reliability of the overhead structures and conductors they support. With investment, at the end of RCP4, 0.5 per cent of our grillage will be in poor health. Without investment, this will be 11.8 per cent	705 grillages refurbished 545 cathodic protections	No more than one major foundation failure every 5 years and none on highly critical foundation assets	43.6
Foundations and access Maintain our transmission line foundations in perpetuity at least lifecycle cost, to ensure the integrity and reliability of the overhead structures and conductors they support Maintain access to our assets to enable us to respond to faults or events quickly and safely on our transmission lines	Slope stability and river pilings Management of access track, bridges, culverts, and fords	No more than one major foundation failure every 5 years and none on highly critical foundation assets	26.7
TOTAL			**724.3**

[34] This includes those due to structures, foundations, and insulator failures.

8.2.3.1 Changes since our consultation

We did not receive specific feedback on our RCP4 plan for the transmission lines portfolio during our October 2022 consultation.

The verifier verified all of our expenditure in this asset class portfolio.

Since the verifier reviewed our expenditure, we have recategorised attachment points from maintenance to capex.[35] This increases transmission lines expenditure by $27.5 million, with an offsetting reduction to opex. We have also updated our forecasts for higher unit costs experienced in 2022/23. This has resulted in an overall increase of $13.9 million in addition to the attachment points recategorisation.

Table 21: Change to transmission lines expenditure forecast since our consultation (constant 2022/23 $m)

	Consultation forecast (September 2022)	Verifier review	Proposal
Transmission lines capex	669.0	682.9	724.3

8.2.4 HVDC and reactive assets

The HVDC inter-island link is a critical part of the network. It enables the North Island to access South Island hydro-electricity generation and the South Island to access North Island thermal electricity generation. The link is critical to the operation of an efficient national electricity market.

The HVDC link comprises a range of assets, including:

- converter stations (valves, converter transformers, DC yard equipment, and AC switchyard equipment)
- submarine cables and cable stations (submarine cables, cable terminations, and buildings)
- electrode stations (earthing electrodes, isolating switches, roof bushings and buildings).

Reactive power is needed in an AC transmission system to support the transfer of real power over the network. We use a combination of static and dynamic plant to supply the reactive power needed by the power system. The reactive power fleet ensures the stability of the power system and maintaining reliability of supply to customers. Our reactive assets incorporate:

- synchronous condensers
- static VAR compensators (SVCs) and static synchronous compensators (STATCOMs)
- capacitor banks and reactors.

[35] This change was confirmed with our auditors.

More information

Please refer to Sections 4.4 and 4.5 of our Asset Management Plan 2023.

8.2.4.1 HVDC

Our HVDC components are diverse and have different environmental operating conditions, redundancy levels, and expected lives. The HVDC link requires specialist international expertise, specifically designed assets to meet local requirements, type testing, and early supplier engagement.

Our planned RCP3 work on the HVDC predominantly focuses on the pole 2 midlife life extension. In contrast, RCP4 focuses on condition-based replacement and refurbishment work, resulting in an increase in expenditure from RCP3. There are two ICT projects in RCP4 for the lifecycle refresh of the communications system, as well as the HVDC terminal servers and PCs refresh. The HVDC submarine power cables will be at the end of their lives and due for replacement early in RCP5. Given the significant investment and lead times to replace the HVDC cables and the uncertainty around the project, we have proposed this as a listed project. See Section 8.2.6.4 for more details.

8.2.4.2 Reactive assets

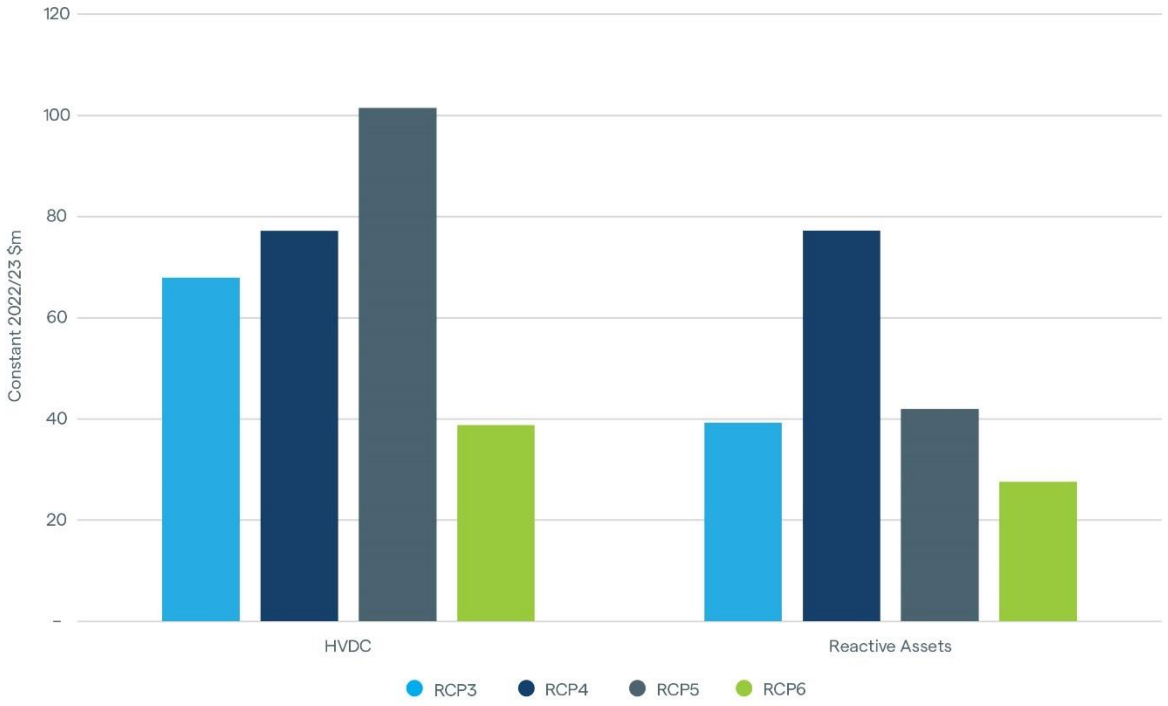
We use switched capacitor banks and reactors to provide most of the reactive power support required for the network. To ensure stability under transient or abnormal conditions, the system also requires fast-acting sources of dynamic reactive power. This is provided by synchronous condensers, SVCs, and STATCOMs.

Investment need is primarily based on addressing:

- capacitor can failures on ageing and deteriorating capacitor banks
- obsolescence and high risk of failure due to ageing of control systems
- minimising the risk of synchronous condenser failures
- control and auxiliary system assets reaching end of life
- life extension work on reactors

There are currently only a small number of qualified suppliers of suitable equipment. Due to the high demands for this type of equipment, prices have increased and are forecast to continue to increase. In addition, the time taken to source equipment may be more volatile, due to increased lead times.

Figure 27: Comparison of HVDC and reactive forecast expenditure over RCPs (2022/23 $m)



In Table 22, we set out an overview of the intended outputs from our proposed RCP4 expenditure, the activities we will undertake, and the measure we will use to track the effectiveness of our spend. This covers our RCP4 HVDC and reactive asset spend. This excludes any listed projects (these are discussed in Section 8.2.6).

Table 22: HVDC and reactive assets overview

Output	Activity	Measure	RCP4 capex (2022/23 $m)
HVDC High availability of the HVDC link to support the national electricity market Ease capacity constraints until the submarine cables replacement and possible capacity upgrades in RCP5 Ability to undertake a prompt cable 'cut and cap' operation, to reduce water ingress in the event of a submarine cable fault	Begin HVDC submarine cables replacement project and complete pole 2 midlife refurbishment Expenditure on HVDC cable surveillance, operational support, investigation projects, condition assessments, refurbishment of tap changers and reactors Tactical HVDC upgrades and maintenance such as net zero grid programme stage 1 and STATCOM enhancements with battery storage Ensure there are sufficient plans, skilled personnel, and emergency equipment in place to enable rapid restoration of HVDC transmission service following failure	Annual bipole availability	80.5

Output	Activity	Measure	RCP4 capex (2022/23 $m)
Reactive assets: dynamic reactive power Manage dynamic reactive power to minimise failures	We will replace Islington SVC 9's control and auxiliary systems We will upgrade all STATCOMs from Windows XP Refurbishment of the third SVC	Availability of SVCs and STATCOMs	28.1
Reactive assets: capacitors and reactors Manage capacitor and reactor health to minimise unplanned outages	A number of capacitor banks are at the end of their life and will require replacement in RCP4	Unplanned outages caused by capacitor banks and components at lowest lifecycle cost	8.9
Reactive assets: HVDC synchronous condensers HVDC availability meets the requirements of the future generation mix and accelerated electrification	We are planning to perform major refurbishments on the synchronous condensers over 2025–2030 to ensure units remain operational until 2042[36]	Average annual availability for each Haywards synchronous condensers	43.9
TOTAL[37]			161.3

8.2.4.3 Changes since our consultation

We did not receive specific feedback on our RCP4 plan for the HVDC and reactive assets portfolio during our October 2022 consultation.

The verifier reviewed a higher expenditure forecast than what we consulted on and accepted all our proposed expenditure. Since then, we have reforecast the delivery of two projects that are already in progress in RCP3. We have moved a portion of spend on these projects into RCP4, which has made a slight change to the proposal.

In addition to the above, we have identified minor timing, scope, and volume changes and updated our expenditure forecasts in constant terms to 2022/23 values.

[36] 2042 is the expected replacement date of pole 2, at which point reactive asset support will be reviewed.
[37] Difference due to rounding.

Table 23: HVDC and reactive assets changes to expenditure forecast since our consultation (constant 2022/23 $m)

	Consultation forecast (September 2022)	Verifier review	Proposal
HVDC and reactive assets	141.3	160.7	161.3

8.2.5 Secondary assets

Our secondary assets support the overall operation of the grid and provide essential services for the monitoring and control of equipment. Secondary assets include:

- **protection schemes**: used throughout the grid to detect and initiate isolation of electrical faults, protect primary equipment, and ensure people's safety; includes protection for bus zone feeders, lines, transformers, and reactive assets, along with special protection schemes
- **revenue meters**: supply electricity volume information and are used for wholesale market reconciliation and billing
- **station DC systems**: provide power (even when the local AC service supply has failed) to protection schemes, circuit breaker trip and close coils, control, and metering
- **SMS**: a telemetry system based on computers and local area networks that have been designed to operate in electricity utility environments; these systems are maintained within the ICT portfolio, enabling the remote control and real-time monitoring of our substations and are essential to ensuring visibility and control of the transmission network.

The primary driver of the protection, battery systems, and revenue meters renewal forecast is asset health. The wide range of asset life expectations means that required work volumes fluctuate over time.

More information

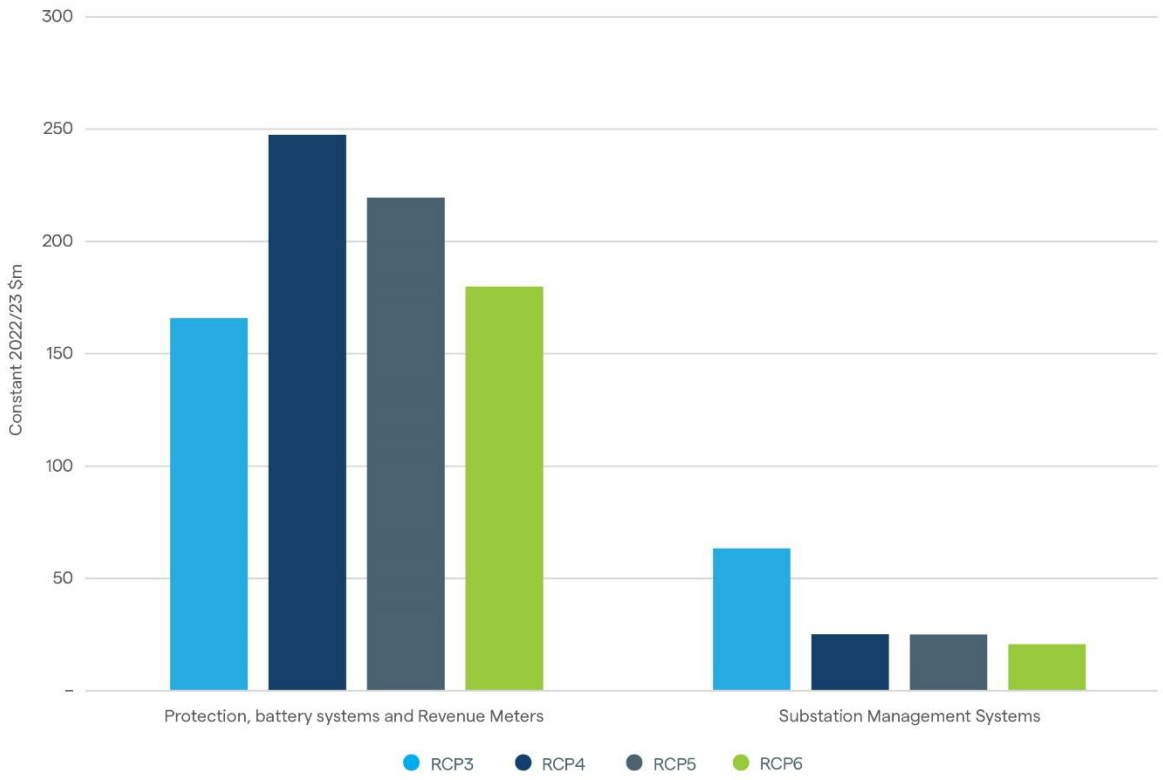
Please refer to Section 4.6 of our Asset Management Plan 2023.

RCP4 expenditure for protection will significantly increase due to:

- installation of bus zone protection at all buses that currently lack this
- installation of line differential protection on more of our transmission circuits to enable faster fault clearance and better fault detection
- auto-reclose on more of our transmission circuits
- a significant increase in costs of materials and labour in general.

We are forecasting SMS RCP4 expenditure to decrease from RCP3. This reflects the change from the deployment of new SMS-based systems to simple age-based device refreshes.

Figure 28: Comparison of secondary systems forecast expenditure over RCPs (2022/23 $m)



In Table 24, we set out an overview of the intended outputs from our proposed RCP4 expenditure, the activities we will undertake, and the measure we will use to track the effectiveness of our spend. This covers all our RCP4 secondary assets spend.

Table 24: Secondary assets overview

Output	Activity	Measure	RCP4 capex (2022/23 $m)
Protection Relays are replaced based on obsolescence or endemic failure Electrification of the economy is enabled through new special protection schemes to enable greater power flow in the existing primary equipment	Replacing approximately 650 protection schemes at the end of their expected useful lives, or aligned with replacement of primary plant Replacing approximately 350 outdoor junction boxes	Human error incidents resulting in unplanned outage	242.9

Output	Activity	Measure	RCP4 capex (2022/23 $m)
Batteries and DC systems[38] With investment, at the end of RCP4, 34 per cent of our batteries will be in fair condition and 18 per cent in poor condition, with 4 per cent in very poor condition Without investment, 35 per cent of batteries will be in fair condition, 32 per cent in poor condition, and 33 per cent in very poor condition With investment, at the end of RCP4, 17 per cent of our battery chargers will be in fair condition and 8 per cent in poor condition, with 2 per cent in very poor condition Without investment, 19 per cent of battery chargers will be in fair condition, 21 per cent in poor condition, and 34 per cent in very poor condition	Replacing approximately 150 battery banks	Interruptions to customers	13.0
Metering All of our revenue meters will be replaced by the end of RCP3, and the next scheduled replacements will occur in RCP6 Most local service supply meters will be replaced in RCP5	Metering expenditure during RCP4 is to cover the costs of power system modelling tools, standalone phasor measurement units, and power quality meters	Interruptions to supply	0.8
SMS SMS maintain visibility and control of the transmission network at both the national level and the local level SMS enable: • detailed security studies • alarm management • asset performance management • remote control and monitoring of our substations SMS contains the telemetry systems based on computers and local area networks that have been specifically designed to operate in electricity utility environments	Lifecycle replacements and telemetry data standard improvements.	SMS failures 5-year rolling average of input/output module failures 100 per cent of sites converted to SMS	25.6
TOTAL			**282.3**

The conclusion of the programme to upgrade or replace remote terminal unit processors at the outstations of all SCADA systems will see SMS costs decrease in RCP4. Costs are likely to be similar in RCP5. From RCP4, we move into planned lifecycle replacements for the devices commissioned in RCP1.

8.2.5.1 Changes since our consultation

We did not receive specific feedback on our RCP4 plan for the secondary assets portfolio during our October 2022 consultation.

Feedback from the verifier was largely positive, and it verified our expenditure.

Since the verifier report, we have identified minor timing, scope, and volume changes and updated our expenditure forecasts in constant terms to 2022/23 values.

Table 25: Secondary assets change since our consultation (constant 2022/23 $m)

	Consultation forecast (September 2022)	Verifier review	Proposal
Secondary assets	293.2	268.1	282.3

8.2.6 Listed projects

In addition to the above portfolios, our capex budget includes listed projects. These are base capex replacement and refurbishment projects budgeted to cost more than $20 million but for which we have uncertainty over the scope, cost, or timing during RCP4.

The five listed projects for RCP4 are:

- Huntly–Ōtāhuhu A (OTA–DRY) reconductoring
- Haywards bus rationalisation
- Rangipō gas insulated switchgear replacement
- HVDC cables replacement
- Brownhill–Pakuranga A cable joint replacements.

8.2.6.1 Huntly–Ōtāhuhu A (OTA–DRY) – RCP4 estimate $37.2 million ($ 2022/23)

The HTY–OTA-A is a double-circuit 220 kV transmission line commissioned in 1983 near Auckland.

Two sections of the transmission line conductor have been inspected by a close aerial drone survey: from tower 125 to Drury substation in 2020/21 and Drury to Ōtāhuhu substation in 2021/22. For both sections, the results show multiple instances of internal conductor corrosion evidenced by white powder product on the conductor, particularly for the tower 125 to Drury section, which had white powder spread on all spans inspected.

[38] Excludes 48 V communication batteries.

We have assessed the overall risk of a conductor failure or break as low, but the combination of corrosion caused by spacer damage (affects the conductor from the outside in) and galvanic corrosion as evidenced by white powder (affects the conductor from the inside out), increases the likelihood that actual load on each conductor may exceed the residual capacity of that conductor in the medium term, resulting in a conductor break in an urban and semi-urban environment.

The close aerial drone inspection established that both sections were in better condition than the asset health model suggested; however, given the peak of work expected for RCP5–RCP6 and the high public safety criticality of these assets, we are proposing to bring forward this replacement to RCP4 to manage longer-term deliverability, public safety, and resource use.

8.2.6.2 Haywards bus rationalisation – RCP4 estimate $44.1 million (2022/23)

The Haywards substation is the largest and most complex substation on our network. It hosts both HVDC and HVAC assets and comprises four switchyards. Switchyard A is the main HVAC switchyard and contains both 110 kV and 220 kV assets. The 110 kV double bus structure in switchyard A is arranged in a vertical fashion with bus A on top of bus B. This arrangement has a smaller site footprint area and provides greater flexibility to switch circuits between the two buses. However, this configuration introduces worker safety risk (the need to manually perform switching steps in a restricted access environment), operational constraints (the need to de-energise both bus A and bus B for maintenance of any assets in either bus), and costly switching activities (lengthy and complex switching sequence, which is mostly paper based).

This is the only remaining site on our network with this kind of bus arrangement. All others have been modified to address these issues. We are currently investigating our options to address this situation at the constrained Haywards site and to determine the optimal solution. The investigation is in the early stage, and presently only high-level information is available.

8.2.6.3 Rangipō gas insulated switchgear replacement – RCP4 estimate $58.7 million (2022/23)

Rangipō 220 kV gas insulated switchgear was installed in 1979 and is now jointly owned by Genesis Energy and Transpower. It is installed in Genesis Energy's underground power station, which connects two 60 MW generators to our grid. The Transpower-owned portion of this gas insulated switchgear contains 536 kg of SF_6 gas, which is 1 per cent of our total in-service SF_6 equipment.

The power station and associated gas insulated switchgear is situated approximately 60 m underground. It is connected to the surface via two sets of 220 kV, oil-filled cables that were installed at the same time. This power station is connected into the transmission circuit between Bunnythorpe and Wairakei and, due to the configuration, the cable and gas insulated switchgear must be in service to enable through transmission between Bunnythorpe and Wairakei. This means an unplanned outage on this gas insulated switchgear can create limitations on northwards electricity flow between Bunnythorpe and Wairakei and can limit the extent to which the Rangipō generation can be offered into the power system.

The 220 kV oil-filled cables from the underground gas insulated switchgear to the above-ground switchyard are in adequate condition for their age. However, they are nearing end of life and will likely need replacement in the next 5–10 years. We also have an unacceptable SF_6 leak rate in the underground gas insulated switchgear, which we can no longer manage through reactive maintenance without accepting high SF_6 losses. We are considering a two-stage approach:

- continuing our campaign to proactively replace seals rather than reactively replacing only those that leak

- accelerating the replacement of the gas insulated switchgear within RCP4 at an estimated cost of $50 million (a listed project within RCP4); this will be a highly complex project.

Due to the complexity of the site and expected scope of work, it is difficult to estimate the timeframes associated with the investigation and associated replacement project. The work will proceed as soon as practicable, and a project advisory team will be established to ensure early escalation of issues and required decisions.

Due to the mixed ownership model of the gas insulated switchgear equipment and likely future impacts to generation at Rangipō during any maintenance or replacement work, we are engaging with Genesis to better understand their longer-term plans and likely generation outages. Coordination with Genesis and a good working relationship will be a key enabler of delivering on our long-term plan to address the issues at Rangipō.

8.2.6.4 HVDC cable replacement – RCP4 estimate $67.3 million ($ 2022/23)

Our HVDC Cook Strait cables are deteriorating and will need replacement by the early 2030s. We are aiming to have new HVDC cables commissioned by 2032 to avoid an increased risk of outages as the cables deteriorate.

This work will be optimised with our Net Zero Grid Pathways Project. This project explores whether we need an additional cable and/or to replace the existing ones with larger-capacity cables. There are significant delivery efficiencies involved if we use a single cable-laying ship and coordinate the work. We will consider these in our analysis. While the cables themselves will not be commissioned until 2032, we will need to commission related assets in RCP4, including a cable storage facility. We will also need to book a cable-laying ship. The estimate above is for expenditure incurred only in RCP4; the overall cost of the project will be significantly higher.

8.2.6.5 Brownhill–Pakuranga A (BHL–PAK-A) cable joint replacements – RCP4 estimate $54.2 million ($ 2022/23)

Note: this listed project was added after the verifier reviewed our plan.

Transpower plans to replace 45 joints at 15 locations on an underground electricity cable between the Brownhill and Pakuranga substations in south-east Auckland. This is a 2- to 3-year work programme starting in 2024. This work is on the Brownhill–Pakuranga-B (BHL–PAK-B) cable joints.[39] The issue is unforeseen and unexpected, but replacing these joints returns this important cable to its intended condition, so it can operate effectively for its expected 30- to 40-year life.

Partial discharge testing at the BHL–PAK-A cable circuit joint bays shows a similar profile to that seen on the BHL–PAK-B joints during energisation of the circuit. This is thought by Transpower to indicate degradation of the joint insulation; however, this is not a proven conclusion, and we require more concrete condition information. The next step is to remove some joints for testing. This will provide an indication of the condition of the rest of the BHL–PAK-A joints and enable operational and lifecycle decisions to be made for the remaining joints on the cable circuit.

The listed project, if determined to be required following the testing, is expected to be delivered in the second half of RCP4. This will be after the completion of the BHL–PAK-B joint replacement programme so that we can learn from this and use the same resources.

[39] Brownhill–Pakuranga cable remediation | Transpower

8.3 ICT

Transpower's ICT systems underpin network reliability, coordination, and restoration of power. They are also essential to effective cyber resilience. Investment in modern, supportable ICT systems increases productivity and value, efficiency, and ICT reliability. In addition, the modernisation of platforms often creates an opportunity for innovation and business improvement. Our ICT is a vital foundation on which we perform our business functions. Our focus is on using appropriate technology, processes, and systems.

Table 26: 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

Our approach to ICT investments is to respond to strategic priorities while taking advantage of opportunities enabled by emerging technologies and market trends. Our objective is to be flexible enough to change our ICT investment direction as technologies and organisational needs change. The rate of change makes forecasting the technologies we will develop during RCP4 and RCP5 difficult.

Overall, we consider that there is potential in future years to further enhance our business and processes by, for example, continued adoption of the anything-as-a-service model for modern

cloud-based services, enhanced use of data and analytics and, as they become sufficiently advanced, adopting digital workplace technologies and intelligent systems.

More information

Please refer to our Asset Management Plan 2023.

8.3.1 Forecasting ICT expenditure

We forecast our ICT expenditure by focusing on the organisational capability required to achieve our strategic objectives and business benefits. We use new and emerging technologies to adapt our business requirements. Our business drivers for our ICT investments are to:

- **strengthen customer collaboration**: improve our customer engagement across all aspects of connections, operation, and investment 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 integrating distributed and intermittent generation 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.

To deliver our ICT objectives, we have a series of sub-strategies to ensure ICT investments are aligned 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.

Since our RCP3 proposal, we have focused on how we set out our ICT strategic investments to more clearly identify the outputs the investments deliver. Our investments are now grouped into programmes and categorised by investment type and investment category (Figure 30). This enables us to balance investment as we innovate and transform functions to deliver new digital business outcomes.

We differentiate between:

- **recurrent investments**: regular expenditure that occurs at least once every 4–5 years
- **non-recurrent investments**: one-off expenditure or expenditure occurring in more than 4- to 5-year intervals.

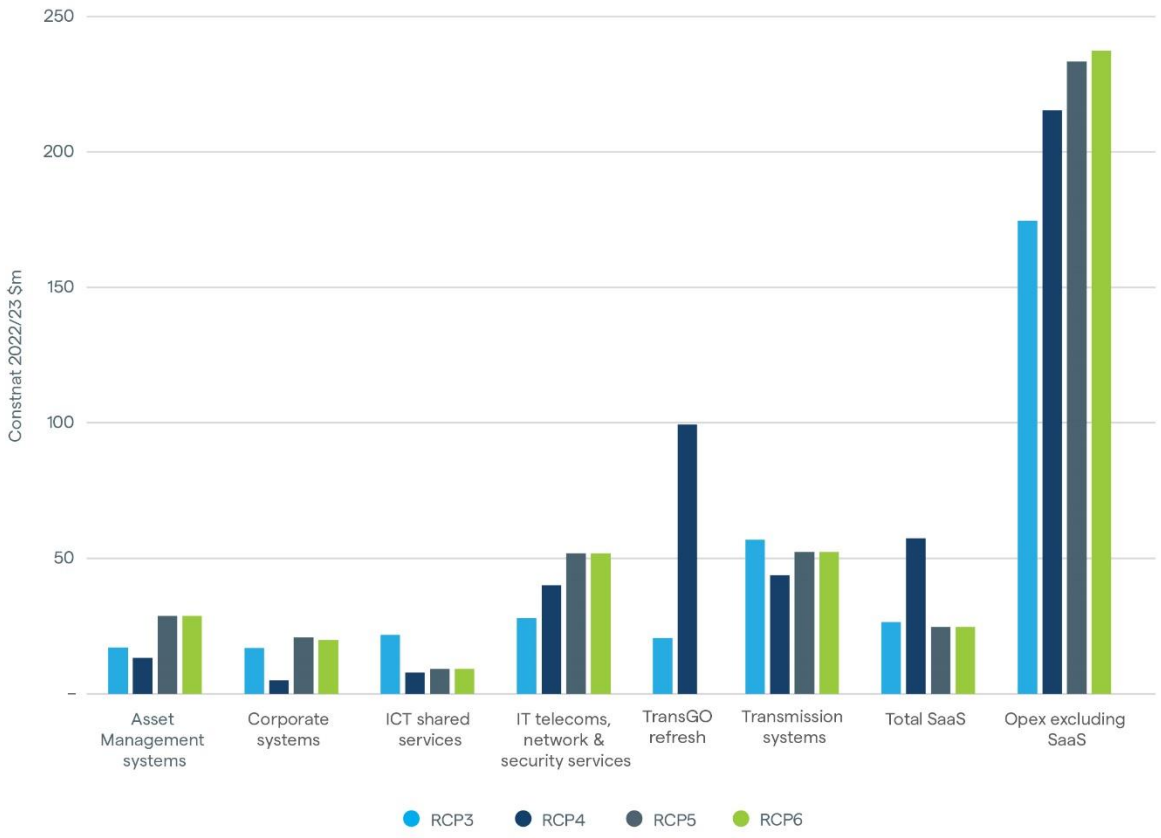
Our investments are categorised into:

- **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
- **benefits driven**: investment in new capabilities to realise benefits for Transpower and electricity consumers
- **compliance**: 'must do' investments to comply with regulations or standards.

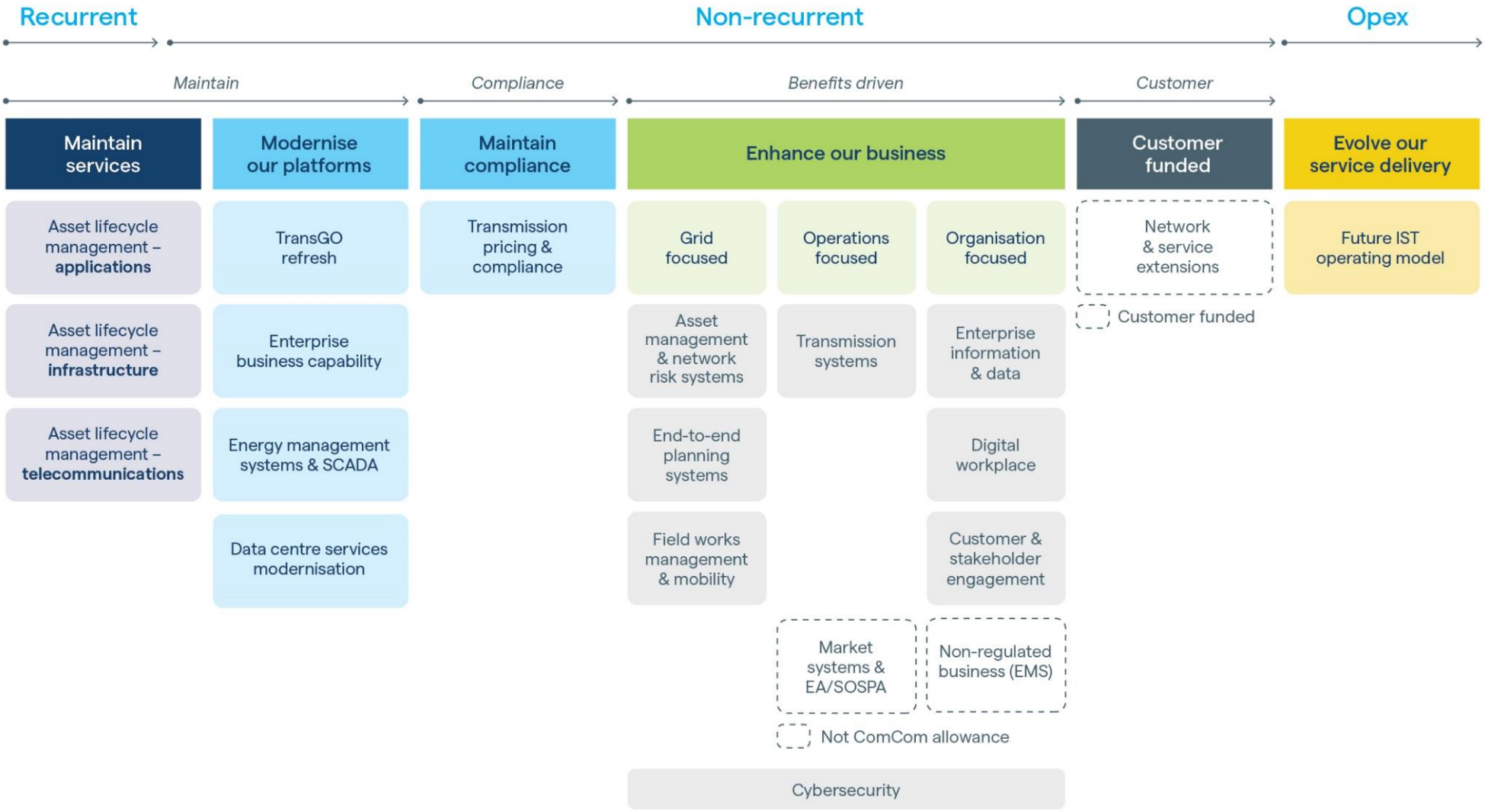
In April 2021, the International Financial Reporting Standards Interpretations Committee published a decision on how entities are to account for the costs of configuring or customising a supplier's application in software-as-a-service arrangements. The implication of this decision is that software-as-a-service costs need to be expensed instead of capitalised. Our RCP3, RCP4, and RCP5 forecasts show a shift in cost classification from capex to opex for software-as-a-service-related initiatives. The ICT spend must be considered in its entirety.

Figure 29: Comparison of ICT forecast expenditure over RCPs (2022/23 $m)



The detail of how our ICT strategies map to expenditure portfolios is further described in the Asset Management Plan 2023.

Figure 30: Overview of ICT sub-strategies and asset lifecycle management strategies based on investment type



8.3.2 ICT capex

Our ICT capex is split into the following categories.

- **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.
- **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.
- **Corporate systems**: support Transpower's core day-to-day business operation, providing shared capabilities across all business teams.
- **Shared services**: supports the ICT infrastructure, systems, and processes that are required for the delivery of ICT services.
- **Telecommunications, network, and security services**: delivers services that provide a secure, high-capacity nationwide communications network, which underpins our mission-critical grid operational services and our business-critical corporate services.

More information

Please refer to Section 5 of our Asset Management Plan 2023.

Our proposed identified programmes are our maintain services investment case and our TransGO Refresh. Maintain services cuts across each of the ICT categories.

In Table 27, we set out a summary of the outputs for each of the ICT categories, the key activities we plan to undertake for RCP4, and our aggregate expenditure. This includes software-as-a-service opex related to these categories.

Table 27: ICT forecast spend overview (constant 2022/23 $m)

Output	Activities	RCP4 expenditure ($ million)
Asset management systems Enable material cost and time savings Enable continuous improvement in asset management maturity Transform our fault response and repair activities Shift to a safety by design culture Mitigate increasing global supply chain risks Maintain asset management systems in a fit-for-purpose lifecycle state	Invest in building information modelling Further expand our asset health and network risk models Field workforce mobility programme Enhance health and safety systems Implement end-to-end planning Enhance procurement, inventory, and warehousing systems Ongoing lifecycle management of our asset management systems	22.1
Corporate systems Achieve higher levels of business performance and acceleration of our organisational effectiveness Modernise payroll system Maintain corporate systems in a fit-for-purpose lifecycle state	Progressively digitise and transform our corporate processes Improve our collaboration and empowerment across internal and external stakeholders Ongoing lifecycle management of our corporate systems	49.9
Shared services Support business change and the security of cloud services Update the computer platform that supports our critical services and enterprise systems Maintain shared services in a fit-for-purpose lifecycle state	Modernise our data centre services Ongoing lifecycle management of our IT infrastructure that supports our application hosting, workplace productivity and operations, delivery, and assurance services	10.2

Output	Activities	RCP4 expenditure ($ million)
Telecommunications, network, and security Leverage the substation network investment and off-the-shelf telecommunications services to increase capacity and provide greater flexibility Manage our cybersecurity risk to the agreed risk appetite Support and meet business needs Maintain telecommunications, network, and security in a fit-for-purpose lifecycle state	Provide a secure, high-capacity nationwide communications network to underpin our mission-critical grid operational services and our business-critical corporate services TransGO Refresh – modernise our telecommunications network Modernise cybersecurity assets Ongoing lifecycle management of our infrastructure, telecommunications, network, and security systems	140.6
Transmission systems Reduce risk of harm Reduce operational risk Meet customer service expectations Ensure regulatory compliance Improve operational effectiveness across business units and regions Enhance efficiency and productivity Maintain transmission systems in a fit-for-purpose lifecycle state	Invest in digital switch management capabilities Introduce artificial intelligence and machine-learning decision models Grid resilience and work distribution Outage planning and management Protection systems Telemetry data management SCADA/energy management system Ongoing lifecycle management of our transmission systems	43.8
TOTAL		266.6

8.3.3 TransGO Refresh

The TransGO Refresh programme constitutes the largest capital portfolio within ICT in RCP4. The nationwide TransGO telecommunications network supports teleprotection, SCADA, HVDC protection, and voice and corporate and application traffic. Several key components of TransGO are reaching the end of their effective life. This drives a major investment to modernise the network during RCP4.

Our plan is to modernise our TransGO wide area network assets. Our underlying fibre network will be retained, whereas the telecommunications equipment delivering our telecommunications services will be modernised. This network investment will be leveraged to also modernise our critical and non-critical substation IP services. Our intention is not to replicate our high-capacity core network, which connects our data centres, control centres, and offices. Instead, we will leverage the substation network investment and off-the-shelf telecommunications services to increase capacity and provide greater flexibility.

We originally planned to deliver this work during RCP3, but the pre-purchase of spare equipment and careful lifecycle management enabled this to be mostly deferred to RCP4. Our planning has highlighted that we need to start investing around $20 million into the TransGO Refresh in RCP3. We will incorporate this expenditure under our existing allowance. The refresh will, however, significantly increase our ICT spend in RCP4.

The verifier has approved our expenditure; however, we maintain that the materiality of uncertainty is significant. This is a single one-off project, like that of a listed project or MCP (the latter has a default incentive rate of 15 per cent). We are therefore proposing that the TransGO Refresh is designated as a low incentive rate project for RCP4.[40] This means that an incentive rate of 15 per cent would apply rather than a standard rate of 34 per cent.[41] We believe that this better balances the risk of under/overspends to consumers and Transpower.

8.3.4 ICT opex

Our ICT opex portfolio is defined by the work programme set by our sub-strategies and asset lifecycle management strategies. ICT opex covers the following.

- **Leases**: costs of leases for ICT components to support our core business functions, including fibre circuits and telecommunications capacity.
- **Third-party support and maintenance**: costs for third parties to deliver some specialist outcomes such as off-site backup of media, infrastructure support, application support, etc.
- **Outsourced services**: costs for outsourcing of some services to specialist providers where practical and cost effective.
- **Licences**: costs of software and hardware licences.
- **Communications and control**: third-party costs to maintain the TransGO national network.
- **Investigations**: costs for pre-capital project activities to explore possible solution options to deliver business outcomes.

ICT opex excludes expenditure related to people in our teams, i.e. costs of staff, contractors, consultants, and overheads associated with these resources. These costs are covered under business support opex.

More information

Please refer to our Asset Management Plan 2023.

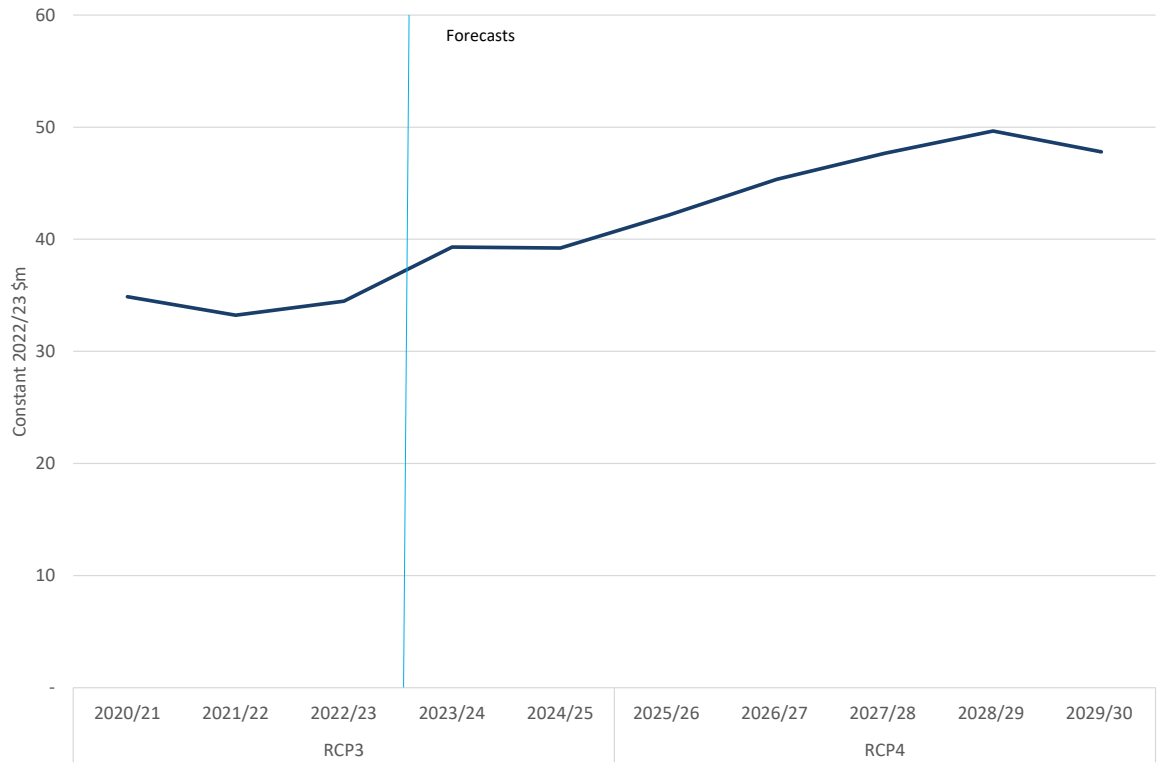
[40] Commerce Commission, *Transpower Capital Expenditure Input Methodology Determination 2012* (Principal Determination), Schedule A, Clause A4. The Commission introduced it for material (greater than $20 million) projects with high-cost uncertainty.
[41] This is based on a forecast vanilla WACC of 7.17 per cent. This rate is consistent with the Commission's July 2023 cost of capital determination for the 2023/24 disclosure year.

Key changes for RCP4 compared with RCP3 include:

- our investments in data and analytics and building information modelling capabilities are expected to drive an increase in licencing and software-as-a-service subscriptions
- the modernisation of our data centre services will increase cloud infrastructure costs; this increase will be offset by a reduction in hosting costs and a reduced need to replace some of the ageing assets
- increases in licence costs are driven by new capabilities for applications
- following the TransGO Refresh, the opex of running our telecommunications network will increase, driven by replacement of our radios and new core network capacity.

We forecast most of our ICT opex using a base-step-trend approach, which will start with 2022/23 as the base year. Investigations forecast is based on a bottom-up estimate. We have forecast several step changes due to the increasing grid workload. These step changes have already started in RCP3. Our RCP3, actual and forecast, and RCP4 forecast spend is shown in Figure 31.

Figure 31: Comparison of ICT opex over time (2022/23 $m)



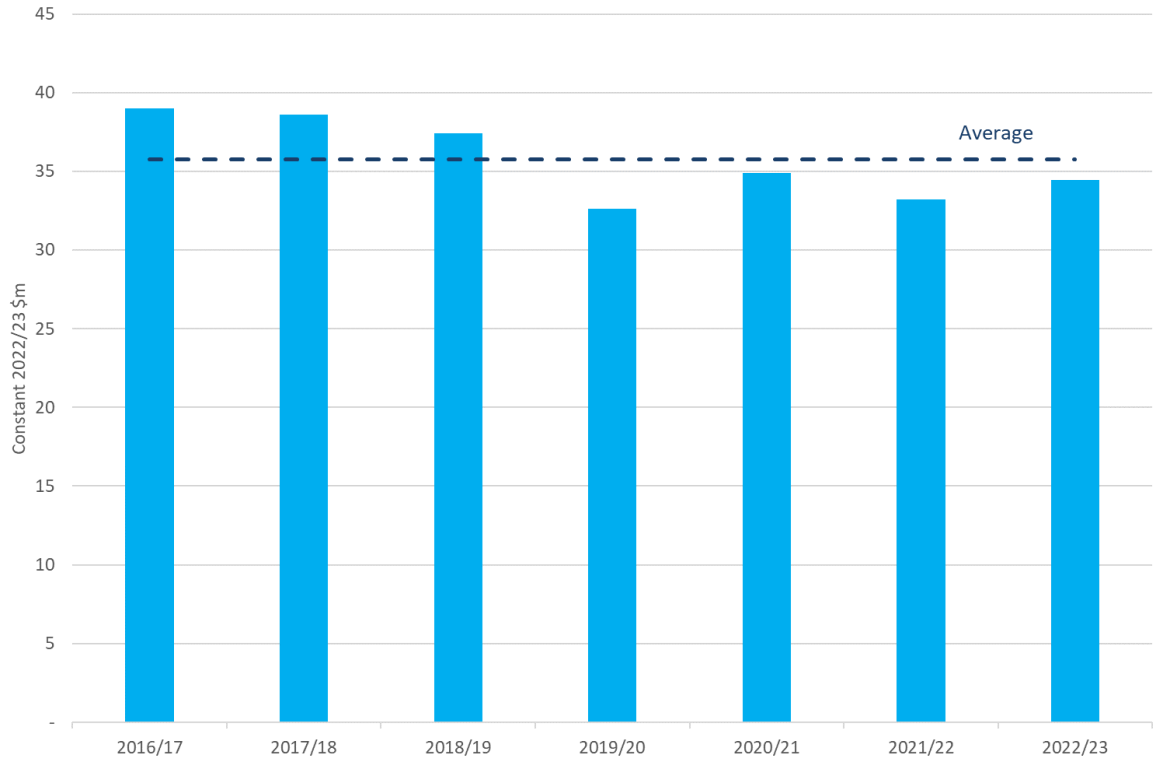
8.3.4.1 Base year

We have reviewed our expenditure in 2022/23 against historical levels and removed any atypical one-off costs. To enable historical comparison, we excluded approximately $6–10 million of leases from each year from 2015/16 to 2017/18. These leases have been capitalised since 2019/20. The further decline in our expenditure across the period is due to the transformation 2 programme that targeted cost reductions. These were achieved across several areas, including outsourced services and licences.

We also removed the non-repeatable expenditure from the base year amount and added back any one-off savings. We have reduced our base expenditure by $5.5 million.

We consider our proposed base year of 2022/23 reflects a prudent and efficient level of expenditure.

Figure 32: Base year calculations for ICT opex



8.3.4.2 Steps

We continuously optimise our workforce through adjusting our insourcing and outsourcing arrangements to balance the trade-offs between quality, cost, and in-house capability. However, ICT opex is increasing.

The drivers for steps changes in our RCP4 ICT opex are as follows.

- **Leases**: TransGO Refresh programme will result in an increase in non-capitalisable Kordia leases.
- **Third-party support and maintenance**, including:
  - outsourcing of core connectivity required as a result of the TransGO programme
  - annual enhancement to the systems that were previously capitalised
  - an increase in the volume of repairs due to an increase in extreme weather events.
- **Outsourcing**, including:
  - an increase in our opex as a result of modernising our data centre infrastructure (this increase is largely offset by capex savings)

- a reduction in server management costs following the implementation of the data centre services modernisation (DCSM) sub-strategy and offsets the above-mentioned opex increases
- an increase due to the implementation of new data and analytic tools to deliver efficiencies
- an increase in our fixed admin payment and telecommunications as a result of the service provider reset and a reallocation of a portion of the fee from grid maintenance to IST. The telecommunications step is cost neutral between IST and grid maintenance
- an increase in network managed services contract costs based on estimated cost increase for licencing fees and uptime support, which is largely driven by base hardware costs
- a decrease in future costs with the IT service provider reset and the initial milestone payment.

- **Licencing**, including:
  - increased cybersecurity and firewall costs as part of the TransGO upgrade and building new cybersecurity capabilities
  - new licence costs associated with benefit-driven investments
  - new software-as-a-service solutions replacing on-premises solutions (this avoids future capex)
  - licence costs for building information modelling
  - new costs associated with licences to support our new vegetation management capability
  - new licence costs associated with our information management investment
  - increased maintenance costs to defer hardware replacement before DCSM introduced; this will be fully offset at the end of RCP4 through the removal of hardware support costs.
- Communication and control: including an increase in our routine preventive maintenance work costs as a result of the service provider reset reallocation of costs from grid maintenance for predictive maintenance. This is cost neutral.

RCP4 investigations opex is based on a bottom-up estimate. We estimate a per year average of $1.5 million, which compares reasonably with $1.9 million on average during RCP3.

8.3.4.3 Trends

Our ICT costs will increase in line with the forecast FTE growth. This is particularly noteworthy in our outsourced services and licencing costs. Increasing digitalisation and use of our tools will also lead to a growth in licencing costs unrelated to the increase in FTE. Other trends we are forecasting in this area include real-time systems due to an increase in installations of human–machine interface SMS and grid/energy management systems.

8.3.4.4 Base-step-trend summary

Table 28 summarises the expenditure components of the base-step-trend method applied to ICT opex. Expenditure categorised as resilience has been removed via the licencing and investigation steps.

Table 28: ICT opex – base-step-trend summary (2022/23 $m)

Component	Description	RCP4 opex ($ million)
Base	2022/23 base year. Adjustments were made for the following atypical costs: • software-as-a-service project implementation • canary honeypot • cybersecurity • data and analytics • telecommunications service provider reset • Christchurch to Dunedin fibre connection • building information modelling and associated licences	177.1
Step	Leases	2.7
	Third-party support and maintenance	3.4
	Outsourcing	28.8
	Licencing	16.8
	Communication and control	1.7
	Investigations	-3.2
Trends	Outsourced services – linked to FTE growth	1.7
	Licencing – linked to FTE growth	8.1
	0.5 per cent per year productivity challenge	−4.5
TOTAL	**Excludes real price effects**	**232.6**

8.3.5 Changes to ICT expenditure since our consultation

We did not receive specific feedback on our RCP4 plan for ICT expenditure during our October 2022 consultation.

The draft report received from the verifier was predominantly positive, and it supported the full ICT capex and opex proposals for RCP4. The verifier did express concern regarding our ability to recruit the required additional personnel due to the scarcity of specialised skills both locally and globally.

The verifier did not review corporate IST, asset management, and digital switch management expenditure.

We have also identified minor timing, scope, and volume changes and updated our expenditure forecasts in constant terms to 2022/23 values.

Table 29: ICT changes since our consultation (2022/23 $m)

	Consultation forecast (September 2022)	Verifier review	Proposal
Total ICT capex	227.8	211.9	209.1
Total ICT opex, including software as a service	277.2	294.4	290.0

8.4 Grid maintenance

Grid maintenance covers all maintenance work on our HVDC and HVAC transmission line assets, substation assets, and our communication sites and services assets (but excluding communications bearer and network assets). It is undertaken to:

- address in-service deterioration of our assets
- respond to transmission faults
- proactively improve some assets
- implement projects to replace asset components.

With the increasing need that comes with maintaining an ageing asset base, optimising opex–capex trade-offs, and a greater visibility of asset condition, we are forecasting a 9 per cent increase in RCP4 total maintenance costs compared with RCP3. Key drivers for the increase are:

- improvements in SF_6 management, to lower SF_6 emissions, reducing our carbon footprint
- additional work due to our buildings and grounds and power cables programmes as well as our towers-to-poles programme. While lowering overall costs, the towers-to-pole programme increases maintenance on towers until they are replaced with poles.

ICT infrastructure is integral to our grid maintenance activities and a key area for our continued investment in innovation, efficiencies, and optimisations. It provides the ability to prioritise work and also to access and update asset information.

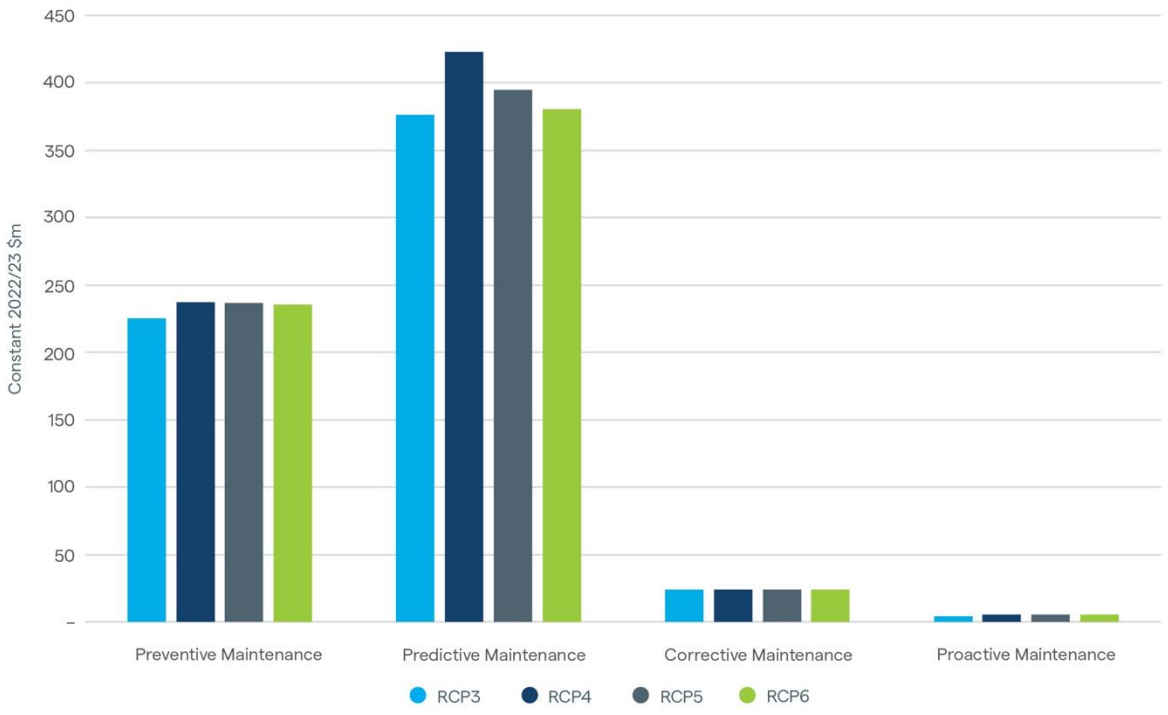
We categorise grid maintenance into four main work types.

Table 30: Grid maintenance overview

Work type	Description	Forecasting approach
Preventive	Routine servicing or inspections to prevent failure or understand asset condition	Base-step-trend and bottom-up
Predictive	Maintenance performed based on known equipment condition before its condition deteriorates into an unsatisfactory state (e.g. outside service specification)	Base-step-trend and bottom-up
Corrective	Fault response or maintenance work undertaken to restore an asset to service, make it safe or secure, prevent an imminent unforeseen event that causes damage, degradation, or an operational failure	Base-step-trend
Proactive	Activities driven by either tactical or strategic reliability analysis to maintain service levels	Base-step-trend

Where we use the base-step-trend method, we start with 2022/23 as the base year, then apply any step changes (e.g. changing regulatory requirements or permanent cost changes not included in the trend), and project this forward based on underlying cost inflation, productivity, and, where applicable, output changes.

Figure 33: Comparison of maintenance forecast expenditure over time (2022/23 $m)



8.4.1 Preventive

Preventive maintenance comprises inspections, condition assessments, condition monitoring, and servicing. It is our most regular asset intervention and, as such, is a key source of effective feedback to the overall asset management system.

We set out the key drivers of preventive maintenance and our work activities in Table 31. The expenditure for these work activities is estimated using a bottom-up approach using asset-specific characteristics, including age, asset type/model, manufacturer, network risk and criticality, and compliance with safety and other regulations.

Table 31: Drivers of preventive maintenance

Drivers	Work activities
Asset-specific characteristics, including age, asset type, and manufacture Network risk and criticality Compliance with safety and other regulations	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 Condition assessments and condition monitoring – periodic measurement activities performed to monitor asset condition and provide systematic data for analysis Servicing – routine tasks performed on the asset to ensure that its condition remains at an acceptable level

In addition to the above, the preventive maintenance category also includes our opex on the following:

- **grid skills**: technical training provided to service providers
- **other maintenance services:** our share of vector tunnel operating and maintenance costs and non-pass-through rates; freight, contract settlement and profit share; small service provider engagement costs
- **utilities**: costs associated with the supply of electricity, water, telephone services
- **service provider management service fee**: covers our service providers contract management service fee and is split between preventive and predictive maintenance.

The expenditure on these opex elements are estimated using a base-step-trend approach.

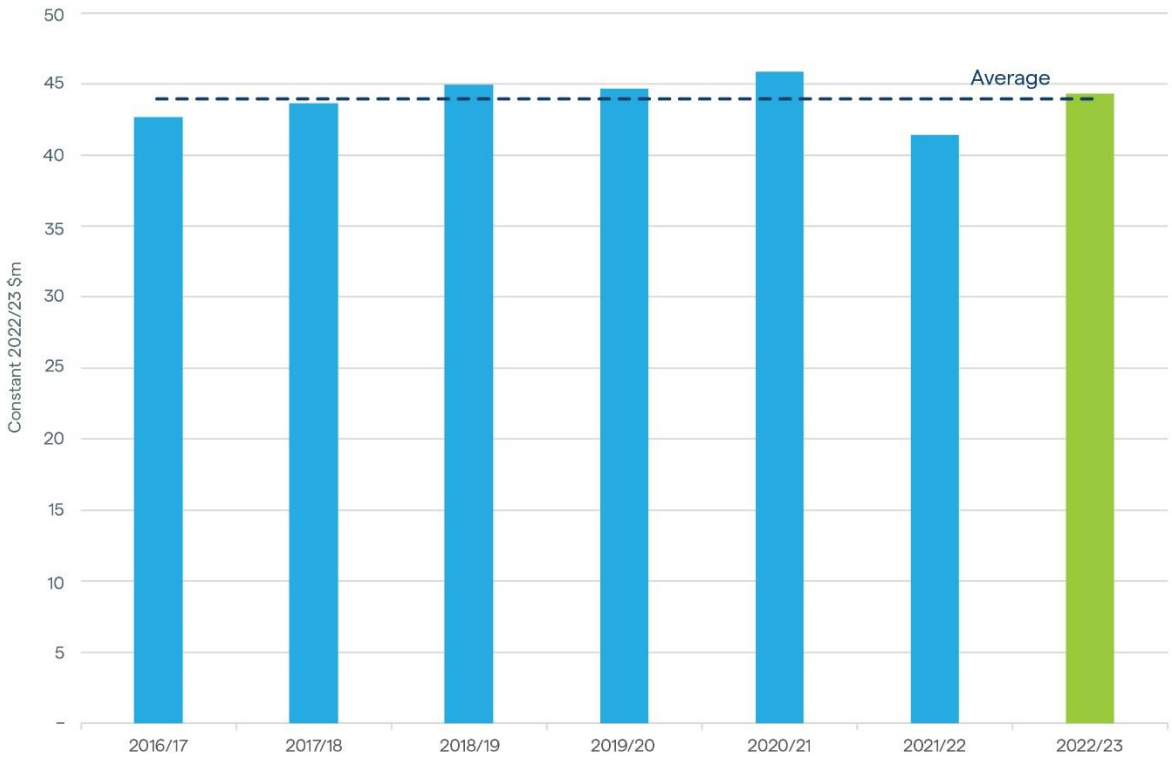
8.4.1.1 The base year

Most of the forecast expenditure for preventive maintenance is bottom-up. In 2022/23, preventive maintenance expenditure was in line with the historical average. Expenditure in 2021/22 had lower expenditure mostly due to an optimisation carried out to reduce our preventive maintenance field work costs, combined with the deferment of work in our grid skills training due to the grid services contract refresh.

We have made two adjustments for atypical costs in the base year:

- a small $0.14 million upwards adjustment for utilities costs
- a reduction of $2.6 million to reflect a transfer of management service fees to predictive maintenance.

Figure 34: Preventive maintenance base year



8.4.1.2 Step changes

We have identified several step changes required for RCP4 preventive maintenance. These are:

- **price increases**: preventive maintenance prices increased with the new service provider contracts; the last of these increases will feed through in the 2023/24 year
- **power cables**: a new requirement to undertake potential difference testing, which has a material cost per test
- **asbestos**: new inspections required to ensure the safety of our and service provider staff
- **outdoor junction boxes in switchyards**: new preventive maintenance to put in place a 5-yearly inspection to align with our outdoor junction box strategy.

8.4.1.3 Trends

We have accounted for the following trends in our preventive maintenance costs:

- increasing volumes of grid assets associated with the commission of new substations driving field work up
- grid skill (training) is increasing as we increase the overall workforce to deliver the required work in RCP4 and beyond; the forecast increase is linked to our capex plan.

8.4.1.4 Base-step-trend summary

Table 32 summarises the expenditure components of the base-step-trend method applied to preventive maintenance.

Table 32: Preventive maintenance – base-step-trend summary (2022/23 $m)

Component	Description	RCP4 opex ($ million)
Base	2022/23 base year	210.0
Step	Price increases	20.5
	Power cables	
	Asbestos	
	Outdoor junction boxes in switchyards	
Trends	Additional substation	6.6
	Grid skills training	
	0.5 per cent per year productivity challenge	-4.5
TOTAL	**Excludes real price effects**	**232.6**

8.4.2 Predictive

Predictive maintenance focuses on defects identified through preventive maintenance and asset information feedback processes. Our objective for predictive maintenance work is to ensure that deferred maintenance is addressed and asset health is managed in line with our strategic objectives. Unlike corrective maintenance, this work occurs prior to failure.

Table 33: Predictive maintenance drivers

Maintenance drivers	Work activities
Asset condition Asset criticality Compliance with safety regulations	Rectifying defects Targeted condition monitoring Vegetation control

In addition to the above, the predictive maintenance category also includes our opex on the following:

- operations
- non-asset-specific maintenance
- maintenance support
- contingency
- predictive maintenance field.

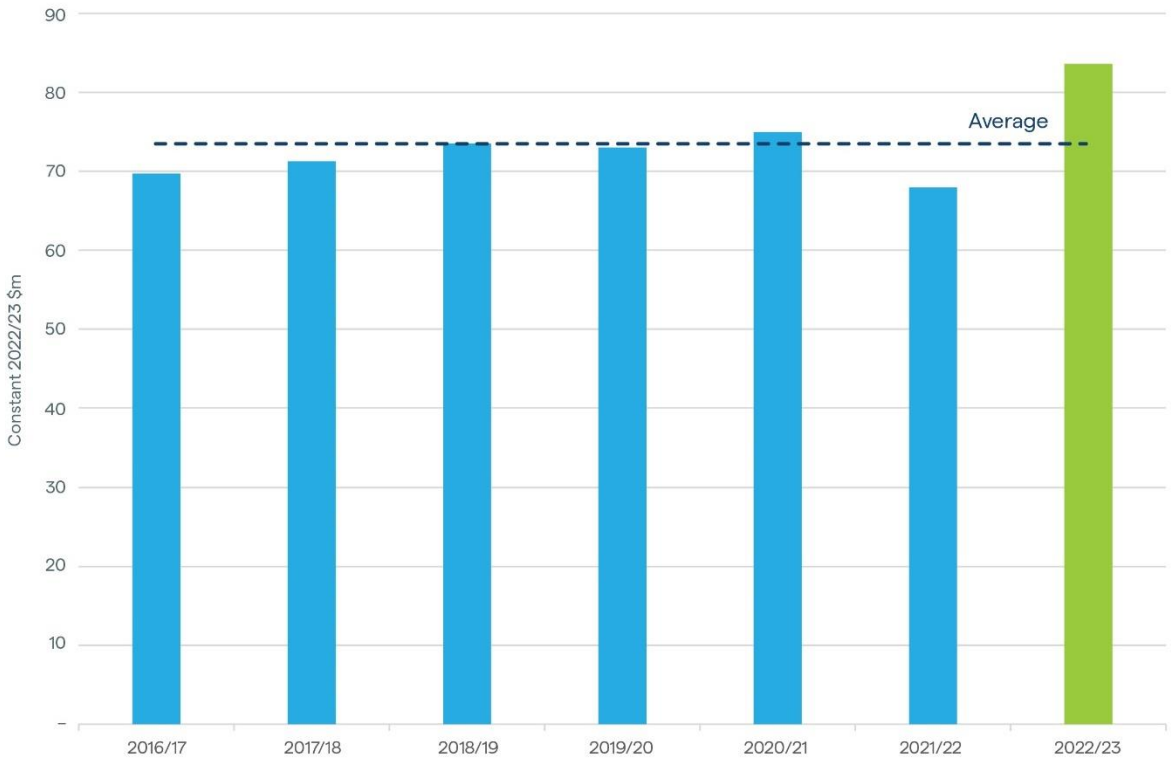
The expenditure on these aspects is estimated using a base-step-trend approach. The final two aspects of predictive maintenance opex are estimated using bottom-up forecasting:

- predictive maintenance field (large)
- maintenance projects.

8.4.2.1 The base year

Most of the forecast expenditure for predictive maintenance is base-step-trend.

Figure 35: Predictive maintenance base year



Predictive maintenance in 2021/22 was lower than the average predictive maintenance spend due to a planned reduction to allow for the introduction of the new grid services contracts.

We made a number of adjustments to the 2022/23 base year for atypical costs. These include:

- reduction due to the costs associated with Cyclone Gabrielle
- reduction from the reclassification of attachment points from opex to capex
- reduction of the provision for enterprise resource planning and underclearance
- increase from the transfer of management service fees from preventive maintenance.

The base year has been adjusted to align with the average contingency expenditure over the last 7 years.

8.4.2.2 Step changes

We have identified several step changes required for RCP4 predictive maintenance. These include:

- **SMS**: deploying new SMS/HMI configurations to site
- **ACS power cables**: rectifying issues due to an increase in outages
- **transmission lines conductors**: completing all priority one underclearance violations during RCP4
- **transmission lines towers**: managing towers to the end of life using a new tower modelling programme
- **transmission lines foundations**: increase in refurbishments and rectification of slope stability issues
- **ACS buildings and ground**s: more buildings need painting; new government policy requires changes to water infrastructure; and we have a new approach to safe roof access and leased buildings
- **transmission lines access**: increased information on the replacement needs of our access tracks, bridges. and culverts.

8.4.2.3 Trends

We have accounted for the following trends in our predictive maintenance costs:

- a material increase in grid works requiring an increase in inspection work, event investigations, defect management, and training
- higher payment to our service providers due to the increase in work.

8.4.2.4 Base-step-trend summary

Table 34: Predictive maintenance – base-step-trend summary (2022/23 $m)

Component	Description	RCP4 opex ($ million)
Base	2022/23 base year. Adjustments were made for a number of atypical costs, including Cyclone Gabrielle, and underclearance provision. Attachment points were also reclassified as capex	328.7
Steps	SMS	103.8
	ACS power cables	
	Transmission line conductor	
	Transmission line towers	
	Transmission line foundations	
	ACS buildings and grounds	
	Transmission line access	
Trends	Material increase in grid works	4.0
	Service provider payment	
	0.5 per cent per year productivity challenge	−8.3
TOTAL	**Excludes real price effects**	**428.2**

8.4.3 Corrective

Corrective maintenance work is usually identified directly because of a fault or during preventive maintenance inspections. The aim of corrective maintenance is to restore an asset to service following a fault, making it safe or secure, while preventing an imminent event that will likely cause damage, degradation, or an operational failure.

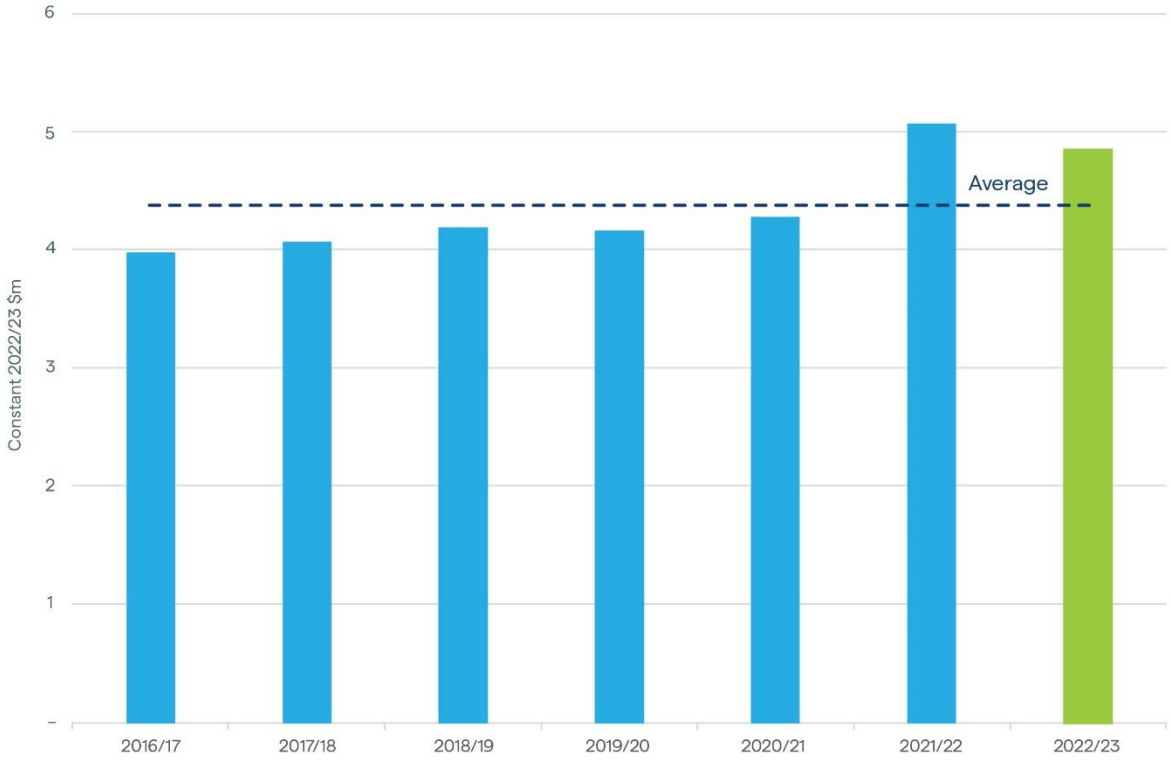
Table 35: Corrective maintenance drivers

Maintenance drivers	Work activities
Safety and reliability	Fault restoration Repairs Inspections

8.4.3.1 The base year

Figure 36 shows the comparison of the base year against the previous 7 years. Expenditure in 2022/23 is higher than the historical average; however, it is in line with 2021/22. We did not identify any atypical costs requiring adjustment to 2022/23.

Figure 36: Corrective maintenance base year



8.4.3.2 Step changes and trends

There are no identified step changes for corrective maintenance. There are no identified trends for corrective maintenance.

8.4.3.3 Base-step-trend summary

Table 36: Corrective maintenance – base-step-trend summary (2022/23 $m)

Component	Description	RCP4 opex ($ million)
Base	2022/23 base year	24.5
Step	No steps	0
Trends	0.5 per cent per year productivity challenge	−0.5
TOTAL	**Excludes real price effects**	**23.9**

8.4.4 Proactive

Proactive maintenance is improvement work initiated by formal analysis and investigation by the engineering or reliability teams. We use it to prevent future failure of equipment by determining potential root causes of failure and dealing with those issues before problems arise. Proactive maintenance activities are driven by either tactical or strategic reliability analysis and approved by a reliability engineer.

Table 37: Proactive maintenance drivers

Maintenance drivers	Work activities
Reliability Cost improvements	Special inspection Reliability-driven corrective work Condition monitoring

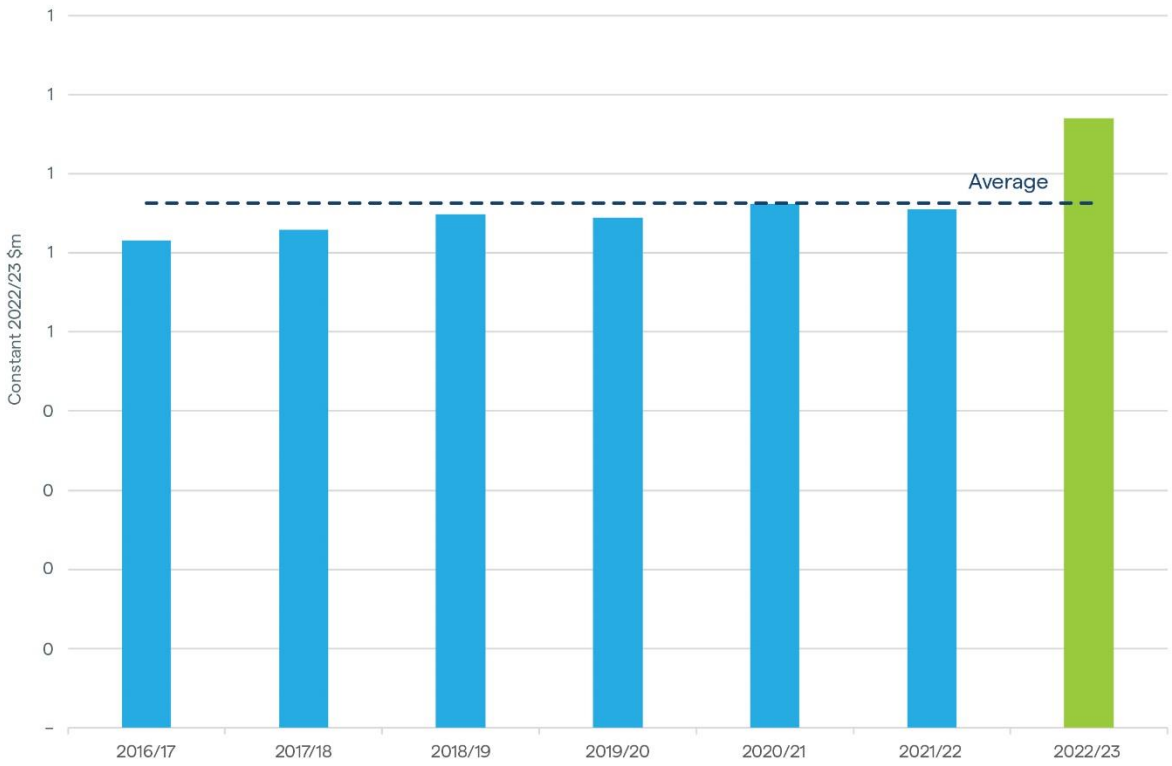
In addition to the above, the predictive maintenance category also includes our opex on proactive field work. This expenditure is estimated using a base-step-trend approach.

8.4.4.1 The base year

Current proactive maintenance work volumes are low. The process for categorising work as proactive maintenance is not yet well established, and this work has generally been categorised as predictive maintenance in the past (usually as maintenance projects). Our RCP3 submission assumed a constant expenditure in proactive maintenance. However, as our categorisation processes mature, we intend to classify more spend as proactive, with predictive work reducing accordingly. This will enable us to better track our progress towards good practice spend ratios.

Figure 37 shows the comparison of the base year against the previous 7 years. While 2022/23 expenditure is above the historical average, this is on very low volume and expenditure. We did not identify any atypical costs requiring adjustment.

Figure 37: Proactive maintenance base year



8.4.4.2 Step changes

Previously, bird mitigation was carried out reactively under predictive maintenance with a limited budget. It has been transferred to proactive maintenance with an increase in allocated funding to reduce bird streaming causing unplanned outages.

8.4.4.3 Trends

We are not currently forecasting any trends for proactive maintenance.

8.4.4.4 Base-step-trend summary

Table 38: Proactive maintenance – base-step-trend summary (2022/23 $m)

Component	Description	RCP4 opex ($ million)
Base	2022/23 base year	3.9
Step	Bird mitigation	1.6
Trends	0.5 per cent per year productivity challenge	−0.1
TOTAL	**Excludes real price effects**	**5.4**

8.4.5 Changes since our consultation

We received no specific feedback on our RCP4 plan for maintenance opex during our October 2022 consultation. Feedback from the verifier was positive and verified our planned expenditure.

In the preparation for this proposal, we identified minor timing, scope, and volume changes and updated our expenditure forecasts in constant terms to 2022/23 values. Higher prices are the biggest driver of the change in forecast expenditure from what the verifier reviewed.

Table 39: Changes to maintenance since our consultation (constant 2022/23 $m)

	Consultation forecast (September 2022)	Verifier review	Proposal
Grid maintenance	662.1	656.8	690.1

8.5 Asset management and operations

Asset management and operations primarily encompasses the staff and consultancy costs associated with work activities in our three grid divisions: development, delivery, and operations.

These divisions encompass:

- tactical engineering and estimation
- strategic performance and risk management
- asset managing planning
- system planning and investment

- planning scheduling and optimisation
- outage planning
- grid operations
- grid project management.

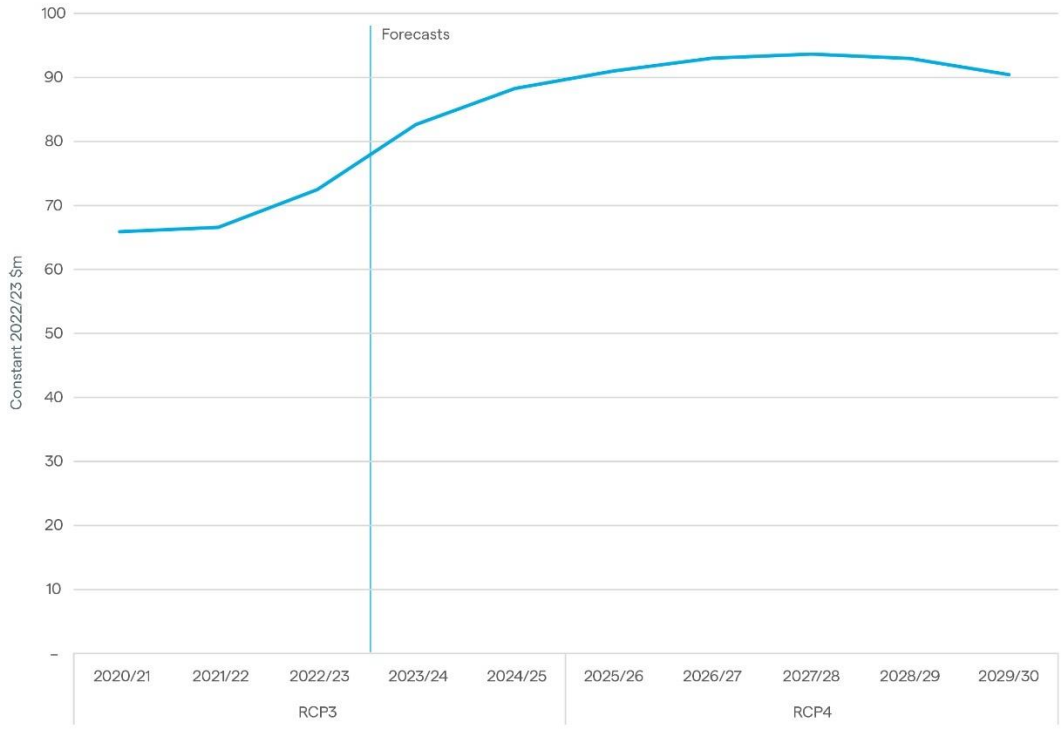
For the purposes of this proposal, we have also classified procurement and supply, landowner relations, and property and environment functions within asset management and operations. This expenditure enables all work on the grid.

Asset management and operations activities include:

- long-term strategic planning for network assets
- providing the required service levels, including grid investigations into potential improvements to the grid or business processes
- tactical planning to develop solutions to maintain and enhance the asset base in line with long-term development strategies
- programming and scheduling of works
- safe and efficient delivery of project-based enhancements, refurbishments, and renewals
- interfacing with service providers for scheduling and efficient delivery of maintenance programmes
- efficient day-to-day grid operation and real-time management of operating centres
- funding electricity market ancillary services of black start, over-frequency reserves, and reserves event charges
- the delivery of capital projects.

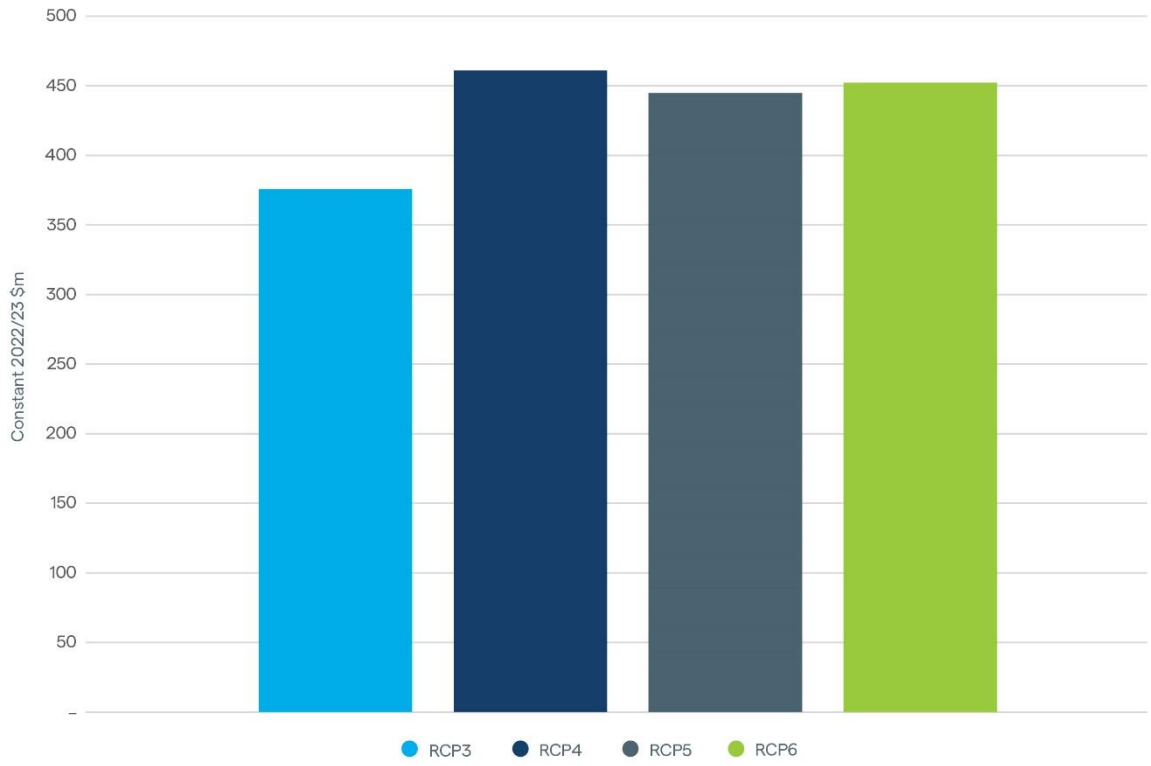
We forecast our RCP4 operating costs using a base-step-trend methodology starting with 2022/23 as the base year. We expect a material step change due to increasing grid workload. This step change has already started in RCP3. Our RCP3, actual and forecast, and RCP4 forecast spend is shown in Figure 38.

Figure 38: Comparison of asset management and operations forecast expenditure over time (2022/23 $m)



We forecast an increase in our asset management and operations activities is needed through into RCP6 to continue to support our investment needs.

Figure 39: Comparison of asset management and operations forecast expenditure over RCPs (constant 2022/23 $m)

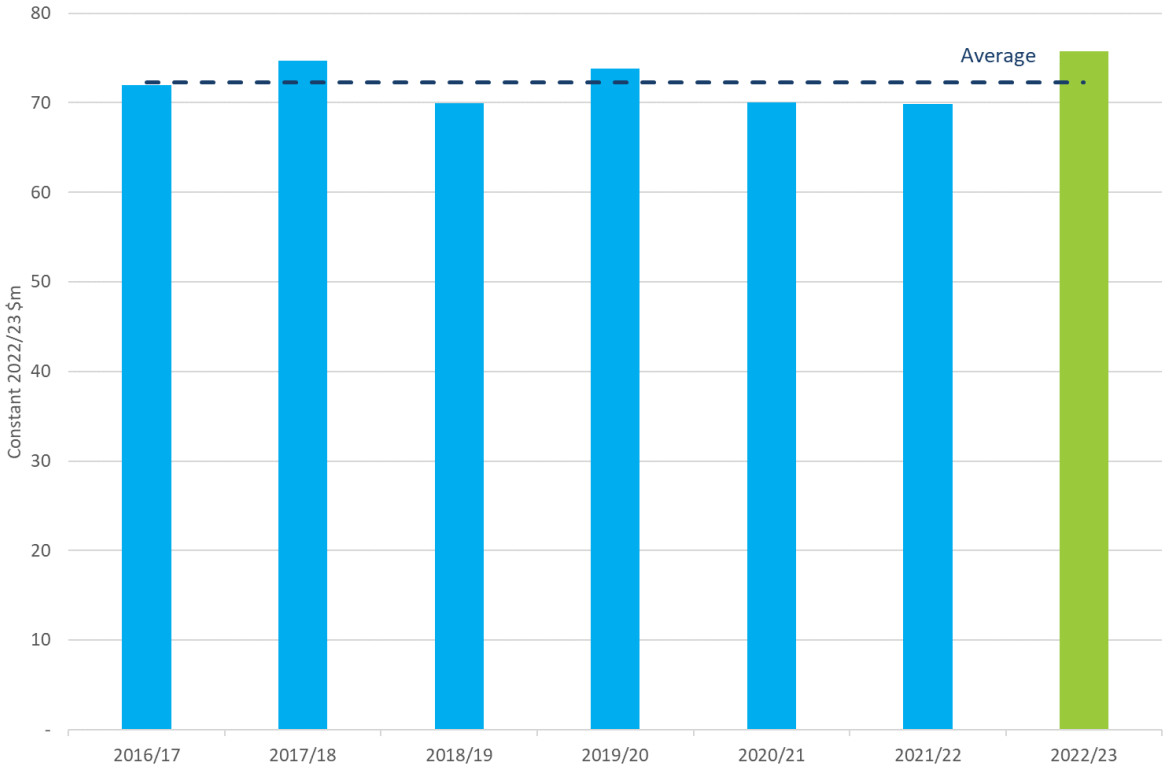


8.5.1 Base year

We reviewed our expenditure in the base year against historical levels and removed any atypical one-off costs. The asset management and operations expenditure in constant terms was relatively constant through the end of RCP2 into RCP3.

We consider our proposed base year of 2022/23 reflects a prudent and efficient level of expenditure.

Figure 40: Historical asset management and operations spend (2022/23 $m)



We made the following key adjustments to the base year for atypical costs:

- removed investigation costs that were already considered in steps
- planned recruitment in 2022/23 that was not completed or staff were recruited part way through the year.

8.5.2 Step changes

For RCP4, we need to increase our workforce capability and capacity to deliver our investment plan. This means a step change in the number of employees we need in all areas of our asset management and operations portfolio. The increase is based on a historical analysis of the opex required to support our capital programme, plus an adjustment for economies of scale and efficiencies.

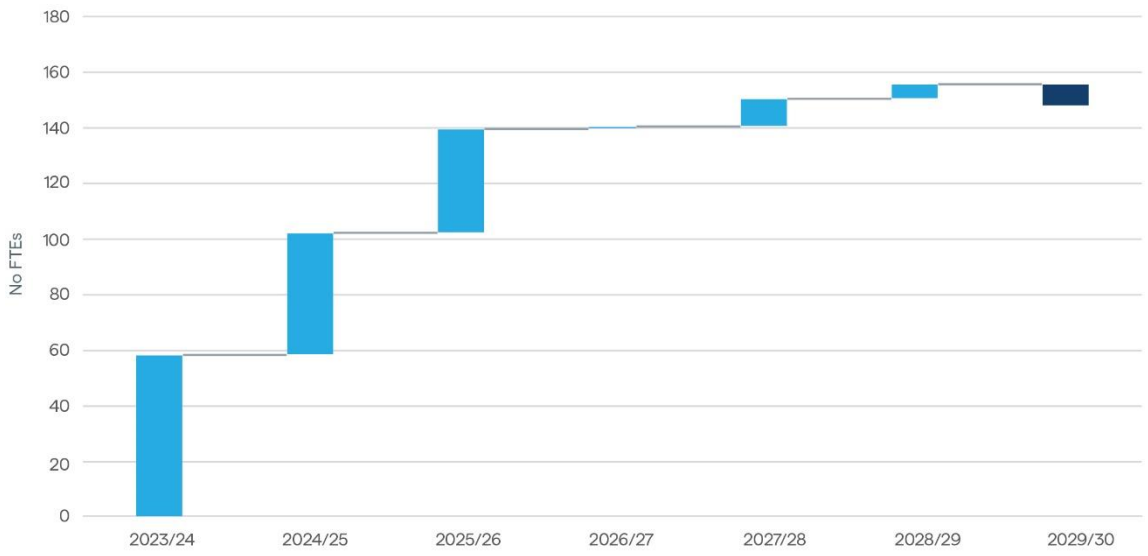
To ensure people are available to resource our RCP4 plan, we have started investing in RCP3. Across our operations, grid delivery, and grid development divisions, our current plan includes a forecast 17 per cent increase in FTEs from 2022/23 to 2029/30 (the end of RCP4). We have added an additional 41 FTEs during RCP3 to increase our project management capabilities, improve our cost estimation, and increase our procurement function to support our capex plans and manage supply chain disruptions.

Key workforce growth drivers include the:

- increase in base capex and associated system studies, project investigations and supporting asset modelling, asset strategies, and procurement and supply requirements
- forecast MCP work programme of approximately $1 billion (such as NZGP). These projects have an impact on the system planning and investment and tactical groups
- forecast $500 million in customer connections and regional development grid projects impacting system planning and investment and tactical noting
- increasing focus on the centralisation of works planning and scheduling
- increasing complexity of transmission equipment
- increasing regulatory (including environmental) and compliance requirements
- uplift in the work programme requiring more planned outages. These outages are becoming more complex to coordinate against a tighter power system and challenging voltage management and security scenarios
- increase in the work programme resulting in the need for increased environmental approvals, landowner access, and property rights negotiations.

We show our forecast of additional asset management and operations FTEs required to deliver our work programme over RCP4 and into the future in Figure 41.

Figure 41:Asset management and operations forecast workforce capacity growth: FTE employees and contractors



This is FTE growth. We plan to capitalise around 41 per cent of the new employees' time, therefore only 59 per cent of the employees' costs are included in asset management and operations opex.

We have also included a step change for instantaneous reserve event charges.[42] We have experienced a few of these charges under the Electricity Authority's strict causer regime; however,

[42] *Electricity Industry Participation Code*, Clause 8.64.

we do not have a charge in the base year. We have estimated the amount based on the average charge on causers over RCP2 and RCP3 to date, and forecast an estimate of three events for RCP4.

8.5.3 Trends

We do not use an output growth trend for asset management and operations, instead we rely on the step changes linked to our work programme growth. We apply changes in real price affects separately. The impact of these can be found in the Expenditure Forecasts workbook, which accompanies our proposal.

8.5.4 Base-step-trend summary

Table 40 summarises the expenditure components of base-step-trend method applied to asset management and operations.

Table 40: Asset management and operations – base-step-trend summary

Component	Description	RCP4 opex ($ million)
Base	2022/23 base year. Adjustments were made for the following atypical costs: • removed investigation costs already considered in steps • planned recruitment in 2022/23 that was not completed or had staff recruited part way through the year	366.2
Step	Increased FTE count to support our investment plan	72.0
	Reduced capitalisation of real-time systems staff	4.5
	Supporting service provider workforce growth	19.1
	Pre-capex investigations for MCPs, base capex, resilience, and sustainability	7.7
	Instantaneous reserve event charges	0.6
Trend	Ongoing productivity challenge We have applied a 0.5 per cent productivity challenge	−8.3
TOTAL	**Excludes real price effects**	**461.8**

8.5.5 Changes to asset management and opex since our consultation

We did not receive specific feedback on our RCP4 plan for asset management and operations expenditure during our October 2022 consultation.

Feedback from the verifier was largely positive and verified our expenditure.

In the preparation for this proposal, we identified minor timing, scope, and volume changes and updated our expenditure forecasts in constant terms to 2022/23 values. Specific changes include:

- 11 additional FTEs to support our larger resilience programme
- higher base year costs
- the additional $0.6 million for the instantaneous reserve event charges.

Table 41: Changes to asset management and operations since our consultation (constant 2022/23 $m)

	Consultation forecast (September 2022)	Verifier review	Proposal
Asset management and operations opex	439.0	435.0	461.8

8.6 Business support

8.6.1 Business support opex

Business support functions encompass the staff and consultancy costs associated with activities that support the delivery of our investment programme and support our asset management and operations activities. It covers the internal costs of permanent employees and contractors of six divisions.

- IST
- External affairs
- Corporate services
- Corporate governance
- People
- Customer and strategy

It excludes any capex. For the purposes of reporting against our regulatory categories, the following categories, which for business reasons are incorporated in business support, are reported in the asset maintenance and operations regulatory category:

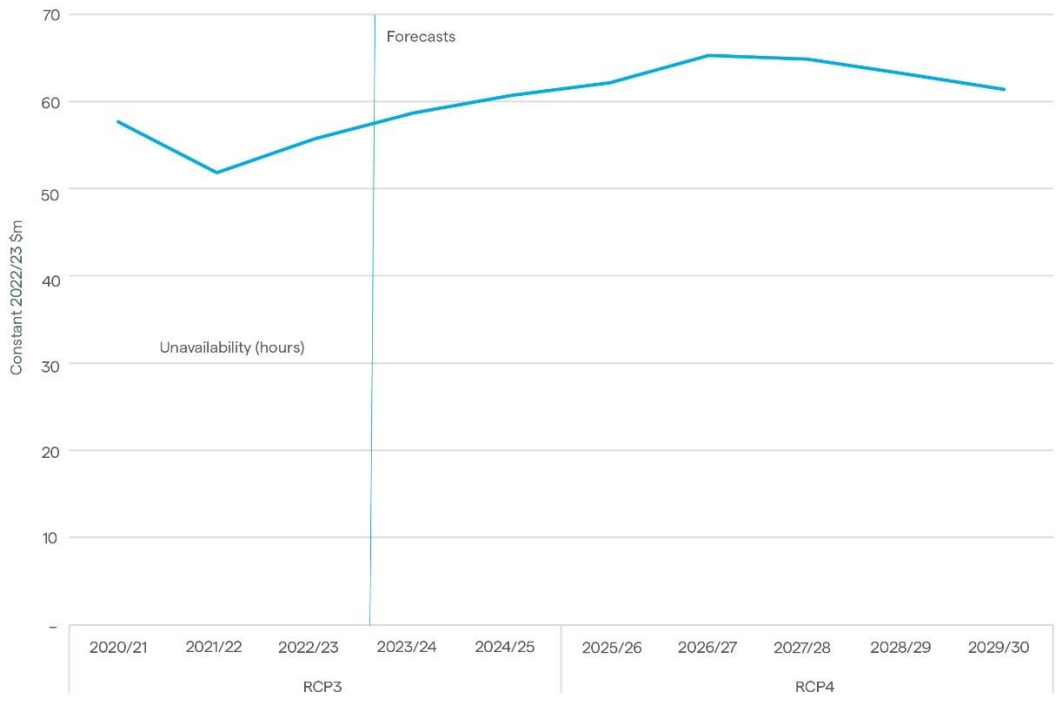
- procurement and supply
- landowner relations
- environmental policy and planning.

Business support opex is directly linked to our planned investment, including ICT, asset management and operations, and maintenance. During RCP4, business support opex will primarily be driven by:

- staff numbers and size of the work programme (this affects all elements of business support costs, including staff numbers and costs, legal and contractor fees, and office rental costs)
- the ICT capital plan
- an increasingly complex legislative and regulatory environment
- an increasing focus on stakeholder engagement
- the implementation of the transmission pricing methodology.

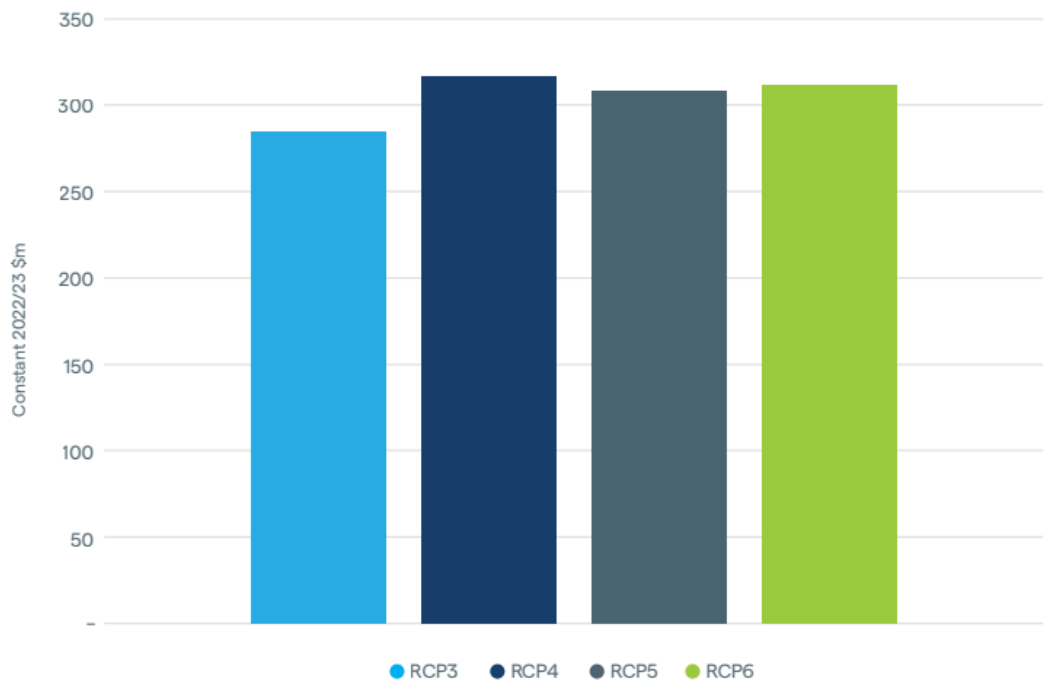
We used historical data, adjusting for efficiencies and new requirements, to forecast the number of business support staff required to support our work programme. Our current plan includes a forecast 14 per cent increase in FTEs from 2022/23 to 2029/30 (the end of RCP4) across business support.

Figure 42: Comparison of business support forecast expenditure over time (2022/23 $m)



We forecast the increase in our business support functions will be sustained through into RCP6.

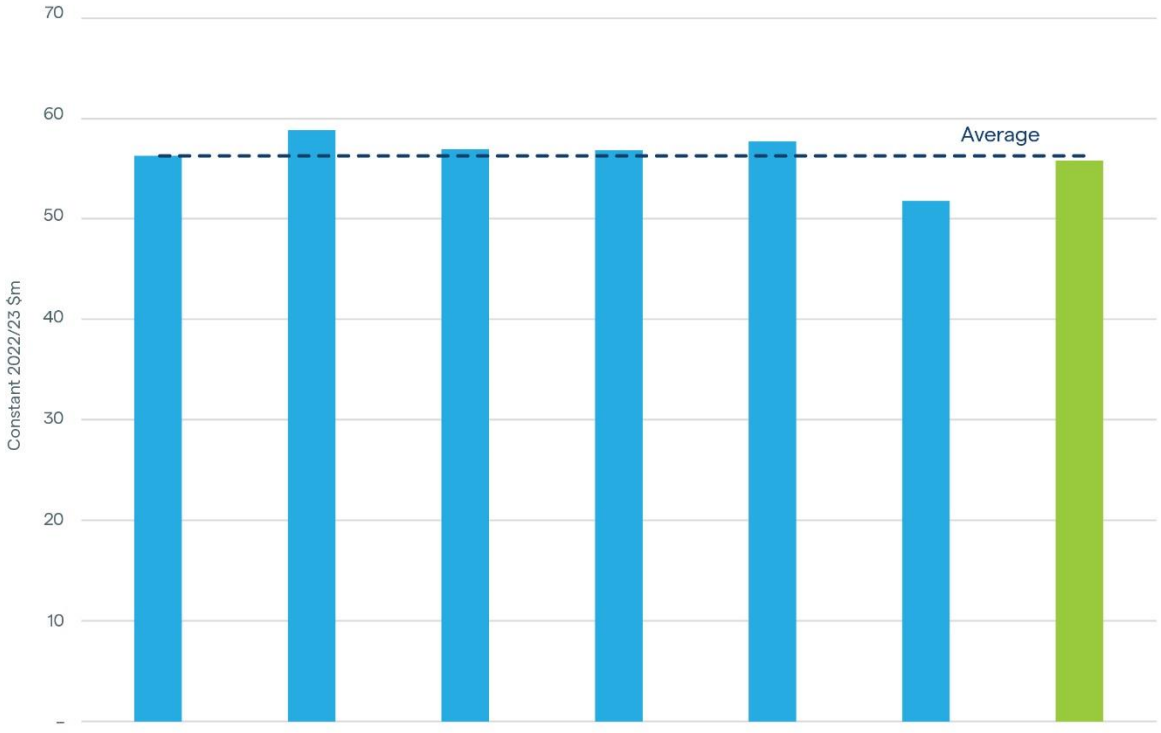
Figure 43: Comparison of business support operating forecast expenditure over RCPs



8.6.1.1 Base year

We forecast our RCP4 operating costs using a base-step-trend methodology. This starts with 2022/23 as the base year, with a few adjustments for atypical costs. The spend is slightly lower than the average for the last 7 years as we continue to lower costs using a combination of factors. These include lower net personnel costs and a reduction in travel costs due to increased use of technology.

Figure 44: Historical business support spend (2022/23 $m)



We have made the following key adjustments to the base year for atypical costs:

- we expect to spend less on consultancy going forward
- changes in planned recruitment in 2022/23 where recruitment was not completed or occurred part way through the year.

Business support expenditure in constant terms has been relatively stable through the end of RCP2 into RCP3. We consider our proposed base year reflects a prudent and efficient level of expenditure.

8.6.1.1.1 Step changes

For RCP4, we need to increase our workforce capability and capacity to deliver our investment plan. This means a step change in the number of employees we need in all areas of business support. The increase is based on a historical analysis of the opex required to support our capital programme, plus an adjustment for economies of scale and efficiency. We also have specific staffing requirements linked to the TransGO Refresh programme.

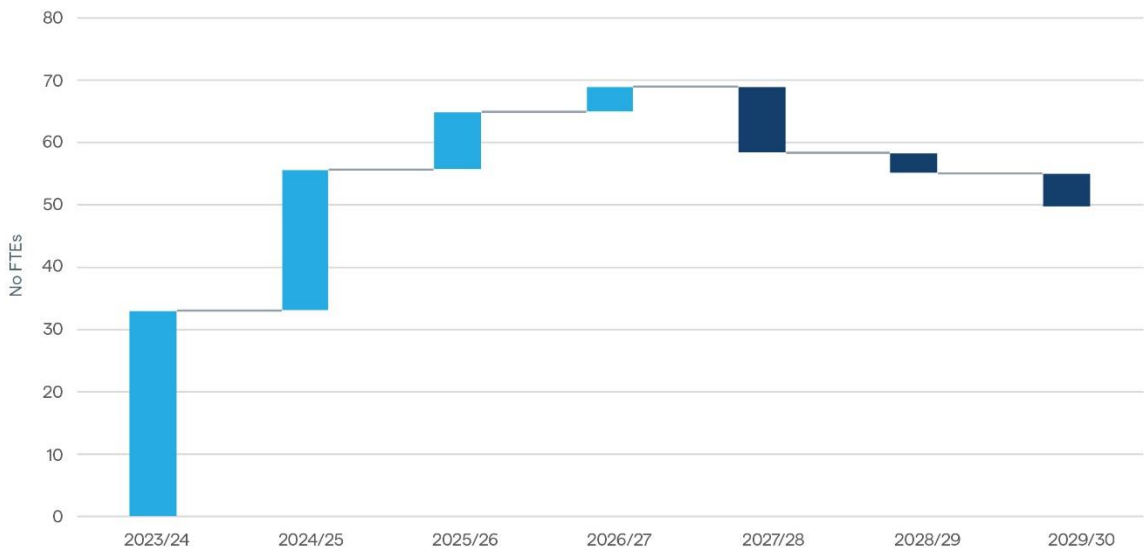
To ensure we have the people available to resource our RCP4 plan, we have started investing during RCP3. Across our business support divisions, our current plan includes a forecast 14 per cent increase in FTEs from 2022/23 to 2029/30 (the end of RCP4).

The key workforce growth drivers include:

- an increase in maintenance and enhancement work on the grid and an increase in major capital projects and customer connections
- a temporary increase in FTEs to support the TransGO Refresh programme
- modernisation of key applications and the introduction of enterprise business capability
- increased investment in grid connections, which will result in an increase in demand for telecommunications services
- an increase in staff, resulting in a requirement for an increase in support services, trainers, and management
- increasing resource management, climate change, sustainability, biodiversity, and worker exploitation regulatory obligations
- increased volume and complexity of key regulatory instruments such as the input methodologies, RCPs and transmission pricing methodology regimens, driving a need for further legal and regulatory resource in legal and regulatory, modelling, and customer pricing .

We show our forecast of additional business support staff required to support the delivery of our work programme over RCP4 and into the future in Figure 45.

Figure 45: Business support workforce forecast capacity growth: FTE employees and contractors (steps from 2022/23)



We plan to capitalise around only 10 per cent of the new employees' time, therefore 90 per cent of the employees' costs will be allocated to business support opex. The majority of the capitalised time relates to ICT staff.

We also expect to undertake an operational review of the transmission pricing methodology. We expect this will cost approximately $1.5 million opex.

8.6.1.1.2 Trends

Within the base-step-trend framework, long-term changes in output (for example, to allow for expected changes in the size of the business) are modelled as trend factors. However, as business support costs are largely driven by the workforce size, which is in turn driven by our capex plan, we have modelled the upward trend in outputs via the step changes.

We have applied a productivity adjustment to reflect expected ongoing productivity improvements. We have assumed an annual improvement of 0.5 per cent in productivity. This is based on independent advice from NZIER using historical changes in labour productivity in industries undertaking similar activities as Transpower.

The adjustment for productivity improvements reduces our RCP4 opex forecast by $5.6 million.

8.6.1.1.3 Base-step-trend summary

Table 42 summarises the expenditure components of the base-step-trend method applied to business support.

Table 42: Business support base-step-trend summary

Component	Description	RCP4 opex ($ million)
Base	2022/23 base year. Adjustments were made for the following atypical costs including for FTEs and consultancy	279.5
Step	Increased FTE count to support our work programme	34.6
	Resource initiatives	4.5
	Implementation of the new transmission pricing methodology and operational review	4.6
	RCP5 preparation	2.8
Trend	We have applied a 0.5 per cent productivity challenge	−5.9
TOTAL	**Excludes real price effects**	**320.1**

8.6.2 Business support capex

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. Business support capital expenditure covers:

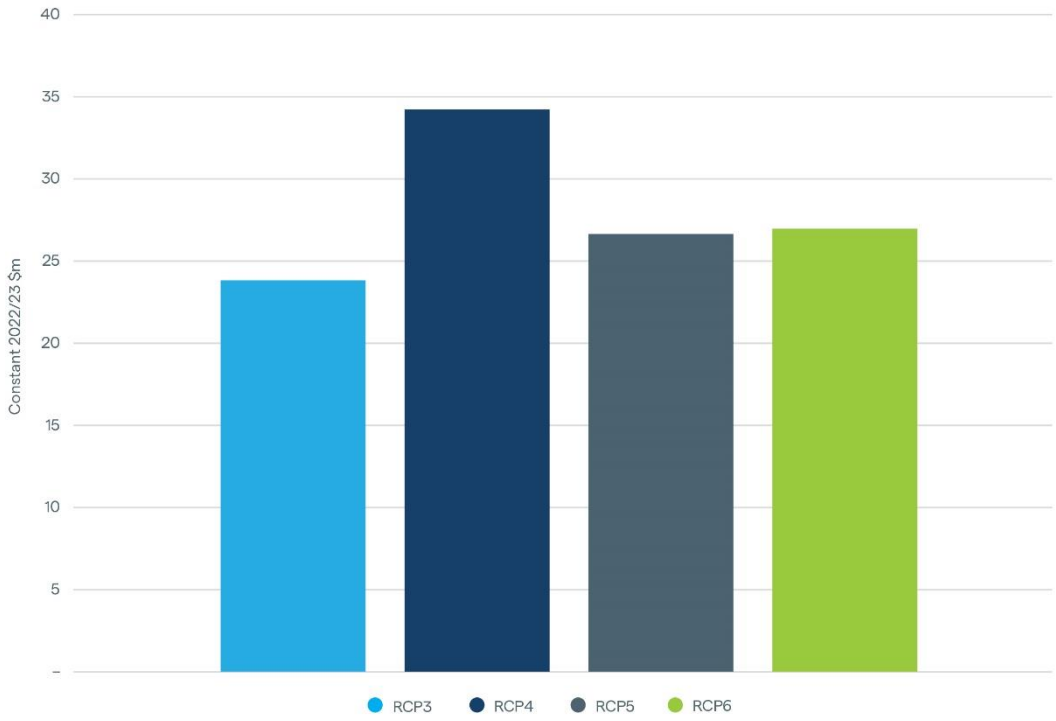
- office buildings
- vehicles
- minor fixed assets – office equipment
- minor fixed assets – information technology and other
- residential houses.[43]

More information

Please refer to our Asset Management Plan 2023.

We forecast business support capex for RCP4 of $34.7 million. This is an increase of 44 per cent compared with RCP3. The increase is largely driven by the need to increase our training capacity to support our service providers in training additional new grid workers.

Figure 46: Business support forecast capex (constant 2022/23 $m)



[43] Our residential houses are commonly located on substation land and largely held for emergency housing during fault response.

8.6.3 Changes to business support expenditure since our consultation

We did not receive specific feedback on our RCP4 plan for business support expenditure during our October 2022 consultation.

Feedback from the verifier was largely positive, and it verified most of our expenditure. However, it considered that 37.1 per cent of forecast expenditure ($16 million) relating to an upgrade of the Wellington office needed its own investment plan and business case. We have excluded this amount from our RCP4 proposal while we consider whether it is required in RCP5.

In addition to the above, we identified minor timing, scope, and volume changes and updated our expenditure forecasts in constant terms to 2022/23 values.

Table 43: Changes to business support since our consultation (constant 2022/23 $m)

	Consultation forecast (September 2022)	Verifier review	Proposal
Business support opex	313.6	331.4	320.1
Business support capex	36.5	46.1	34.7

8.7 Insurance

We procure approximately $1 billion of external insurance cover annually. This is to mitigate financial risks associated with damage to our property and provide liability for damage we might inadvertently cause to others in the normal conduct of our business. Insurance primarily covers financial consequence from catastrophic event risk as well as higher-frequency risks we have identified as appropriate to insure.

We both self-insure (for risks we consider appropriate) and externally insure (for risks we consider it prudent to cover externally). Our use of a captive insurer enables us to retain a reasonable amount of risk and to reduce the use and cost of transferring risk to third-party insurers.

8.7.1 Insurance approach

We use our captive insurer, Risk Reinsurance Limited, where risks are small, where market-based cover is unavailable or expensive, and where we think we have a better understanding of the risks than the market and can therefore price the risk more accurately and lower than an external insurer.

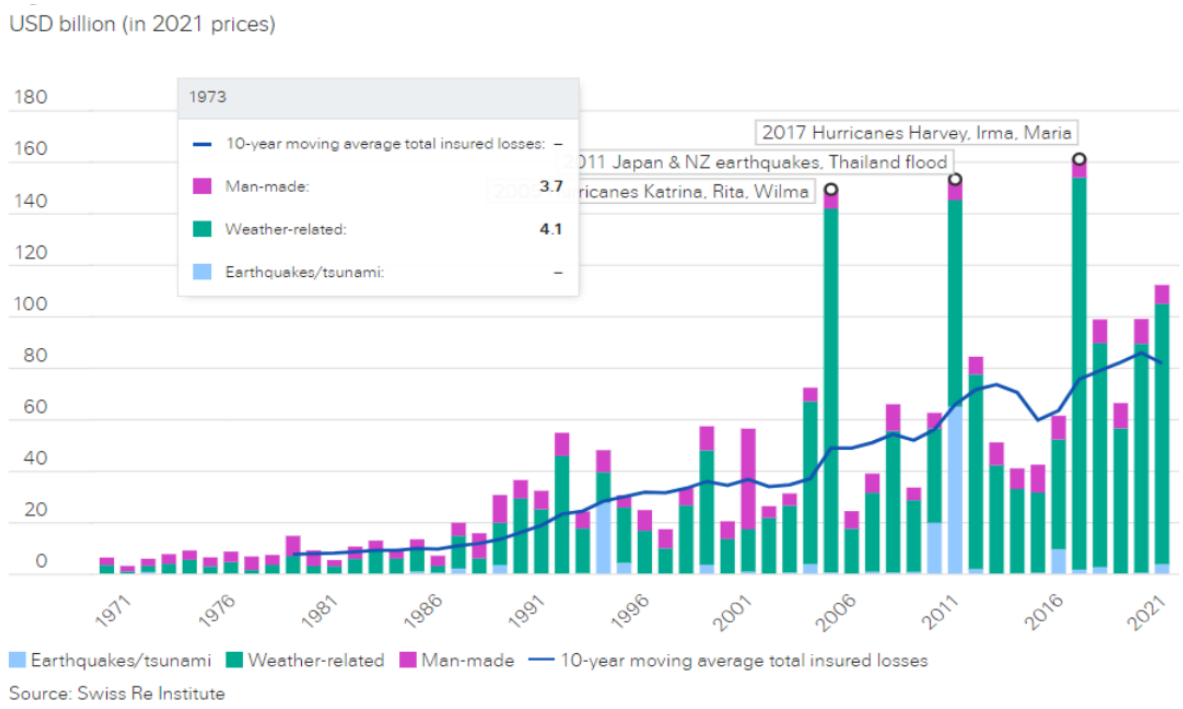
Our use of a captive insurer enables us to retain a reasonable amount of risk and to reduce the use and cost of transferring risk to third-party insurers. For example, our material damage and business interruption cover is for $750 million; $740 million of that cover is provided by external insurers, but we retain $10 million of risk within Risk Reinsurance Limited.

Our overall approach (the mix of external insurance and self-insurance) keeps our insurance premiums low while transferring significant risks externally to avoid significant profit and loss

volatility following catastrophic events. The procurement of adequate insurance cover means we can be confident that we can continue to deliver a reliable grid for the long term without having to unreasonably call on additional resources from our shareholders or consumers.

Insurance premiums are driven by perception of risk, loss experience, availability of capital, and insured values. This means premium movements vary significantly from inflation. Premium rates respond quickly to catastrophic events such as earthquakes, hurricanes, and flooding. Climate change is leading to more frequent and more severe weather events. These events are driving up premiums.

Figure 47: Globally Insured losses (1970–2021)



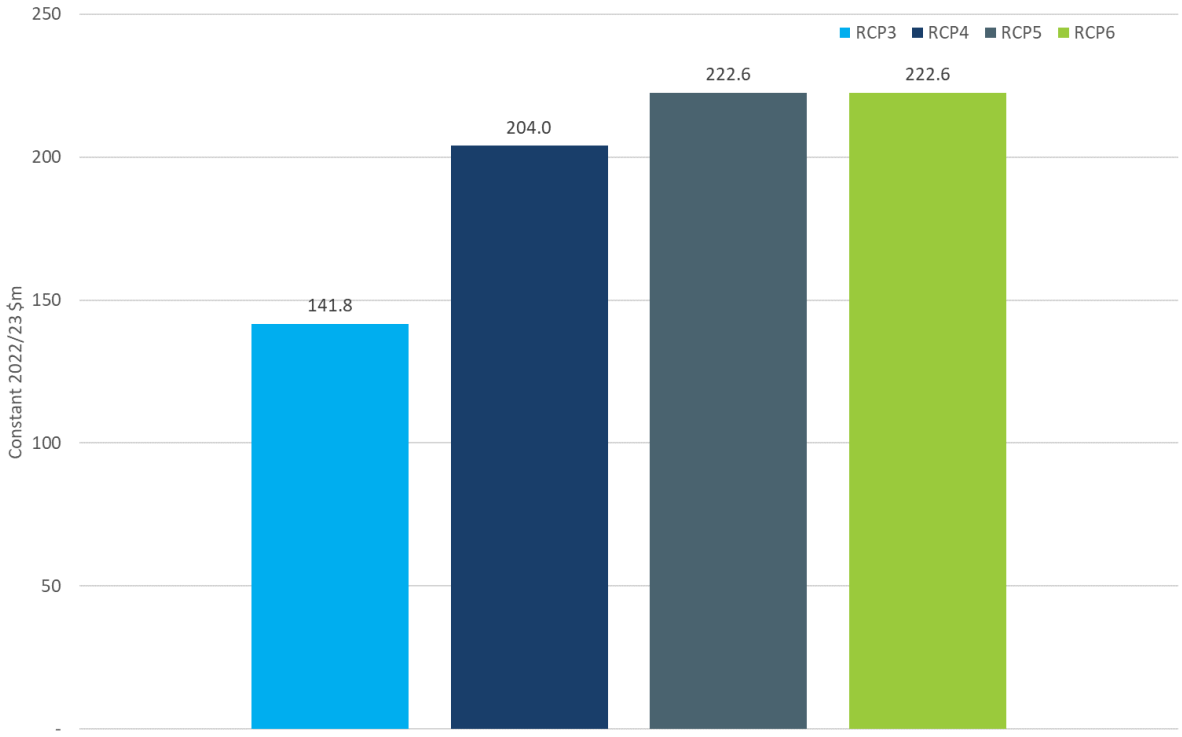
The primary determinants of insurance opex are the insurance type, the volume we purchase, and market pricing. To ensure that we insure prudently, we observe other similar-sized organisations' insurance approaches and receive advice from insurance brokers. Like utilities worldwide, we are facing a significant increase in our insurance costs and will incur higher than expected insurance costs during RCP3. We forecast that our RCP3 insurance costs will be over $132 million; in our RCP3 proposal, we forecast insurance costs of slightly over $100 million.

We forecast, based on external advice, an increase of close to $50 million in RCP4 over our RCP3 expenditure. This includes an increase in coverage for bushfires in response to climate change risk. We have built into our forecast increased costs due to premium rises and the increase in the value of our assets.

Our forecasts are for premiums 7 years ahead; we are concerned that if the frequency of severe weather events increases above what is built into our forecasts, we will be unable to cover our insurance costs without reducing spending in other areas. To mitigate this risk, we considered proposing an uncertainty mechanism to allow for an adjustment to our allowance if outturn insurance costs were above/below a certain threshold. This would balance the risk between

Transpower and consumers if the outturn costs were materially higher or lower than forecast. However, based on feedback from the verifier, we have decided not to include the uncertainty mechanism in our proposal.

Figure 48: Comparison of insurance operating forecast expenditure



Our approach to forecasting insurance opex is primarily based on actuary and insurance broker expert forecasts. This relies on information about the value of our existing assets and replacement costs and the broker's and actuary's views on premium increases.

Our proposed resilience spend (see Chapter 9.0) does not impact our insurance premiums for RCP4. This is because:

- we do not purchase business interruption cover (other than for HVDC substations)
- while the resilience spend may help mitigate claim values, this would mitigate increases above the premium trend increase and, if this did impact, we would not see it until RCP5 at the earliest.

8.7.2 Base-step-trend summary

Steps are driven by specific changes to our policies for additional risks we consider it is prudent to cover for. Independent expert advice drives the trends in our forecast premiums.

Table 44: Insurance – base-step-trend summary

Component	Description	RCP4 opex ($ million)
Base	2022/23 base year. Adjustments were made to match actual premium rates for September 2023 to August 2024	136.9
Step	Increase in risk premium	9.4
Trend	Asset and replacement cost growth and actuarial forecasts Increase in premiums prices over CPI We do not include a productivity adjustment for insurance premiums as this implicit in the broker/actuarial forecasts	34.8
Total	**Includes real price effects**	**181.1**

8.7.3 Changes to insurance expenditure since our consultation

We did not receive specific feedback on our RCP4 plan for insurance expenditure during our October 2022 consultation.

The verifier verified all of our insurance and did not raise any concerns with our approach.

We provided to the verifier expenditure forecasts that were developed prior to the extreme weather events in early 2023 and our annual renewal process in August 2023. However, our forecast has come down as actual premiums for 2022/23 were lower than forecast.

Table 45: Insurance changes since our consultation (constant 2022/23 $m)

	Consultation forecast (September 2022)	Verifier review	Proposal
Insurance	193.5	195.9	181.1

9.0 Resilient network

As a lifeline utility, Transpower must be able to function to the fullest possible extent, during and after an emergency, even though this may be at a reduced level. To achieve this, we work to understand the network vulnerabilities and acceptable risk levels. Our job is to anticipate the future.

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. To achieve this, we work to understand the network vulnerabilities, service impacts, and acceptable risk levels for a range of credible resilience threats, including common mode failures, cyber-attacks, and natural hazards. Climate change exacerbates many natural hazards.

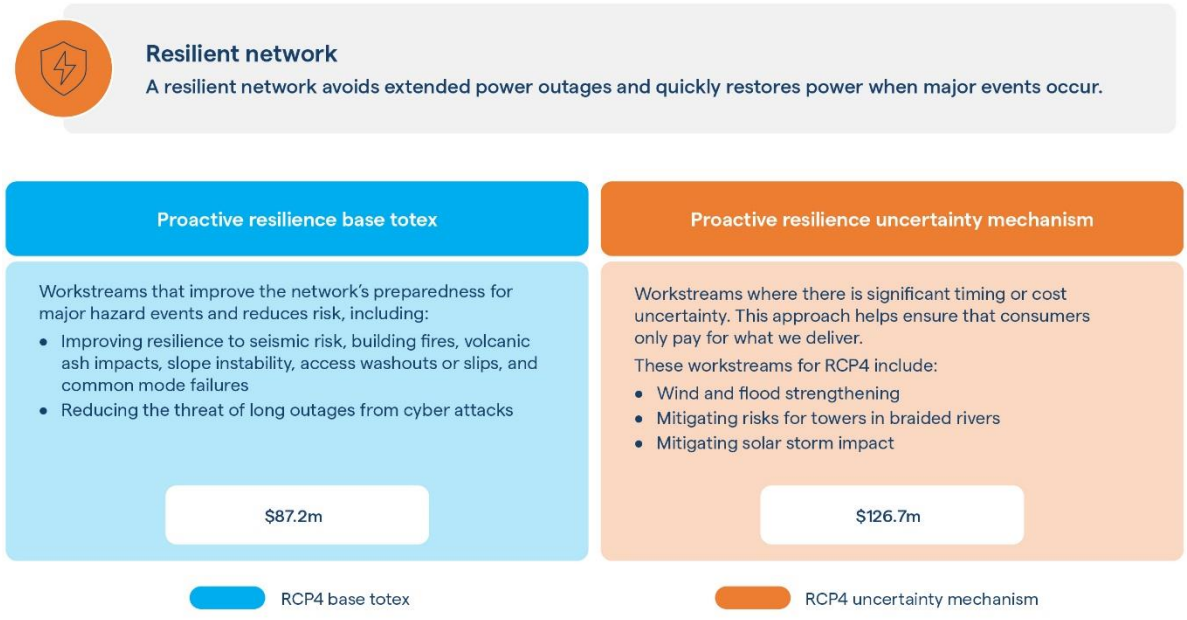
Stakeholder expectations of a resilient electricity system are increasing, and greater reliance on electricity due to decarbonisation and for transportation and heating, will further increase expectations of a resilient transmission service.

The expenditure we are seeking for our proactive resilience plan makes up 4.6 per cent of the RCP4 total ($213.9 million). This expenditure is proactive and will help to maintain expected service levels in the context of significant and increasing resilience threats and changing stakeholder expectations.

More information

Additional detail on how we have developed our resilience plan within the context of our wider plan is provided in our Asset Management Plan 2023.

Figure 49: Delivering a resilient network



Reliability and resilience are connected. Service reliability primarily focuses on lower-impact frequent events, whereas resilience is more concerned with events with larger impact. Resilience expenditure can help improve reliability; however, our resilience expenditure does not impact our proposed RCP4 service measures (see Chapter 7.0). This is because the Commission adjusts for major unexpected events to ensure they do not appreciably impact our service level targets.

We deliver resilience benefits through our wider work plan by building back better. For example, when we replace or refurbish assets, we build to meet the latest standards. Given that a large part of the grid was built to now superseded standards, the expenditure included in our 'reliable and safe network' outcome provides an opportunity to progressively deliver resilience benefits as part of routine lifecycle investments.

Where lifecycle investments or upgrades are over a decade away, for RCP4 and beyond, we are proposing a proactive resilience plan that identifies and delivers work primarily driven by resilience needs. This plan includes hardening assets to major hazards and investments in readiness to assist in our response and recovery after a major event. For RCP4, we propose that this is funded partly as base capex and opex and partly through a new uncertainty mechanism. This new uncertainty mechanism would enable us to access funding for some resilience workstreams that currently have significant scope, timing, or cost uncertainty while ensuring we balance risks between our customers and ourselves.

The rest of this chapter is structured as follows.

- Section 9.1 outlines our changing resilience expectations and drivers for investment.
- Section 9.2 details our investment planning approach for our proactive resilience programme for RCP4.
- Section 9.3 outlines our proposed proactive resilience workstreams and funding for RCP4.

9.1 Resilience expectations are changing

There is increasing interest in and focus on resilience, locally and globally. We consider resilience as part of our asset management approach and have been maturing our approach in recent years. As a critical infrastructure provider, we are increasingly expected to deliver a resilient network and transmission service.

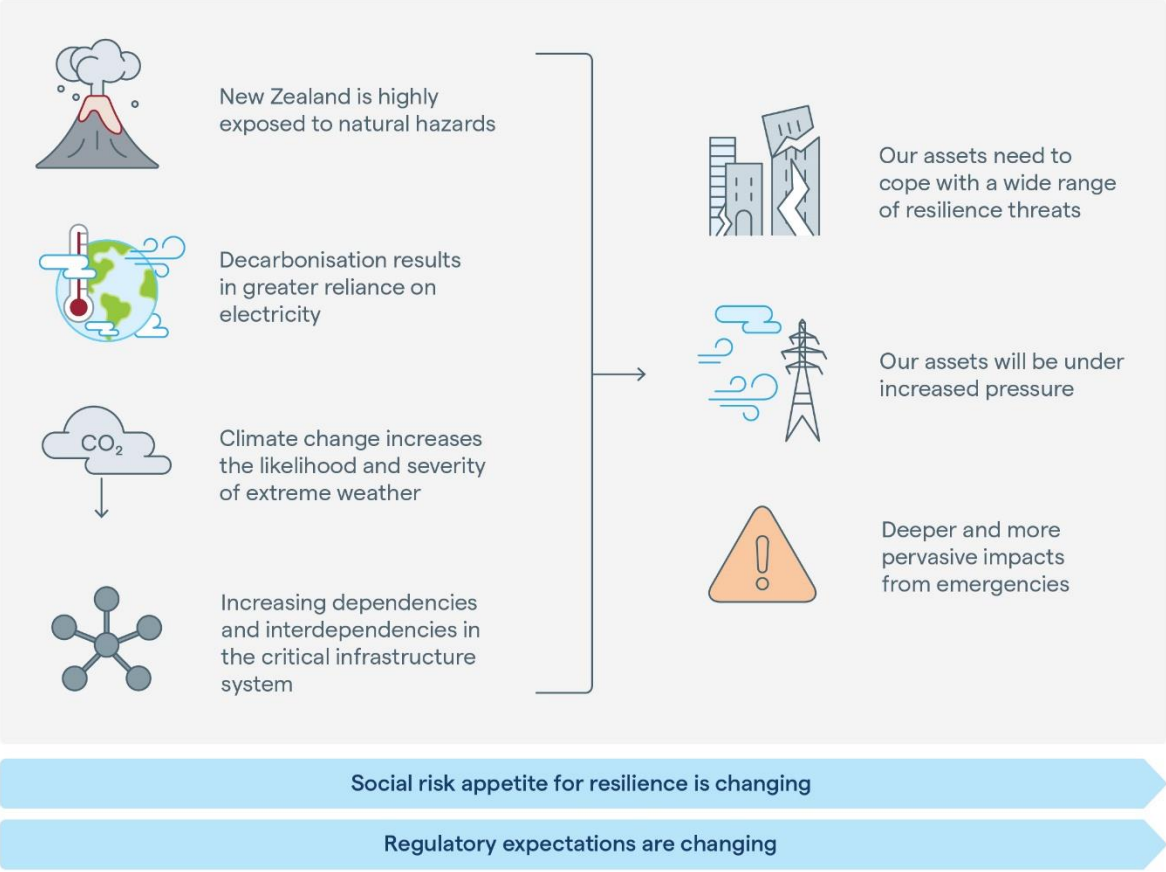
Recent survey results from the Consumer Advocacy Council[44] found that, for small businesses and residential consumers, resilience ranked as their second biggest electricity-related concern after affordability. This is consistent with our consumer advisory panel's advice, which recommended Transpower take a longer-term view of resilience, including climate change risk.

"this [resilience] is very important, and can also affect where communities can live and where they may move to" - Feedback from our consumer advisory panel

[44] Consumer Advocacy Council consumer sentiment survey July 2023

Our customers also expressed support for our resilience plan through our RCP4 consultation process, our electricity distribution network workshops, and in individual meetings. Local government and mana whenua are also highly engaged on these topics, with many concerned about extreme weather events, the impacts of climate change, and ensuring their regions are habitable in the long term. There is also broad interest in information sharing, exploring opportunities to work together to develop solutions and/or contingency plans, and funding pathways for resilience. Our proactive resilience programme considers several drivers, which are shown in Figure 50 and discussed further below.

Figure 50: Significant and growing resilience challenges



Relative to our international peers, a large proportion of our infrastructure is exposed to a broad range of natural hazards, exacerbated by Aotearoa New Zealand's geography. This is important as our load and generation locations require a relatively long and narrow grid backbone with regional connections. The length and narrowness of this grid backbone creates more resilience challenges when compared with other more 'meshed' networks. Our infrastructure could also be impacted by other resilience threats, such as building fires, damage by third parties, and criminal sabotage, including through cyber attacks.

The key resilience threats, and related hazards, to our network are shown in Table 46. We have developed our understanding of priority resilience threats through information gathering and analysis. We will continue to mature our understanding and analysis of these resilience threats and impacts to the transmission service during the rest of RCP3 and RCP4. Threats have been prioritised for analysis and inclusion in our RCP4 resilience programme at both a strategy and a planning level. In the future, we will review wider threats and investments.

Table 46: Resilience threats and major hazards

		THREATS	GRID MAJOR HAZARDS
NATURAL HAZARDS		 **Seismic**	• Substation buildings • Substation equipment and bus structures • Transmission lines and cables • Communications
		 **Volcanic**	• Insulator flash over from ash • Line loading damage • Disruption to electronics/AC systems • Lahar impacting sites/lines
		 **Tsunami**	• Risk to towers/poles • Risk to substations • Risk to subsea cables and cable stations
		 **Space weather**	• Geomagnetic-induced currents • Transformer damage • Voltage control and protection issues • No voice communications • Loss of interference with satellite communications
		 **Land stability**	• Risk to towers and poles • Risk to access tracks • Landslides damaging buildings and structures
	WEATHER-RELATED RISKS	 **Flooding**	• Risk from braided rivers (and other rivers) to towers/poles • Risk to substation control equipment and cables • Risk to ICT fibre routes
		 **Severe wind and tornados**	• Tower and pole collapse • Increased bushfire risk • Conductor failures increase
		 **Snow**	• Snow/ice loadings on lines • Snow loading on buildings
		 **Increased temperatures**	• Conductor derating • Peak loads move into summer • Insufficient cooling of control equipment, particularly at substations
		 **Bush fires**	• Bushfire encroaching assets • Transpower starting bush fire • Increased bush fire risk • Flashover on lines due to flames
ASSET RISKS		 **Common mode failure**	• Asset failure causes widespread long-duration outage • Critical towers understrength • Cascade failures and substation design
		 **Vandalism, sabotage, terrorism**	• Physical damage of assets and theft • Interference with network operations • Interference with market • Denial of service • Corruption of our data
		 **Asset fires**	• Substation building fire risk • Transformer cascade fire risk • Cable fire risk and other equipment fire risk

Increasing levels of dependencies and interdependencies across Aotearoa New Zealand's critical infrastructure mean the impacts of emergencies become deeper and more pervasive. In addition, climate change is increasing both the frequency and the magnitude of extreme weather events. Recent events, such as Cyclone Gabrielle, illustrate the interconnected nature of Aotearoa New Zealand's infrastructure system, where failures or outages in one sector can quickly cascade across the entire system. In that context, it is essential that the grid continues to operate or recovers quickly when faced with a range of crises.

The New Zealand Lifelines Council has prepared its 2023 National Vulnerabilities Assessment, which considers the interdependencies between our critical infrastructure systems. Our proposed RCP4 resilience plan will support us to prepare for, or deliver to, these expectations.

9.1.1 Regulatory changes

Resilience-related regulatory changes that have occurred or are being foreshadowed, include the following.

- **National adaptation plan**: We have a statutory requirement to develop and implement the Transpower adaptation plan as part of the national adaptation plan.[45] Our plan will outline how we will adapt to climate change through the design, delivery, and operation of the national grid and how we will address exposed assets and new investments in infrastructure. We are currently developing our adaptation plan for publication in 2024. This RCP4 proposal includes funding to address key climate-related risks critical for implementation of our adaptation plan. Alongside our planning, Te Waihanga will develop resilience standards for critical infrastructure by 2025.
- **Taskforce on climate-related financial disclosures**: We are among 200 companies in Aotearoa New Zealand required to formally report climate change risk under the taskforce on climate-related financial disclosures commitments and the External Reporting Board standard. In our first disclosure in 2021/22, we used desktop flood studies to identify which substations are vulnerable to flooding. We then estimated the potential increase in vulnerability due to climate change and the associated climate-related financial impact risk. We intend to continue to develop our understanding of climate risks and how these affect the national grid.
- **The Emergency Management Bill**: This Bill has already been through its first reading in the house and is likely to be passed in 2024. If it passes in its current form, we (and other critical infrastructure providers) will be required to contribute to sector-specific plans on response and recovery and report annually on our planned emergency levels of service.
- **Critical infrastructure regulation**: The Department of the Prime Minister and Cabinet released a consultation document on proposed critical infrastructure regulation on 13 June 2023. We will continue to engage on this matter and expect this work will result in regulatory reform that may impact us during RCP4.

[45] Action 5.10 of Aotearoa New Zealand's first national adaptation plan.

9.1.2 Historic events and investment

Transpower has experienced the impact of major hazard events in recent times. Figure 51 shows that there has been increasing wind and flood events in recent years and that, before Cyclone Gabrielle, the largest events, as measured by energy unserved, were related to common mode failure.

Historically, we primarily invested in resilience by building back better. When we do replacement and enhancement work, we bring our sites and lines up to current standards. This continues to be a large part of our approach and progressively addresses legacy assets that were not designed to today's standards. The limitation with this approach is that opportunities to address risks through upgrades or replacements can be decades away.

We began to develop a more proactive approach in RCP1 and RCP2. In 2011/12, we started to undertake high-impact low-probability studies of key substations and invested approximately $5 million during RCP2 under this programme to mitigate fire hazards at substations. We also purchased a mobile substation and strategic spare transformers, providing both reliability and readiness benefits. In 2016, we improved our ability to respond to events with the roll-out of the coordinated incident management system.

Where possible, we have also learnt from and built back better after events that have impacted the grid. For example:

- the Ōtāhuhu earth wire failure led to the $111 million Ōtāhuhu diversity project, beginning in 2009, and several substations having earth wire replaced with masts
- the 2014 Penrose fire led to increased focus on the high-impact low-probability programme and investment to address fire hazards
- braided river flood protection of structures as part of the 2019 Rangitātā flood recovery and proposed as part of our proactive RCP4 resilience programme.

Since 2018, we have been developing a national view of risk information by resilience threat and hazard type, which supports the planning approach outlined in Section 8.1.

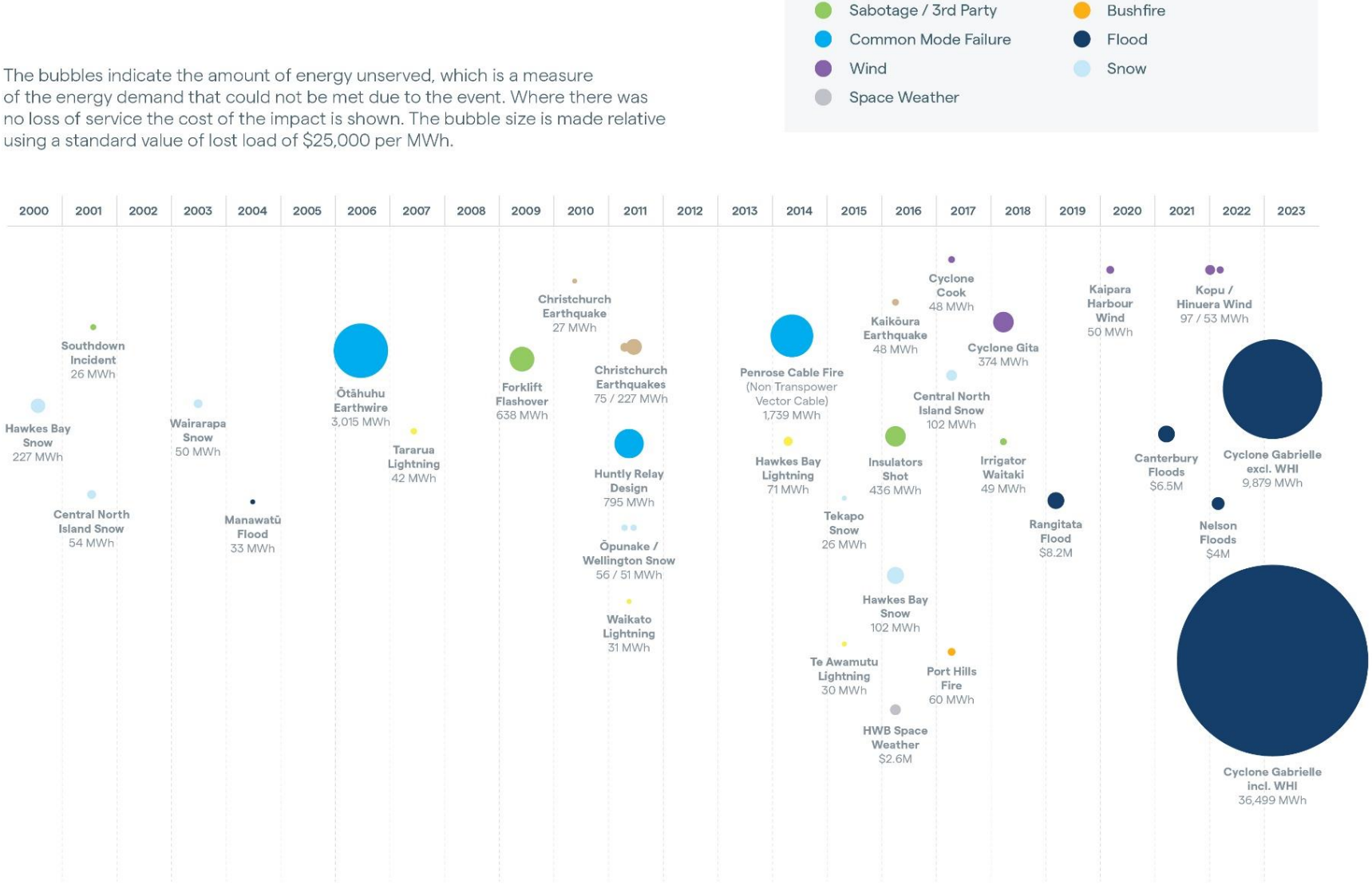
While we have developed a greater understanding of resilience threats and how they may impact our assets and service, we will need to continue to stay up to date with related research[46] and changing threat landscapes in areas such as cybersecurity.

[46] Such as research into volcanic eruptions, earthquakes, space weather, and climate change.

Figure 51: Historic events

Resilience History

The bubbles indicate the amount of energy unserved, which is a measure of the energy demand that could not be met due to the event. Where there was no loss of service the cost of the impact is shown. The bubble size is made relative using a standard value of lost load of $25,000 per MWh.



9.2 Investment planning approach

Our resilience planning capability has matured significantly in the last few years, with increased understanding of vulnerabilities and impacts, organisational learning, and risk-based prioritisation. Our RCP4 planning approach for resilience reflects this and includes a:

- grid resilience strategy based on the four Rs (reduction, readiness, response, and recovery)[47]
- grid resilience portfolio management plan
- ICT strategies and investment cases.

These documents capture the drivers and details of our resilience plan and provide line of sight within our wider asset management system.

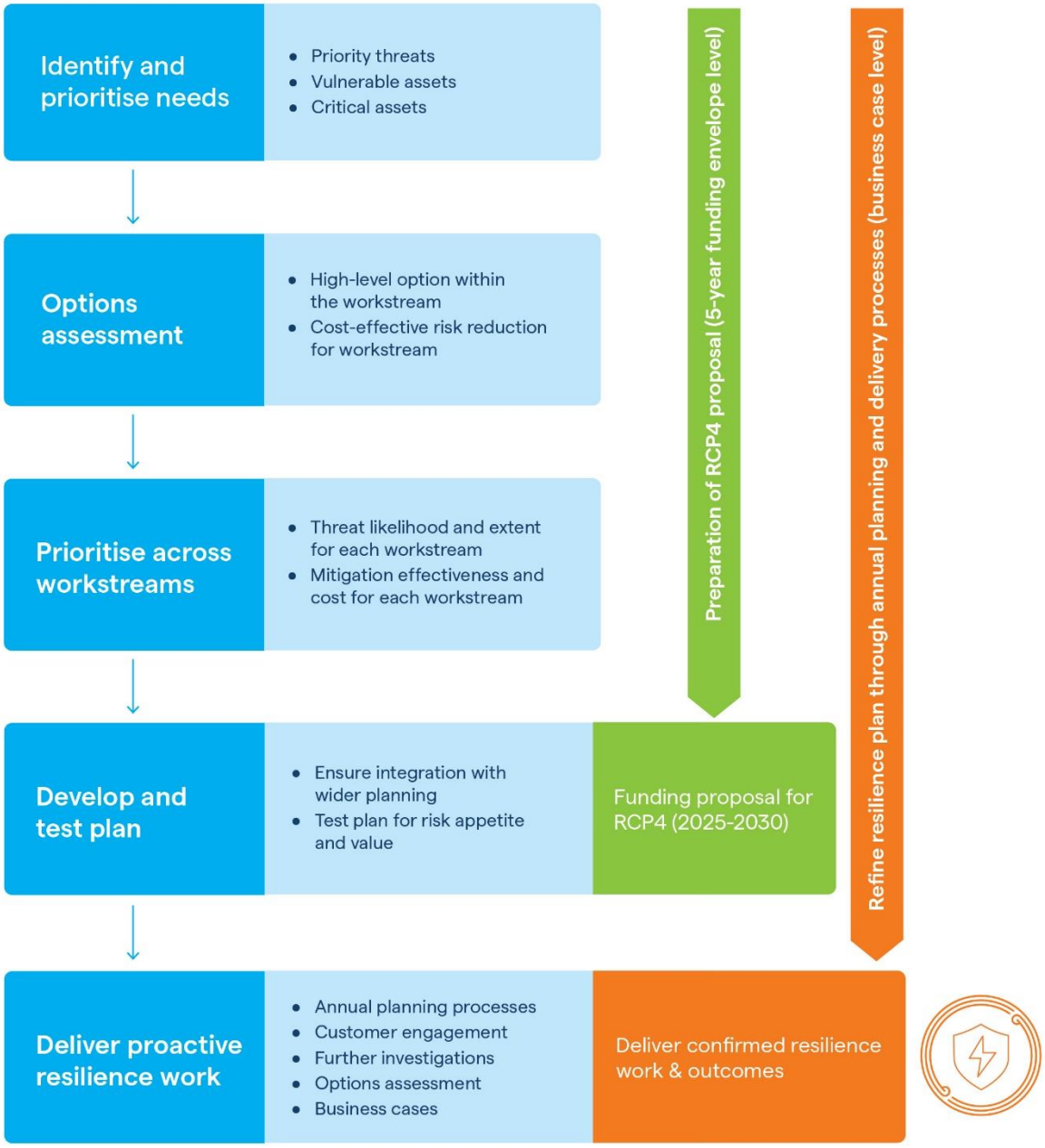
When deciding where to invest in resilience for RCP4, we balance a proactive approach of risk reduction and readiness with a reactive approach of responding and recovering after an event. With the frequency and severity of natural hazards increasing, a purely reactive approach would see customers and consumers bear the costs of both disruptions to their services and building back.

Our risk reduction investments aim to protect or strengthen assets that are vulnerable and critical to the system where service impact to customers and consumers is most significant. Our readiness investments aim to reduce the time it takes to respond and restore service.

Broadly, we applied our asset planning decision framework to develop our resilience programme and proposed funding envelopes for RCP4. We will continue to refine our plan for delivery, as summarised in Figure 52.

[47] **Reduction**: Identification and mitigation of networks and vulnerability risk; **Readiness**: Readiness planning, training, and exercising before and event; **Recovery**: Long-term reinstatement of network to provide pre-event security of supply service standards; **Response**: Immediate actions just before, during, and after an event.

Figure 52: Investment planning approach for resilience



Our RCP4 proposal reflects a relatively early stage of our resilience planning process. Our work to date has focused on developing our understanding of resilience needs and developing a prudent and efficient funding envelope. To do this, we have applied a range of techniques, including prioritisation based on vulnerability and criticality, multi-criteria analysis, and initial cost-benefit analyses. We have also considered a range of high-level solutions, including potential trade-offs between opex and capex solutions and proactive and reactive investment approaches for resilience.

We use power system modelling to identify the effect on consumers of loss of service, then use this information to determine a quantified criticality of an asset or site. This identifies the vulnerable assets with the largest impact on the system and our services. This is then considered alongside other criticality dimensions such as regional contingency plans and black start plans. This balances a service-centred perspective and an asset-centred perspective.

Our approach to resilience will continue to mature, and further investigations and analysis will be used to refine our plan prior to delivery. Our approach considers the varied nature of the resilience threats, the capability required, and the information available to develop and support our plan.

We expect many of the interventions to be site specific and to vary commensurate to the level of investment, risk, and complexity. In developing our RCP4 proposal, the level of analysis and detail applied in this process can vary and will be commensurate to the level of investment, risk, and complexity.

Testing our proposed resilience investments with customers, councils, and wider stakeholders is crucial to delivering resilience outcomes in a cost-effective way. This engagement can highlight non-transmission alternatives on the distribution network, joint contingency planning, and investments in the community. We will continue to learn more about our customers' future expectations and tolerance for the length and magnitude of interruptions. Engagement and integrated planning can deliver more value and avoid maladaptive investments over the longer term that may result in increasing costs or failing to address resilience risks.

The resilience programme aligns with and complements our replacement, enhancement, and growth investments, as those investments also improve our resilience through new build design or a modern equivalent standard.

9.2.1 Resilience criteria

We have developed resilience criteria to identify vulnerable assets. The benefits of specifying criteria include the ability to:

- scrutinise assumptions
- manage public expectations of achievable service levels
- understand more clearly the dependent services, which can inform contingency planning, incentivising, and identifying needed resilience upgrades.

Our resilience criteria provide an appropriate balance between achieving resilience through strengthening existing assets, with what we would do if we were building new. This ensures we set reasonable thresholds for vulnerability to enable us to quickly identify the assets most likely to be affected by a hazard. For example, our new substations are built to withstand a 1:450-year return period flood event, whereas our resilience criteria is defined as 1:250 years.[48]

We will continue to develop and expand our resilience criteria for other hazard types and widen the criteria to include factors such as restoration.

Table 47shows our current resilience criteria compared with our new-build criteria.

[48] Some of our existing substations have been impacted by 1:100-year floods.

Table 47: Current resilience criteria

Hazards	Climate change related	New build design standard (return period)	Resilience vulnerability criteria
Flooding substations and damaging control equipment and cables	Yes	450-year RP	≤250-year RP
River flooding that damages towers and poles	Yes	50-year RP	<50-year RP
Severe wind damaging towers	Yes	300-year RP	≤150-year RP
Risk to station buildings, equipment, and bus structures (from seismic events)	No	2500-year RP	<2500-year RP
Damage to substation assets (from tsunami)	No	2500-year RP	2500-year RP
Insulator flash over (from volcanic ash)	No	-	25-year RP
Transformer damage (from space weather)	No	-	150-year RP

9.3 Our RCP4 resilience plan

Our proposed resilience plan for RCP4 is shown in Table 48 and Table 49. Each table details the expenditure we are proposing under different funding mechanisms. Our base capex/opex plans include investment in resilience where there is high certainty on need and cost, such as our seismic upgrade programme. Other workstreams with greater scope and cost uncertainty would be funded through a new uncertainty mechanism.

The resilience programme expenditure is based on estimated quantities and expenditure at the workstream level. Actual quantities and spend may differ from forecast quantities and spend, due to the uncertainty ranges associated with risk, solutions, and costs, and ongoing refinement of our plan prior to delivery.

Table 48: Resilience workstreams proposed for base capex/opex funding

Resilience workstreams	Forecast RCP4 deliverables	Forecast expenditure (2022/23 $m)
Strengthening critical buildings to meet seismic policy requirements for life safety and to maintain essential service	34 buildings	29.5
Portable/mobile substation solutions to minimise response time and run emergency exercises	1 switchroom 2 protection-in-a-box 1 control room 4 drills	15.9
Land stability works for towers and poles to manage slips that could result in critical transmission circuits being removed from service	53 structures	10.9
Fire stopping, detection, and suppressive upgrades to substation buildings	82 buildings	7.1
Remove earthwire overhead stations – common mode failure risk mitigation	13 substations	3.4
Equipment spares for the new seismic hazard model risk (sites exceeding IEEE693 'high')	Additional 10 spares each of circuit breakers, current transformers, voltage transformers	3.4
Pre-enabling works to allow a spare transformer to be easily connected at Wilton for major failures of non-air bushings/GIS	1 substation	1.9
Hardening bridges and access tracks in the event of land instability and flooding	6 bridges and access tracks	1.2
Emergency exercises for tower restoration	10 drills	1.2
Hardening transmission lines for a volcanic ash event in the central North Island	41 strain towers	1.1

Resilience workstreams	Forecast RCP4 deliverables	Forecast expenditure (2022/23 $m)
Development of new capabilities in response to the changing cybersecurity threats, technology, and business environments. Our cybersecurity investment to replace existing regional-based firewalls associated with the TransGO Refresh will also build resilience in our network. This investment is incorporated in the reliable and safe grid outcome area	Across all sites and services	2.2
Improve information to enable decision making and improve visibility and awareness of high-impact events that can affect the grid in order to react and restore faster and avoid utility supply outages	Tools to support operations	9.2
TOTAL		**87.2**

The uncertainty mechanism proposed for resilience is a 'use-it-or-lose-it' discrete funding mechanism. If it is not spent, then funds are not recovered from consumers, and we would not receive an incentive payment for underspending. Although an uncertainty mechanism comes with an additional regulatory burden, it means consumers face less risk on the uncertainty of the need and the cost compared with including the funding requirement in base capex/opex. We propose that only work associated with the six resilience workstreams listed in Table 49 are funded through the resilience uncertainty mechanism. This ring-fences the funding. We plan to provide regular updates on the resilience work delivered to customers and stakeholders via our annual Asset Management Plan and disclosures and in an end-of-period report.

Table 49: Resilience workstreams proposed for uncertainty mechanism funding

Resilience workstreams	Forecast RCP4 deliverables	Forecast expenditure (2022/23 $m)
Flood - resilience solutions at substations	11 substations	45.9
Flood – hardening critical and vulnerable HVAC and HVDC towers in braided rivers	61 tower foundations	30.2
Space weather mitigations for transformers	7 transformers (10 neutrals)	18.1
Hardening HVDC towers against wind damage	122 towers	14.1

Resilience workstreams	Forecast RCP4 deliverables	Forecast expenditure (2022/23 $m)
Portable/mobile substation solutions to minimise response time and run emergency exercises	1 mobile substation	13.5
Mitigation for loss-of-time synchronisation within the network due to solar storms	8 terrestrial clocks and associated assets	4.9
Total		**126.7**

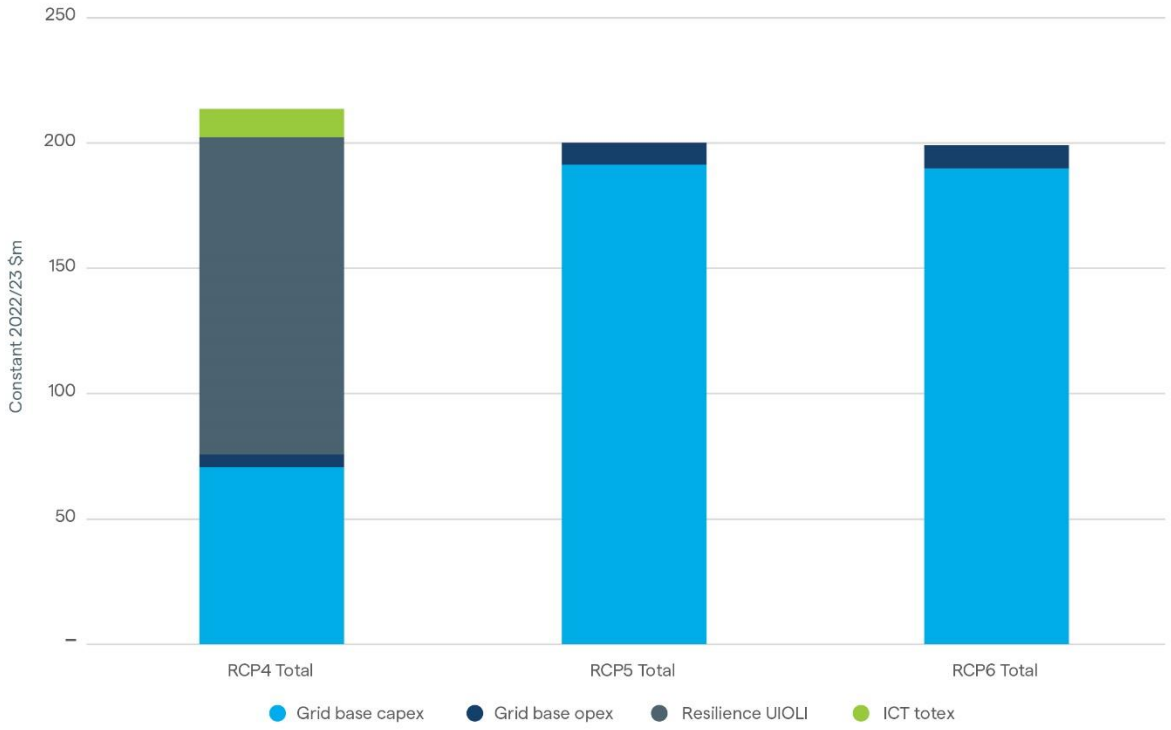
Our proposed RCP4 resilience plan expenditure is summarised in Table 50.

Table 50: Funding for resilient network

Funding	Forecast expenditure (2022/23 $m)
Base capex	75.0
Base opex	12.2
Uncertainty mechanism (capex and opex)	126.7
TOTAL	**213.9**

RCP4 represents the start of an ongoing programme of systematic resilience investments. Figure 53 shows our resilience forecast for RCP4–RCP6.

Figure 53: Long-term resilience forecast RCP4–RCP6



9.3.1 Changes to resilient network expenditure since our consultation

Since we consulted on our draft RCP4 plan in 2022, we have updated our plan to reflect our experiences during Cyclone Gabrielle and the January 2023 Auckland floods as well as further analysis. Notable changes for our final resilience plan include:

- acceleration of flood mitigation work at substations
- investment in more portable and mobile solutions for substation assets to reduce emergency response times
- accelerating flood mitigation work for HVDC and HVAC towers in braided rivers
- increasing funding proposed for hardening HVDC towers against wind and mitigating land stability risks for towers and poles.

The verifier reviewed our draft resilience plan and proposed uncertainty mechanism as at 15 February 2023. The verifier considered our draft plan to be prudent and in line with good electricity industry practice and verified the proposed resilience expenditure. The verifier also found that the proposed uncertainty mechanism supports "accurate cost recovery and efficient investment incentives."[49]

Since our plan was provided to the verifier, we have accelerated some workstreams after stakeholders' expectations changed following Cyclone Gabrielle, as noted above.

[49] Verifier report

We plan to provide regular updates on the resilience work delivered to customers and stakeholders via our annual Asset Management Plan and disclosures and in an end-of-period report.

Table 51: Resilience changes since our consultation (constant 2022/23 $m)

	Consultation forecast (September 2022)	Verifier review	Proposal
Resilience – base capex and opex	78.0	60.8	87.2
Resilience – uncertainty mechanism	37.4	55.7	126.7
TOTAL	**115.4**	**116.5**	**213.9**

10.0 Enhancing the network

We need to invest to enhance or develop the grid to meet changes in the demand and the generation mix, including the transition to an economy heavily dependent on a highly reliable electricity supply for its energy needs.

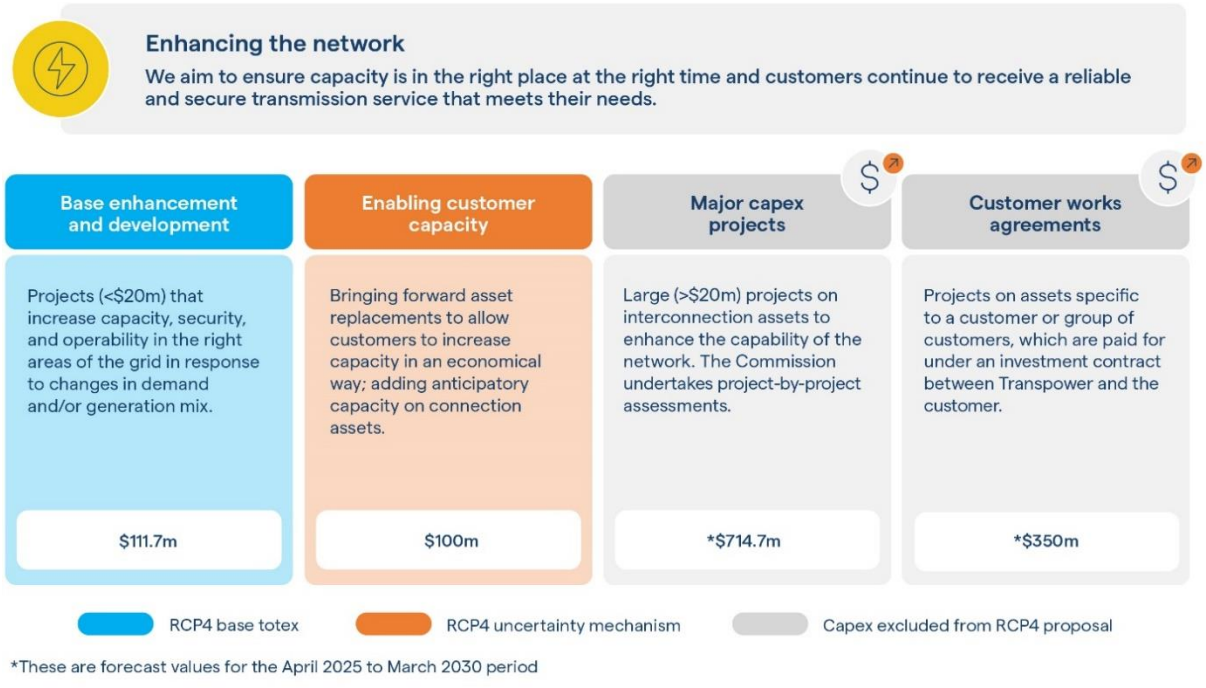
Aotearoa New Zealand is targeting net zero emissions by 2050. Our customers are spending millions of dollars on innovation, infrastructure, and new technology to prepare for a clean energy future and to cut their emissions. Government policies are supporting this private investment and further driving demand for electrification across transportation and process heat.

We need to invest to enhance or develop the grid to meet changes in the demand and the generation mix, including the transition to an economy heavily dependent on a highly reliable electricity supply for its energy needs.

More information

Our latest Transmission Planning Report 2023 contains further detail of our base enhancement and development, major capex projects, and customer works.

Figure 54: Delivering an enhanced network



*These are forecast values for the April 2025 to March 2030 period

There are four different ways enhancement or development investments in the grid can be funded.

- **Base enhancement and development capex**: Projects on interconnection assets forecast to cost less than $20 million.[50] This is covered in Section 10.3.
- **Uncertainty mechanisms**: For the RCP4 period, we are seeking more flexibility from the Commission to respond as certainty is created on the changes required to the transmission network. We are proposing additional uncertainty mechanisms in RCP4 to provide flexibility to respond to customers' needs during the regulatory period while ensuring that risks are balanced between Transpower and our customers.
- **Major capex projects**: Projects forecast to cost more than $20 million on interconnection assets.[51] These are submitted to the Commission for approval on a case-by-case basis and are not included in our RCP4 proposal.[52] We are forecasting major capex project investment proposals of over $700 million during the RCP4 period.
- **Customer works agreements** (also known as transmission works agreements): Projects with assets specific to a customer or group of customers that are paid for under an investment contract between Transpower and the customer. Typically, these investments affect the services received by those customers only. We recover the costs of these contracts outside of the RCP4 MAR.

Only the first two categories of funding are included in our RCP4 proposal. However, we are proposing funding mechanisms within RCP4 to deliver some transmission works agreements-related work more efficiently.

In this chapter, we set out:

- our investment planning approach to changes in demand and generation mix
- the drivers for all future enhancement and development expenditure on the grid, including those not funded under our RCP4 proposal
- how we have developed our RCP4 base enhancement and development capex forecast
- our proposed uncertainty mechanisms to support enhancing existing or developing new customer connections.

10.1 Investment planning process

There are two main elements to our enhancement and development investment planning process:

- identifying grid needs and opportunities for changing grid capability
- investigating options to resolve these issues through our asset planning decision framework.

[50] Note, we expect this value to increase to $30 million for RCP4. This change does not affect our forecasts.
[51] Although these projects could include work on connection assets.
[52] Projects | Transpower

More information

Please refer to Appendix A of our Transmission Planning Report 2023.

10.1.1 Identifying grid needs and opportunities

We develop demand and generation forecasts annually through engagement with, and forecasts provided by, our customers. Using these forecasts, we test the capability of the grid, at grid exit points, grid injection points, and on interconnected grids, to meet forecast needs over the next 15 years. Our approach tests our ability to meet an N-1 security standard. This allows us to identify future enhancement and develop investments.

In addition to testing using the annual demand and generation forecasts, we also obtain information about potential transmission needs, opportunities, and risks associated with current asset capability through our ongoing operation and maintenance of the grid. This information is collected via our asset feedback register.

Information from customers' requests for new or enhanced connections, or disconnections, also feeds into our needs identification process.

If the upgrade is related to interconnection assets, these will either be base enhancement or development capex or an MCP. If it is related to connection assets, we work with our customers to agree whether we will proceed with the project under a transmission work agreement.

10.1.2 Options assessment

All identified enhancement and development needs and opportunities are reviewed and assessed to determine if there is an investment need and, if confirmed, we progress them into our asset planning decision framework as 'system needs' (see Section 8.1). This includes determining whether providing N-1 is economic and supported by the customers affected.

Using this framework requires us to consider system needs alongside refurbishment, replacement, and maintenance requirements. If appropriate, we combine customer needs into collective grid needs, ensuring that investigations consider interrelated development needs and opportunities. This ensures that we deliver cost-effective solutions for our customers.

10.2 Demand and generation forecasts

The combination of electrification opportunities and the government's target of 100 per cent renewable electricity generation by 2030 presents a once-in-a-generation challenge.

Our grid was developed for baseload thermal and hydro generation, and it needs to evolve to handle growing distributed and variable sourced generation, enabling Aotearoa New Zealand to reliably meet its objectives.

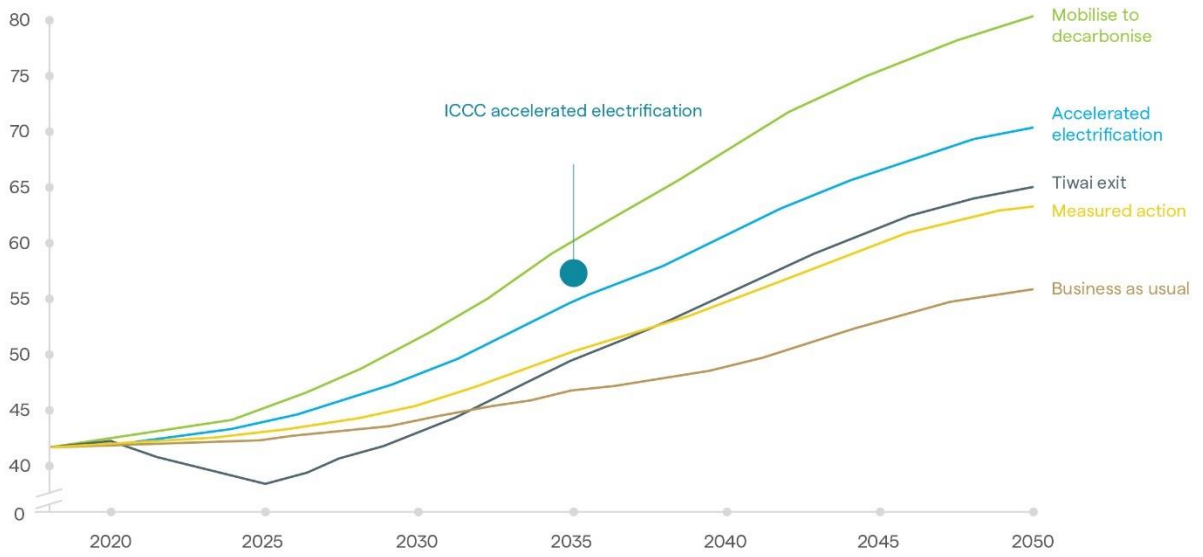
Transport and process heat for industry make up a significant proportion of our emissions. Electrification is happening fast, so capacity and security across the grid needs to be front footed. Forecasts show we also need to make a significant investment to support the national transition and our customers' decarbonisation journeys. We are committed to enabling the resources required in a way that engenders least regrets.

Electrification of the economy will not only be met by grid-connected generation. Distributed energy resources such as rooftop solar and batteries and demand side response will also be important features of the energy system. The country is already experiencing a significant rise in distributed renewable generation, although this is currently low by international standards.

In Whakamana i Te Mauri Hiko, we describe how our context is evolving. We considered five possible scenarios to guide our strategic priorities and decisions. In our 6-monthly monitoring reports, we identify how we are tracking against each scenario given the economic situation and our industry observations. We remain on track for the accelerated electrification scenario.

The five scenarios and their impact on the overall electricity demand are shown in Figure 55.

Figure 55: Electricity demand assumptions for different scenarios (TWh)



Overall, the scenarios highlight a range and variety of possibilities and outcomes that enable Transpower to plan and to take account of uncertainty. All these scenarios serve to highlight the common characteristics that we need to grapple with – in the future, the grid and power system operations will become more important and more complex.

More information

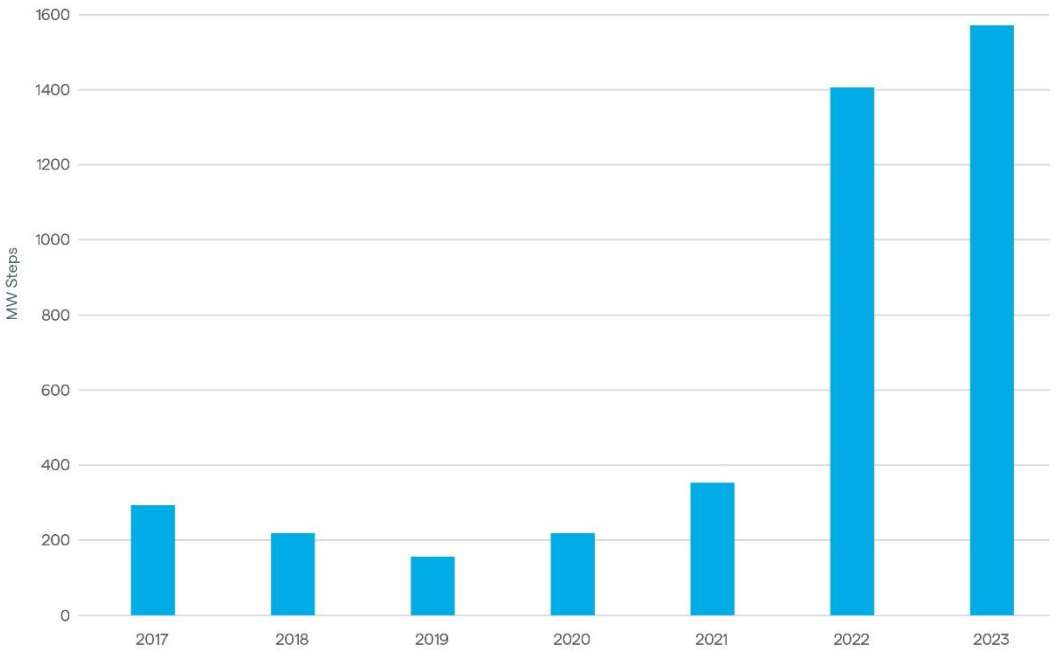
Please refer to Chapter 3 of our Transmission Planning Report 2023.

We engage with our customers on an ongoing basis to understand their transmission services needs. This includes engaging with electricity businesses annually to update our demand forecasts. Our

forecasts then include their estimates of peak demand and the impact of distributed energy resources.

We have seen a significant uplift in customer forecast step loads arising from decarbonisation activities (see Figure 56). This includes from initiatives supported by government grants, which have encouraged electrification of process heat.

Figure 56: Electricity demand steps forecast (15 years) from load customers

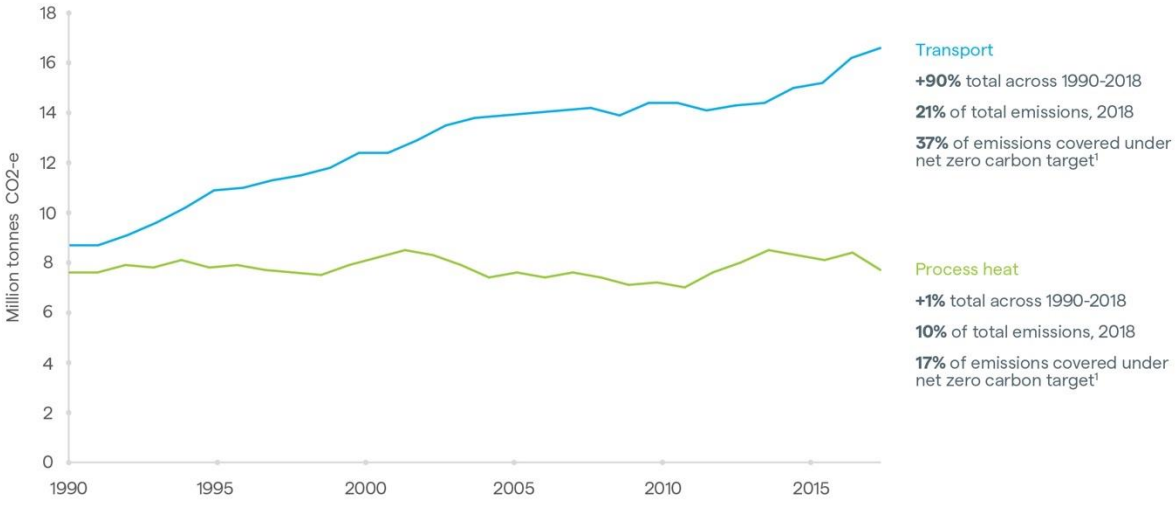


10.2.1 Process heat and transport emissions

As Aotearoa New Zealand's energy system evolves, electricity will increasingly drive more and more of our national and local economies. The success of our regions and country will become increasingly dependent on secure, affordable electricity supply.

Electrification of low-temperature process heat and light transport is a reality today and forms the foundations of the country's decarbonisation goals. If accelerated further, electrification of process heat and transport will enable Aotearoa New Zealand to achieve its emission targets for 2050 as highlighted in our Electrification Roadmap.

Figure 57: Process heat and transport emissions 1990–2018



[1] Net zero carbon target excludes biogenic methane from agriculture and waste

10.2.1.1 Transport electrification

The EV boom is beginning to take off. If this is supported by policy, regulatory, and industry settings, our power grid will be better used, with EVs flattening the load across time.

Rapid uptake of light EVs will drive transport decarbonisation. By 2030, marginal abatement costs may mean that reducing transport emissions saves money.

If we get the incentives right and support electrification of transport with infrastructure, a robust and resilient grid and electricity networks, and integrated policy settings, we can expect electrification of transport to be staged across the next 15 years.

Electric vehicles will place a greater demand on the grid. Pricing signals and smart infrastructure may help reduce the impact EVs will have on peak demand. Our forecasts include electricity distribution businesses' forecasts on the impact of EVs, and we test a range of sensitivities. Given the magnitude of the impact from EVs, we expect the investments needed to meet the future demand to be major capex projects or customer-specific contracts.

10.2.1.2 Process heat electrification

The Government investment in decarbonising industry fund has already led to an increase in process heat electrification. The Energy Efficiency & Conservation Authority has nearly $1 billion in funding to drive this programme. We are experiencing a material increase in requests from distributors to increase capacity at grid exit points, and we expect this to accelerate further. Whakamana i Te Mauri Hiko estimates 6.8 TWh (just over 16 per cent) of Aotearoa New Zealand's projected electricity growth by 2050 will be created by the electrification of industry (currently running process heat using coal, oil, and gas).

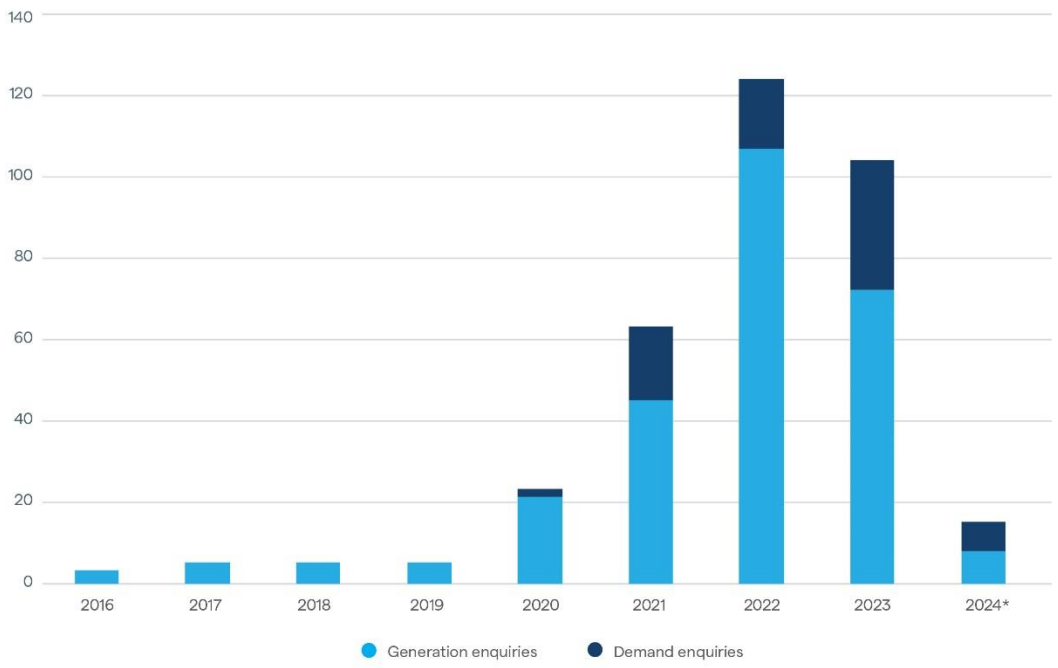
We can expect electrification of process heat to accelerate in stages across the next 15 years. It is important we are proactive in providing process heat plant owners with the clarity and information they need (with respect to transmission) to help with timely investment decision-making.

Initially, we expect the impact of the electrification of process heat to primarily affect customer-specific contracts or result in major capital projects (rather than base capex). We see an opportunity to assist our customers by bringing forward the replacement of some assets to increase capacity.

10.2.2 New connections and upgrades to existing connections

Over the last few years, we have seen significant growth in generation connections enquiries. At the same time, the volume of demand-driven connection requests (either for new grid exit points or upgraded ones) is increasing. New and enhanced connections are funded directly by customers under Transpower works agreements.

Figure 58: Connection requests



We are experiencing a large year-on-year increase in the number of enquiries for connecting renewable generation projects to the grid. To ensure our customers are aware of the scale of new connection enquiries and their locations, we have launched a web dashboard.

Solar resources are well distributed across the country and have a much smaller environmental footprint than many other forms of generation. The generation technology can be rapidly deployed to almost anywhere in the country where it makes economic sense for developers. As such, it is difficult to predict where and when these connection enquiries will progress to actual connections, especially given the current volume of site investigations.

There have also been changes in the way the grid is used, with some industrial consumers committing to retiring current operations. Industrial customers disconnecting from the grid can trigger the need for new interconnection transformers when generation developed to serve the former industrial load remains in service.

The incidence of solar power, large-scale batteries, and wind farms is increasing. But to transport these net zero emission electrons to the cities and towns where they are needed requires new and upgraded transmission links and connections.

Customers are required to fund the cost of their connection through new investment contracts. However, some customer investments can create the need for Transpower to invest in interconnection assets to ensure we meet our reliability standards.

There is also an opportunity to align customer needs with our Asset Management Plan 2023, ensuring the assets that are replaced at the end of their life are suitably sized for the future. This will also provide our connected customers with choice to increase the size and capacity of these assets for the marginal cost incurred rather than the full replacement cost.[53]

We have initiatives under way to address the issues we face with managing these more rapidly deployed forms of generation technology, including:

- developing and maintaining our Envision Opportunities tool that enables developers to explore available capacity at our grid exit points, to connect generation under a range of system conditions
- investing in digital customer interfaces to enable customers to:
    - undertake two-way interaction with core systems to provide and receive information
    - see more detailed technical information on proposals, options, and decisions
    - visualise new build proposals, provide feedback, and track progress
    - receive and interact with timely information on grid operations outage management, fault management, and planned maintenance
    - subscribe to information they want to see
- working in the regions to provide information specific to our connection ability in that area
- using the flexibility of solar and wind generation to explore opportunities to play a role in coordinating investments in network infrastructure to enable connection of renewable generation.

10.2.3 Base-case scenario

The above context supports our base case for setting out expenditure forecasts for the next 15 years under the Whakamana i te Mauri Hiko scenario 'accelerated electrification'.[54] This is described below. Further details on this base-case and alternative scenarios are set out in our Transmission Planning Report 2023.

[53] Base capex (recovered via transmission pricing methodology) covers the replacement with modern equivalents, and the customer pays the marginal cost directly under a transmission works agreement.
[54] We monitor how we are tracking against each of the five scenarios every 6 months. Our monitoring reports are available here: Whakamana i Te Mauri Hiko - Empowering our Energy Future | Transpower

Table 52: The base case for expenditure forecasts 'accelerated electrification'

The base case: 'accelerated electrification' A realistic yet aspirational scenario with growing political and social pressure to decarbonise with government support. Anticipates large-scale transformation requiring integrated, coordinated planning and action, but involves no sharp social or economic disruptions.	
Assumptions	**Outcomes**
Government policy evolves to support electrification No other specific policies or any one policy change Widespread adoption of electric vehicles and electrification of process heat Increasing energy efficiency Smart demand solutions to assist in managing peak demand Increasing levels of solar and accompanying battery installations. Gross domestic product: reduced electrical intensity by 1.7 per cent per year	A genuinely low-carbon economy Reduced household expenditure on energy Significantly improved terms of trade Aotearoa New Zealand is a showcase climate leader
Transpower is using this scenario to ensure our organisation is working towards a single view of our energy future, both strategically and operationally.	

This base case underpins our base enhancement and development expenditure (discussed in Section 10.3), our major capex projects, and our Transpower works agreement-linked customer works.

10.2.4 Major capex projects

Our approved and unapproved major capex projects over the next 15 years are set out in Table 53. Please see our Transmission Planning Report 2023 for more details.

Table 53: Approved and unapproved major capex projects

Region	Project name	Indicative commissioning	Economic or reliability?	Status
Approved major capex projects				
North Island grid backbone	Waikato and Upper North Island voltage management (WUNIVM)	2023–2026	Reliability	In delivery
Major capex projects under consideration by the Commission				
Grid backbone	Net zero grid pathways – HVDC, central North Island, Wairakei ring	2023–2030	Economic	Awaiting approval
Unapproved major capex projects – under investigation				
North Island grid backbone	Waikato and Upper North Island transmission capacity (formerly WUNIVM – stage 2)	2027–2035	Reliability	Investigation currently under way
Upper South Island	Upper South Island voltage stability	Tentatively 2027, depending on demand step changes	Reliability	Investigation currently under way
Western Bay of Plenty	Western Bay of Plenty regional	Tentatively 2027	Reliability	Investigation currently under way
Unapproved major capex projects – investigation scheduled for options analysis				
Grid backbone	Net zero grid pathways 2 Further enhancement to grid backbone and regional networks	2030+	Economic	Investigation to start 2023/24

Region	Project name	Indicative commissioning	Economic or reliability?	Status
Waikato	220/110 kV interconnection capacity	Tentatively 2026	Reliability	Investigation to start 2023/24
Unapproved major capex projects – investigation scheduled to confirm need				
Southland	Southland transmission capacity	TBC	Economic	Needs identification
Northland	Northland 220 kV transmission capacity	TBC	Economic	Needs identification
North Island grid backbone	Waikato and Upper North Island thermal capacity	TBC	Reliability	Needs identification
	New Zealand battery project	TBC	Economic	Awaiting confirmation of option

10.3 Base enhancement and development expenditure

Most enhancement and development system needs reflect changes to electricity demand and generation development, use, and retirement. Drivers of enhancement and development system needs are varied and often complex, with several intersecting issues requiring consideration and resolution.

As the external environment changes, so too does demand and generation. This gives rise to enhancement and development system needs as the transmission grid must change to meet agreed or mandated service, security, or reliability standards. A change may increase or decrease grid capability, depending on the driver, and could be used to elicit a range of system outcomes including:

- providing more capacity to generators or connected loads
- matching reliability or security of supply to the required standard or agreed service level
- maintaining or improving power quality measures
- managing the dynamic response of the power system to disturbances

Asset health and criticality could also drive enhancement and development system needs as our renewal planning may identify the need for a future grid capability change.

More information

Please refer to Chapter 4 of our Transmission Planning Report 2023.

Our forecast RCP4 base enhancement and development expenditure is based on an aggregated portfolio of 'extremely likely' and 'highly likely' projects that we have identified through our enhancement and development investment planning approach.[55]

Table 54: Extremely and highly likely investments

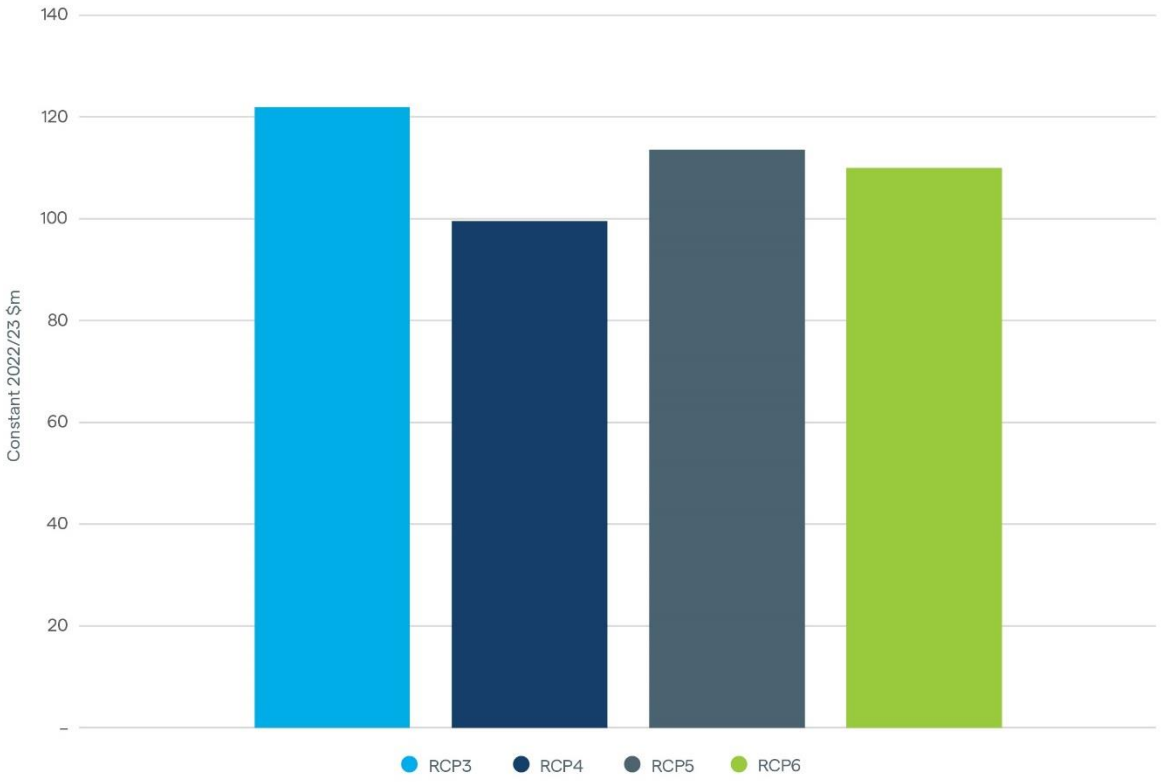
Extremely likely expenditure	Highly likely expenditure
Investments we expect to progress through our options assessment and to meet approval stage gates This includes projects that are already well into the design process, where we have confidence in projected generation or load changes, and/or that have other drivers (such as asset condition) we consider certain	Investments we expect to progress through the options assessment and to meet approval stage gates, but that have a less certain identified solution and associated cost This also includes projects with less certain drivers, or those that would occur later in the period when we have more certainty around the costs of the project

We have identified further likely projects to occur during RCP4; however, there is a high degree of uncertainty around their scope and cost. We therefore proposed the continued use of an uncertainty mechanism to provide funding as greater certainty is gained during the first 2 years of RCP4.

Figure 59 provides a summary of our forecast RCPs base enhancement and development expenditure.

[55] Tables 4-1 and 4-2 of the Transmission Planning Report 2023 sets out the projects included as extremely likely and highly likely investment expenditure.

Figure 59: RCP base enhancement and development forecast capex



Based on a portfolio approach of the extremely likely and highly likely RCP4 projects, our expenditure total for base enhancement and development is $111.7 million. This is our low expenditure scenario, as we expect other projects with an investment need during RCP4.

We are relying on the availability of the enhancement and development reopener mechanism when putting forward our RCP4 enhancement and development expenditure proposal. If this reopener were not available, our forecast expenditure would be materially higher to cover other likely projects.[56]

10.3.1 Deliverability of enhancement and development programme

Whether we have the resources to deliver the enhancement and development programme was considered at the asset portfolio level. While the base enhancement and development programme is relatively small, we have considered its deliverability alongside our other expenditure areas. This is reflected in our Transpower-wide deliverability and workforce planning (summarised in Chapter 6.0). As enhancement and development projects develop, we will actively manage resourcing by

[56] For RCP3, the Commission introduced an uncertainty mechanism for enhancement and development expenditure. This mechanism allowed us to seek additional allowances if we identified specific new projects in RCP3. In May 2022, we sought additional enhancement and development allowances from the Commission due to the increased impact of customer work on our grid. This includes the connection of more wind generation and new grid exit points. We used the RCP3 E&D reopener to request a further $41.0 million allowance from the Commission for base E&D projects. The Commission approved $40.6 million.

balancing grid network security/capacity risk over deliverability constraints. This should ensure we can deliver both renewal and enhancement and development programmes.

We expect to use the reopener mechanism in RCP4 to ensure we can continue to maintain services while responding to changes on the grid. This allows the Commission to only include extremely or highly likely projects in our allowance, but the reopener gives us certainty that we can seek additional funding for enhancement and development work if required.

10.3.2 Changes since customer consultation

As previously noted, we engage with our customers on an ongoing basis. This feeds directly into our investment planning process. In addition to our regular engagement with customers, we held four additional regional workshops with electricity distribution businesses in April and May of 2023. These workshops allowed us to present regional information on our planned RCP4 spend, including grid exit point-specific spend.

In addition to feedback on the day, we also received written feedback from several distribution businesses. Through this feedback, several distribution businesses let us know about projects that were no longer required (an example is provided below). They also questioned the scope of other projects. We have reflected this feedback in our list of RCP4 enhancement and development projects.

Case study: Hororata voltage and capacity risk management

Prior to the consultation workshops with our customers, we had planned to invest $12 million in managing voltage and capacity risk at Hororata. While we were aware of uncertainty around the need for this investment, feedback from Orion confirmed the commissioning of the new Norwood grid exit point, combined with load shifting, would manage the risk without the need for this investment.

10.3.3 Changes to base enhancement and development expenditure since our consultation

We did not receive specific feedback on our base enhancement and development spent during our October 2022 consultation.

The verifier verified all our proposed insurance expenditure and did not raise any concerns with our approach. Although, while the verifier agreed that our corridor management expenditure was prudent and efficient, it considered that it should not be capitalised. We have since reviewed our treatment, and received external advice, and we still consider that, based on generally accepted accounting practice, corridor management should still be capitalised.

Our forecasts have been refined from the estimates the verifier reviewed. The changes are driven by additional projects and refinements in our cost estimates.

Table 55: Changes to base enhancement and development expenditure since our consultation (constant million 2022/23)

	Consultation forecast (September 2022)	Verifier review	Proposal
Base enhancement and development	102.9	105.1	111.7

10.4 Enabling customer capacity – uncertainty mechanism

As shown in Figure 56, the transition to net zero is leading to large step changes in demand. This is rapidly increasing the need for capacity at our grid exit points. These are customer connections assets, and, under our regime, our customers fund enhancements via new investment contracts.

To support our existing and new customers with electrification, we are proposing that Transpower has access to additional funds to cover:

- bringing forward connection asset replacements (e.g. replacing a transformer earlier than planned in order to replace it with a larger-capacity transformer)
- adding anticipatory connection assets capacity with a new or augmented connection (where it is prudent and efficient to do so).[57]

We are proposing a $100 million mechanism to cover both areas of expenditure. However, we estimate that $75 million would be a fund for bringing forward asset replacement and $25 million would be for anticipatory connection assets. We propose that the funding under the uncertainty mechanism would be excluded from our initial MAR. Our allowable revenue would increase if funding were used under this mechanism.

An uncertainty mechanism will give us the flexibility to respond to customer requirements while, in contrast to seeking base capex funding, only putting minimal risks on consumers if the customer projects do not eventuate.

10.4.1 Bringing forward asset replacements

Our base capex proposal covers the replacement and refurbishment of existing connection assets. We replace existing assets with a modern equivalent where appropriate and in agreement with customers, rather than simply replacing with a like-for-like. Enhancements over and above a modern equivalent where the assets have not reached the end of their useful life are funded directly by the customer via a new investment contract.

To help our customers deal with the step changes in demand, we are proposing a new funding mechanism for RCP4. This would provide us with access to funding for bringing forward asset

[57] This is referred to as 'first mover disadvantage – type 2' in the new transmission pricing methodology.

replacements, where they are nearing end of life. For example, this would fund the replacement of a transformer near the end of its useful life with a transformer with a higher capacity. The customer would pay the incremental costs of the transformer and the costs associated with bringing forward the replacement (e.g. paying for the remaining net book value of the asset).

Our revenue allowance would only increase if we undertake work to bring forward asset replacements at a customer's request during RCP4. We would only use this mechanism to support customers in bringing forward work from RCP5, i.e. the maximum time we would bring forward an asset replacement is 10 years.

As we would need to have a clear link to customers' works, and customers would need to agree the contracts, there would be pressure on us to ensure the costs are prudent and efficient.

Case study: Gore anticipatory capacity

Prior to 2022, there was a constraint in the South Island transmission grid whereby it was not possible to send excess Southland Murihiku power north through the Clyde–Upper Waitaki area. During 2022, activity was undertaken by Transpower to increase the capacity through this area and hence reduce the risk to Aotearoa New Zealand of Manapouri's generation not being available as part of the whole generation pool should the New Zealand Aluminium Smelter at Tiwai Point close.

We are currently upgrading the Gore grid exit point, replacing the two 60M VA 110/33 kV transformers with 80 MVA transformers, increasing the total to 1200 MW. Further upgrades throughout the network increase the 2035 capacity to 1,260 MW. As Transpower cannot commit to upgrades beyond 10 years, no increase is signalled from 2035 to 2050 at this time.

10.4.2 Anticipatory connection capacity

New or existing customers are required to contract with Transpower for new or upgraded connection assets. This is done on a first-come first-served basis. The first mover may face a large connection charge if it is establishing a new grid exit or entry point. This upfront investment may benefit 'second movers'. To reduce this first-mover disadvantage, the Electricity Authority purposefully created a cost-recovery mechanism under the 2022 Transmission Pricing Methodology, for the expenditure related to *anticipatory capacity* first-mover disadvantage. This provides for first movers to be compensated as other connectees join.

The Electricity Authority's changes also allowed for Transpower to recover costs for anticipatory connection assets. These assets may add capacity, or lower the cost of adding capacity, for future movers. The costs for anticipatory connection assets would initially be recovered from existing connectees until the subsequent connectees join.[58] The connected or connecting customer would still be responsible for funding the costs they create, but there would be efficiencies by better timing these upgrades or utilising economies of scale.

As we have previously not been able to recover our costs, we have not yet undertaken anticipatory investment in new connection assets. This means we have no historical data to analyse on the volume of need for incremental capacity or the associated costs. Any anticipatory investment will heavily depend on the type and location of any generation or load. Therefore, we do not consider we can produce a prudent and efficient forecast for anticipatory connection assets for RCP4. Our

[58] Please see *2022 Transmission Pricing Methodology*, paragraph 4.23 for more information.

customers would face both volume risk and unit cost risk if we included any expenditure for such assets in our base capex.

We are therefore proposing that expenditure on anticipatory connection assets be covered by an uncertainty mechanism. There would be no restriction on the minimum project size; however, a project with incremental costs above $20 million would be excluded from the mechanism as it would fall under the definition of an MCP.

10.4.3 Proposed option and assessment

Our proposed option is for a use-it-or-lose-it mechanism of enough value to meet connection asset needs across the whole 5-year period. We propose a fund of up to $100 million. We would be able to access the fund on an annual basis, and our RCP4 revenue allowance would be increased in a mechanical way only *if triggered*.

This estimate is based on a high-level upper indicative estimate of $75 million to bring forward customer works and $25 million for incremental connection capacity. The former is based on an estimate of five transformer replacements with equipment and works costs up to $15 million each. As we are proposing a use-it-or-lose-it mechanism, only actual costs would be reflected in our revenue.

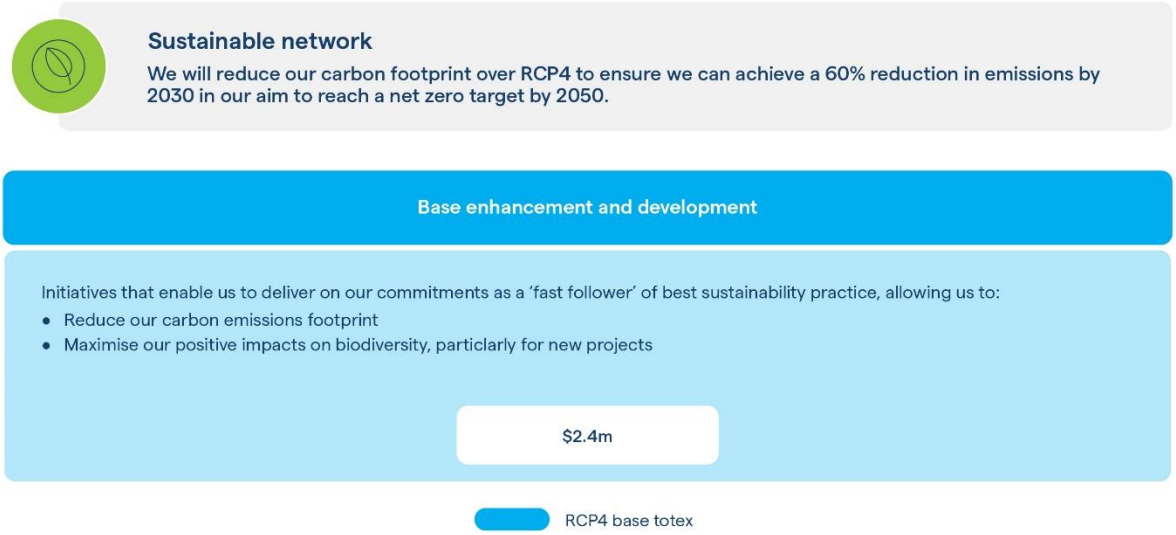
11.0 Sustainable network

Our sustainable strategy provides our overarching aspirations and targets in relation to climate change, environmental stewardship, operating a sustainable business, and working effectively with our communities.

With the scale of work involved in RCP4, we know we need to improve our engagement with iwi and hapū, landowners, councils, and other stakeholders. Ongoing cordial relationships tend to be less expensive than constant reinvention of contacts and interaction. Strengthened partnerships reduce project delays and costs.

The sustainability programme is largely supported by internal resources, with budget used for specialist expertise, pilot studies, and other support.

Figure 60: Delivering a sustainable network



Our sustainability programme includes a variety of initiatives to meet our sustainability aspirations across Transpower, our service providers, and suppliers. Most of our sustainability work cuts across all elements of our business and is therefore embedded within businesses as usual. However, we are proposing a small amount of additional expenditure to support further reducing our carbon footprint and meeting our biodiversity targets over RCP4. This expenditure is covered in this chapter.

We must report under the Taskforce on Climate-related Financial Disclosures and will be required to do the same under the Taskforce on Nature-based Financial Disclosures. The proposed expenditure is necessary to support the grid in being environmentally sustainable and climate resilient in the future. It is essential that we maintain our social licence to operate through this period.

Internationally, most transmission organisations are making similar sustainability investments to those we propose within our own strategy, in order to meet government climate change targets.[59] As part of setting our aspirations and sustainability work programme, Transpower closely reviewed the sustainability commitments of similar peer electricity transmission organisations internationally, including in the UK, Ireland, the European Union, Canada, the USA, China, and Australia.

There are a range of business drivers to which our sustainability strategy contributes, including brand and reputation, employee attraction and retention, investor expectations, and environmental, social, and governance reporting requirements. It also fulfils several statutory obligations, e.g.

[59] As set out in the *Paris Agreement*, Aotearoa New Zealand's carbon budgets are set by the Climate Change Commission and Government's emissions reduction plans.

climate-risk reporting under the Financial Market Conduct Act 2013, and membership obligations (e.g. as members of the Climate Leaders Coalition and Sustainable Business Council).

Transpower has committed to being a 'fast follower' of international and local best sustainability practice rather than an early adopter. This approach means we can commit to following the tested approaches of our peer organisations, learning from their innovations and practice, rather than incurring more costs and taking more risks with innovation and early adoption.

Our consumer advisory panel supported our 'fast follower' approach. The panel considered that sustainability and climate change are areas of medium importance. The panel support Transpower paying close attention to international and local developments and acknowledged that a lot of the work programmes under sustainability and climate change depend on developing technology and its associated cost. Members of the consumer advisory panel were keen for Transpower to undertake sustainability improvements where the cost-benefit analysis stacked up.

As part of the ongoing development of our sustainability work programme, we regularly engage with key stakeholders though our materiality assessment to get independent feedback and insights on our material issues and activities, ensuring our priorities and focus remain relevant. Our latest materiality assessment exercise revealed a high degree of alignment across stakeholder groups with our plans and priorities, with climate change perceived as a challenge with impact on the wider energy sector, and Aotearoa New Zealand as a whole. Transpower has an extensive programme of work under way under our sustainability strategy to address these material areas of concern.

Figure 61: Sustainability priority areas

Of these three areas, climate change has the widest scope and is the most challenging, with climate change expectations and mitigation having significantly ramped up during RCP3.

11.1 Climate change

Reducing our carbon footprint by 60 per cent by 2030 and achieving a net zero grid by 2050 are key aspirations within our sustainability strategy and our broader Whakamana i Te Mauri Hiko strategic purpose. Our sustainability strategy outlines several important work programmes in response to Government and international climate targets, emerging local issues for our sector, and international good practice.

11.1.1 Setting sustainability expectations for our service providers

This will see sustainability embedded in day-to-day work. Key areas set out in the service provider contract are carbon reduction and waste reduction, as well as positive relationships with landowners, iwi, and hapū. Our grid service providers have incorporated internal costs associated with delivering on our sustainability aspirations into their contract pricing throughout the contract term. Our RCP4 proposal includes internal support to work with grid service providers to measure and deliver carbon reduction objectives and sustainability outcomes and ensure a consistent approach. This is required as part of our responsibilities under the Taskforce on Climate-related Financial Disclosures.

11.1.2 Ensuring the grid is resilient to climate change

As discussed in Chapter 9.0, we must ensure the grid is resilient to climate change and meet our obligations under the Government's National Adaptation Plan in developing a Transpower adaptation plan. Much of what is required here is consistent with our activity to implement the Task Force on Climate-Related Disclosures framework in a manner that will meet the associated Aotearoa New Zealand Climate Standard reporting requirements for climate-reporting entities from 1 July 2024.

11.1.3 SF_6 emissions reduction

SF_6 is used in some HV switchgear and is our largest source of controllable greenhouse gas emissions. It has around 22,800 times the global warming potential of CO_2.

Our SF_6 management strategy includes a phased investment programme to reduce SF_6 emissions over time, which will reduce Transpower's annual Emissions Trading Scheme (ETS) surrender payments for SF_6 emissions through RCP4. This includes a proactive maintenance and replacement programme to reduce SF_6 emissions from our network. We have assessed this programme as cost positive against our ETS costs.

There is currently no proven alternative to SF_6 for HV switchgear. However, we are investigating the feasibility and costs of implementing a long-term plan to minimise SF_6 leakage and investigate alternatives to SF_6. Such a plan would require investment in alternative technologies, relying on technological innovation. These currently come at a higher cost, particularly for higher-voltage circuit breakers and SF_6-free equipment.

11.1.4 Equipment lifecycle and carbon reduction

We are committed to decreasing carbon emissions in all our equipment, not just SF_6. This will largely be undertaken through influencing procurement specifications, such as via a low-carbon or longer design life premium on new equipment such as transformers. Given the long operational lifecycles of many of our investments, this will be an area of increasing focus as an internal carbon price becomes more embedded in Transpower and business investment decision making. It will also occur when we include embodied carbon and operational carbon running costs in our annual greenhouse gas emissions reporting. It is, however, hard to determine the range of costs at this stage, and we will investigate further over the RCP4 period.

11.1.5 Enabling new renewable connections to reduce transmission network losses

Our Whakamana i Te Mauri Hiko scenarios assume there is increased renewable generation build over the next decade, resulting in substantial reductions in transmission network loss emissions. However, Transpower does not control investment decisions in these developments. We will continue our advocacy in this area and work to facilitate new connections.

We also have a work programme to better understand the make-up of transmission network losses and whether there are carbon reduction opportunities that we can affect, directly or indirectly. This, for example, might involve investing in more efficient, lower-loss transformers at our substations.

11.1.6 Identify and use low-carbon, cost-effective approaches and construction materials

We are in a unique position given our important role in enabling electrification across the economy. Ultimately, as electrification increases and we build connections and upgrade the national grid to support electrification in order to meet Aotearoa New Zealand's climate change targets, our carbon footprint will increase. While we can design, construct, and operate new energy sources in the most carbon efficient manner possible, the scale of the increase in transmission infrastructure will cause a corresponding increase in our carbon footprint. This comes as a result of operating the network and accounting for the embodied carbon as part of the construction, as well as upgrading of the electricity network. As part of ensuring our sustainability investments are cost effective, our sustainability work programme includes:

- trialling lower-carbon and lower-cost assets, including timber control and switching rooms at our substations
- trialling ester oil transformers to improve product lifecycles
- designing our assets to reduce costs, e.g. optimising concrete and steel in our substations and tower foundations.

We continue to roll out EV fast-chargers at our offices and key operational sites.

11.2 Environmental stewardship

We are facing increasing obligations around the effects of our assets on the environment, particularly:

- loss of indigenous biodiversity (from vegetation and habitat clearance associated with line maintenance and new construction projects)
- contamination of land and waterways from our activities (from historic activities, including stream crossings, tower painting, and line and tower replacement)
- waste from our construction, maintenance, and asset-replacement activities.

These environmental effects are factored into our consenting and compliance processes. In addition, there are a number of opportunities to improve environmental values around our existing assets

more generally. For example, we are working in collaboration with iwi and hapū, councils, and local communities to achieve a net gain in biodiversity across our asset base. Opportunities include:

- increased indigenous planting in and around our assets to improve biodiversity values
- upgrading stream crossings at key sites to enhance fish habitat
- addressing historic land contamination issues at high-risk areas.

We recently developed a biodiversity strategy to guide some of this work. As part of this, we engaged with utility infrastructure owners, including Waka Kotahi and KiwiRail. We are hopeful that this may lead to a reduction in maintenance costs.

Several electricity distribution businesses are also investing in similar environmental sustainability commitments. Many other organisations are well advanced with planning and frameworks that address the increased expectations to protect the natural environment.

We are investigating opportunities and working in collaboration with other entities in the sector to better manage our waste and use resources efficiently. We have a target to minimise waste through measurable improvements by 2030. This will require improved lifecycle decisions and to align with the Government's waste minimisation strategy and legislation.

Other areas we are working on to prioritise our environmental stewardship include:

- a pilot restoration partnership at Takapu Road substation in Wellington, as well as piloting our net biodiversity gain objective for new projects on the central North Island grid upgrade and Hautapu grid exit point projects
- progressing our waste minimisation strategy with monthly waste reporting in place for our service providers against waste targets
- preparing a contaminated land management strategy, including an action plan to focus our activity through the RCP4 period.

11.2.1 Sustainable business and our communities

Other areas we are working towards as part of our sustainability strategy include:

- using decision frameworks that consider social and environmental impact through the asset lifecycle, including the roll-out of our new sustainability by design standard to our engineering consultancies
- transparent reporting of our impacts, aspirations, and progress
- acknowledging the connections of mana whenua to the land, and partnering to remediate the natural environment, minimising the impact of our work on the land and sites of cultural significance
- working with landowners to reduce the impact of our footprint
- responding to opportunities to minimise our physical presence
- supporting inclusion through employee engagement
- continuing to promote a health and safety culture.

11.2.2 Sustainability costs

Based on a review of our sustainability programme commitments, we have developed an estimated cost for sustainability objectives, over and above work incorporated in our reliable and safe network work, of $475,000 per year through RCP4. This is based on two key premises:

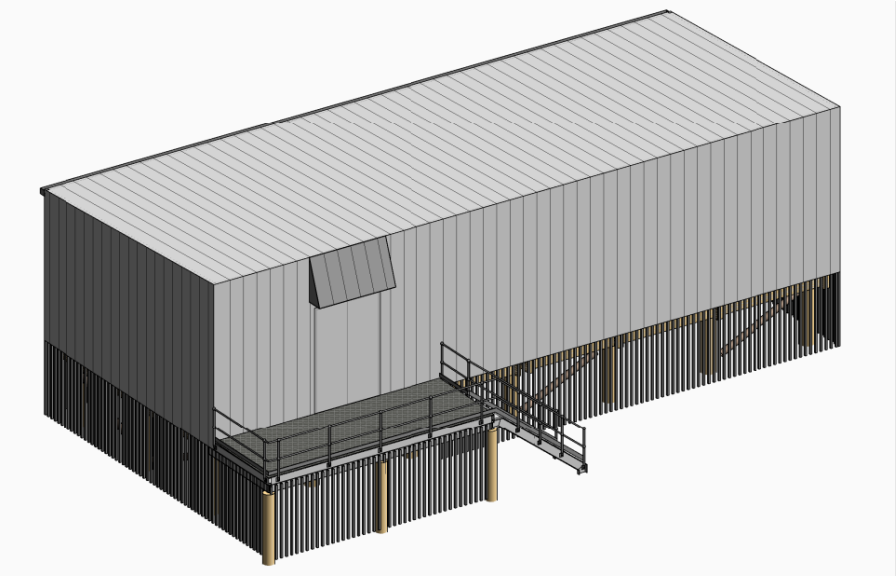
- relatively advanced work programmes for sustainability objectives, with detailed cost breakdowns
- embedding our sustainability objectives into early decision making and investment programmes.

We have not incorporated carbon pricing costs for investments through RCP4, nor have we included an allowance for costs associated with embodied carbon emissions in our network and infrastructure construction and operation. We have allowed for internal staff time in better understanding and influencing sustainability outcomes in design processes, influencing our grid service providers and wider supply chain, and implementing our strategy to minimise future risk through RCP4. We have not allowed for additional costs to build more sustainable projects such as low-carbon buildings and infrastructure around our network. Our desire is to achieve this for RCP4 within existing funding.

Case study: cost reductions through sustainable practice

In many cases, early consideration of sustainability will lead to cost optimisation or reductions. In some cases, there will be cost increases, but we will work hard to minimise these as far as practicable. Recent sustainability examples we have been working on that have been able to be subsumed within existing budgeted expenditure include the following.

The **consideration of a lower-carbon timber option** as part of the Pāuatahanui substation control room building upgrade project will result in overall project cost savings, as well as significant reductions in embodied construction and operational carbon, with reduced need for large-scale earthworks and piling to support a more traditional pre-cast concrete control room. A comparative lifecycle assessment of the Pāuatahanui substation control room building options demonstrated a significant saving in embodied carbon between the traditional pre-cast concrete structure (246,210 kg CO_2-e) and the cross-laminated timber control room building (3,960 kg CO_2-e), along with an associated reduction in building costs for the more sustainable, locally grown and manufactured timber option.



Pictured: A 3D rendering of Transpower's new Pāuatahanui substation control room building, using more sustainable cross-laminated timber construction.

Early investment in SF_6-free switchgear (such as circuit breakers) will ensure no further ETS costs for SF_6 emissions through the life of the switchgear. This will reduce longer-term ETS surrender costs (forecast to increase from a current price of around \$78/tonne CO_2eq to \$140/tonne CO_2eq by 2030 – based on 2022 Climate Change Commission modelling). Transpower's 2022 annual SF_6 emissions liability was \$293,000 (based on surrender of 175.94 kg of SF_6 gas used in 2022, translating to a total of 4,011 tonnes CO_2-eq).

The **installation of light-weight solar panels** on the roof of our Bunnythorpe warehouse involves an initial small cost premium over the non-solar warehouse construction costs. This is expected to result in annual cost savings in electricity for at least 10–15 years for the design life of the solar panels. Solar panel installation at this site will also facilitate corresponding savings in operational costs, through electricity for electric forklifts and supporting our EV charging network at Bunnythorpe as well as improving our understanding of carbon reduction opportunities for other operational sites.

Planting indigenous vegetation around some of our assets through our biodiversity strategy commitments will involve some upfront costs to purchase, plant, and maintain plantings but will reduce our long-term maintenance costs.

Improving our waste management practices may initially result in increased costs through waste diversion options and transportation, taking into account an allowance for government levies on construction and demolition waste being introduced in 2024. As scale and value in the waste economy is realised, our waste streams and other end-of-asset-life equipment (much of which has high scrap value [steel and aluminium] or use for other applications [UPS battery systems and circuit boards]) will increasingly generate income and may be cost neutral.

12.0 Expenditure and revenue

Revenue is set by the Commission at a level that covers our costs. Our biggest cost is funding past and future investments. This covers the return on and return of (depreciation) our regulated asset base. The other major component of our revenue recovery is operating costs.

Please note that, when considering the proposed expenditure in our plan, at our forecast cost of capital, the impact of $100 million of capex is approximately $20 million of revenue that needs to be recovered in RCP4. Opex is on a one-to-one basis with our transmission revenue requirement.

12.1 Expenditure

This section provides an overview of Transpower's total expenditure forecasts. Table 56 sets out our proposed base opex and capex across the four outcome areas, excluding expenditure associated with uncertainty mechanisms.

Table 56: Proposed RCP4 base expenditure by outcome (2022/23 $m)

Outcome	Capex	Opex
Reliable and safe network	2,066.4	1,943.0
Resilient network	75.0	12.2
Enhancing the network	111.7	-
Sustainability	-	2.4
TOTAL	**2,253.1**	**1,957.6**

In Table 57, we set out our estimated expenditure on listed projects, noting that listed projects are subject to a separate Commission assessment process before we can recover costs, and the capped amount of expenditure for resilience and enabling customer capacity uncertainty mechanisms. The expenditure under the use-it-or-lose-it mechanisms will only be added to our revenue if we deliver outputs within the defined boundaries of these mechanisms.

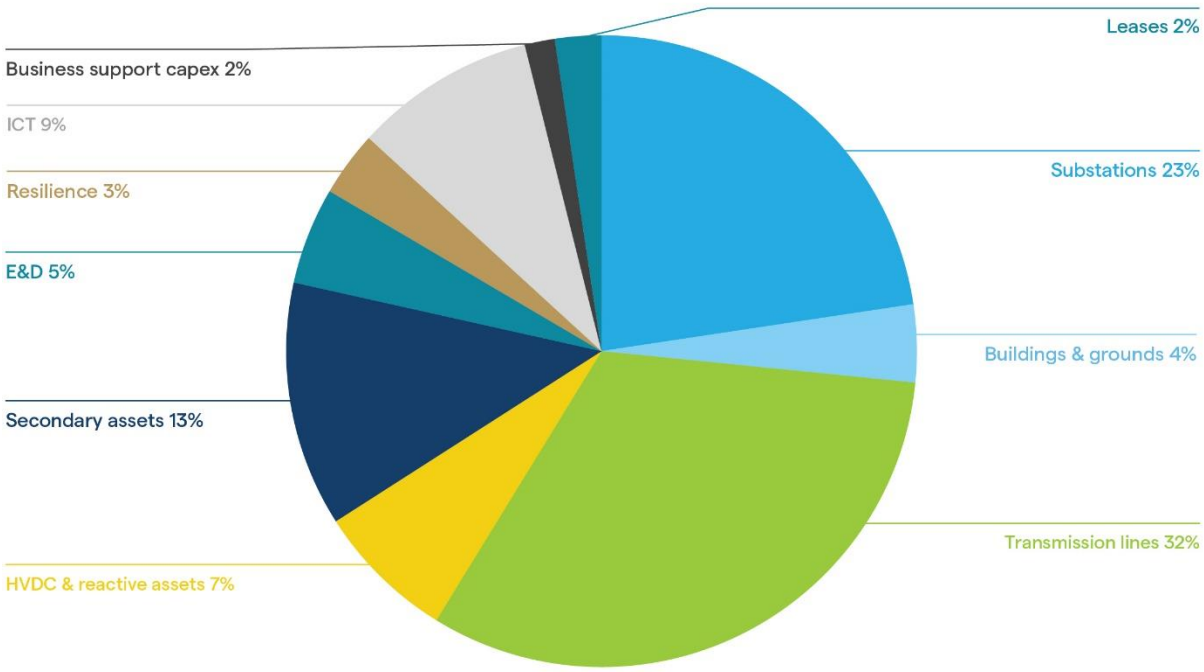
Table 57: Proposed RCP4 expenditure by uncertainty mechanism (2022/23 $m)

Outcome	Total expenditure
Listed projects	261.5
Resilience uncertainty mechanism	126.7
Enabling customer capacity	100
TOTAL	**488.2**

12.2 Capex

We forecast a 32 per cent increase in base capex, including capitalised leases, for RCP4 – from $1,698.9 million in RCP3 to $2,250.2 million in RCP4. This step change in capex is to allow us to respond to our ageing asset base. Figure 62 shows the proportion of expenditure across different asset classes and functions. It excludes the amount for uncertainty mechanisms as these are not part of our base revenue forecast.

Figure 62: Capital expenditure forecast for RCP4



12.3 Opex

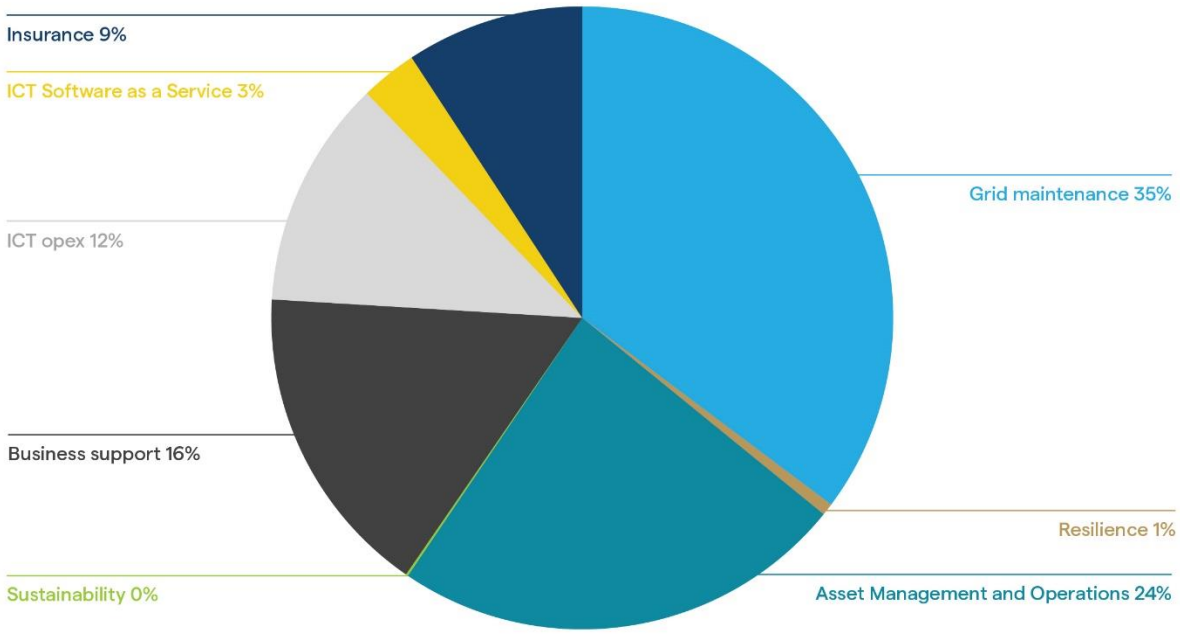
We are forecasting a 20 per cent increase in opex for RCP4 – from $1,632.6 million in RCP3 to $1,957.6 million in RCP4.

Driving this forecast increase is a:

- 9 per cent increase in maintenance spend
- 36 per cent increase in insurance
- 23 per cent increase in asset management and operations
- 12 per cent per cent increase in business support
- 28 per cent increase in ICT operating expenditure.

We are now also required to report some software as a service as opex, which we previously reported as capex.

Figure 63: Operating expenditure forecast for RCP4



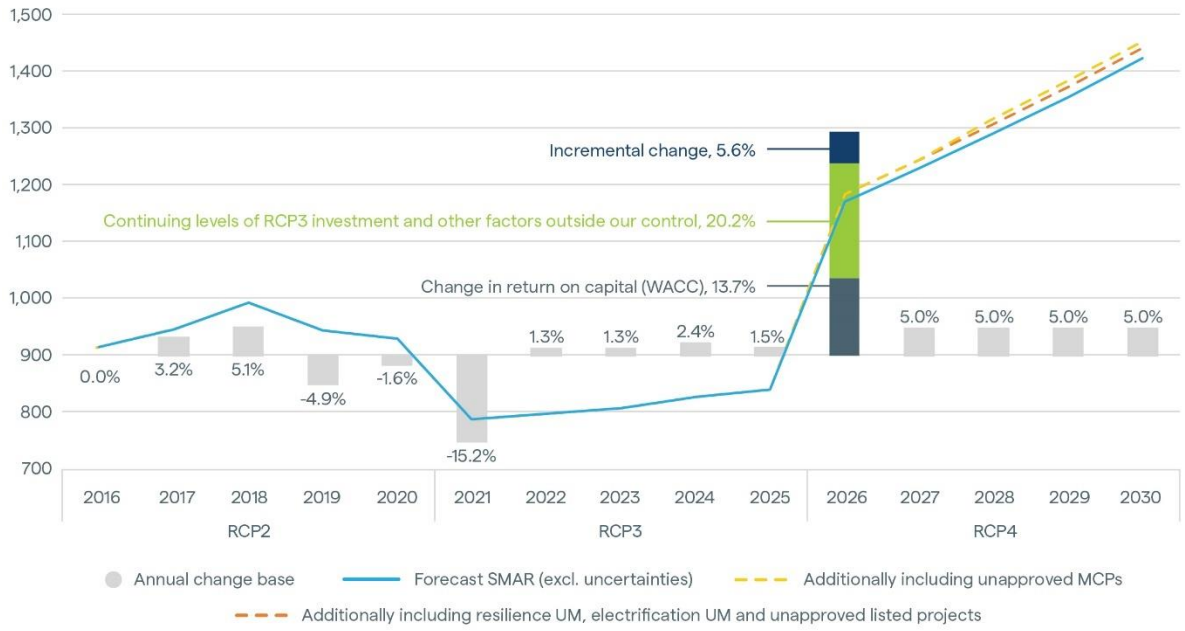
12.4 Revenue

The Commission sets the revenue we can recover for transmission services for each of the 5 pricing years starting from 1 April 2025. The revenue allowance the Commission sets excludes expenditure associated with uncertainty mechanisms and any financial incentive penalties or rewards applied throughout the RCP.

Our overall (nominal) revenue for 2025 to 2030 is forecast to be $6,474 million, compared with $4,065 million for 2020 to 2025. This is an increase of 59 per cent. This excludes unapproved major and listed capex projects, as well as our proposed uncertainty mechanisms (these would potential adda a further $118m of revenue during the RCP4 period).

In transitioning to RCP4, our revenue would initially increase by 39.4 per cent, followed by smaller year-on-year increases.[60] Smoothed MAR is predicted to pass $1.1 billion at the start of RCP4 and steadily rise to $1.4 billion.[61] Figure 64 shows revenue requirements, variously including and excluding proposed uncertainty mechanisms, listed projects, and major capital projects.

Figure 64: Smoothed revenue forecast 2016–2030, nominal



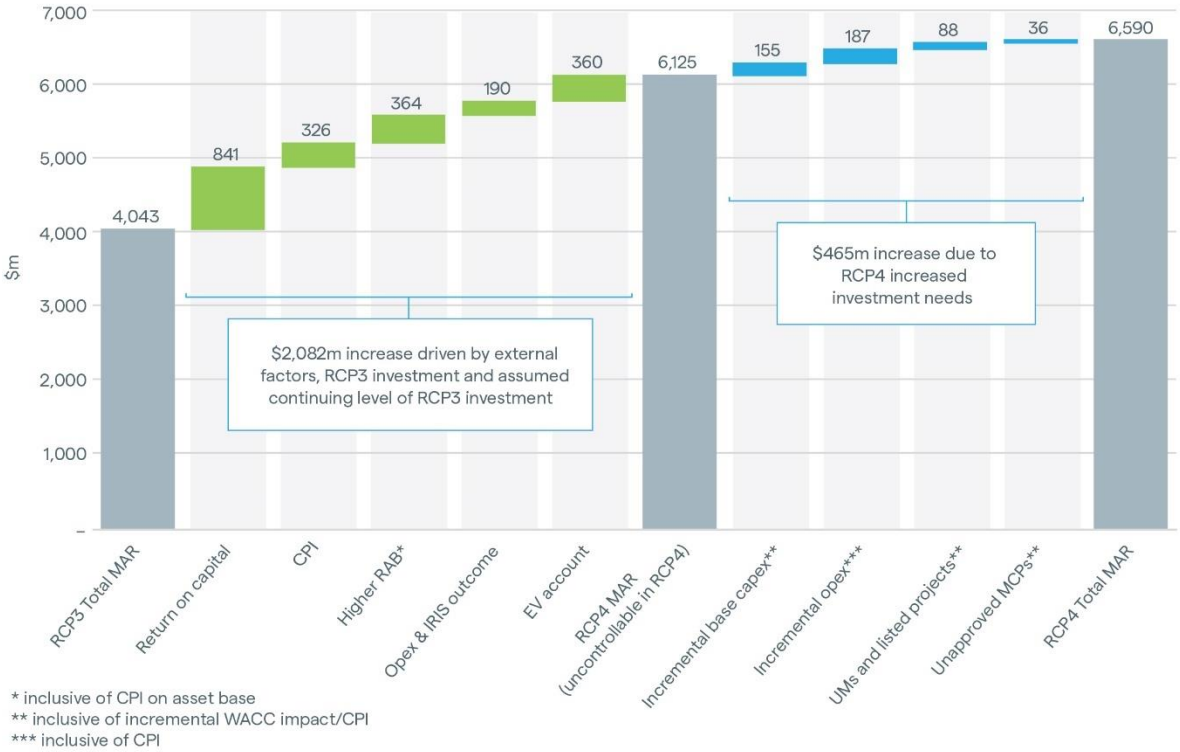
[60] We have smoothed our MAR with a 5.0 per cent per year increase to account for the underlying rate of change in investment profile and inflation forecasts. The 39.5 per cent step between the final year of RCP3 and the first year of RCP4 accounts for both uncaptured CPI (as the RCP3 allowance was set on 2019's expectation of forecast CPI) and the increase in the rate of return.

[61] Major capital projects do not form part of our RCP4 proposal but are a driver of our revenue requirements.

The key drivers of the increase in our revenue requirements are:

- under-recovery during RCP3
- the expectation of a higher required rate of return on our assets
- a larger regulatory asset base (RAB) with higher depreciation
- inflation
- higher opex.

Figure 65: Cost movement forecast from RCP3 to RCP4, MAR[62]



The Commission sets the allowable rate of return (WACC) for each RCP based on financial conditions at the time of the reset. For RCP3, the Commission set the rate of return at 4.57 per cent (vanilla WACC). Our revenue forecasts include a forecast of 7.17 per cent for the allowable rate of return for RCP4 (vanilla WACC). This component of revenue is set by market conditions and the Commission's input methodologies.

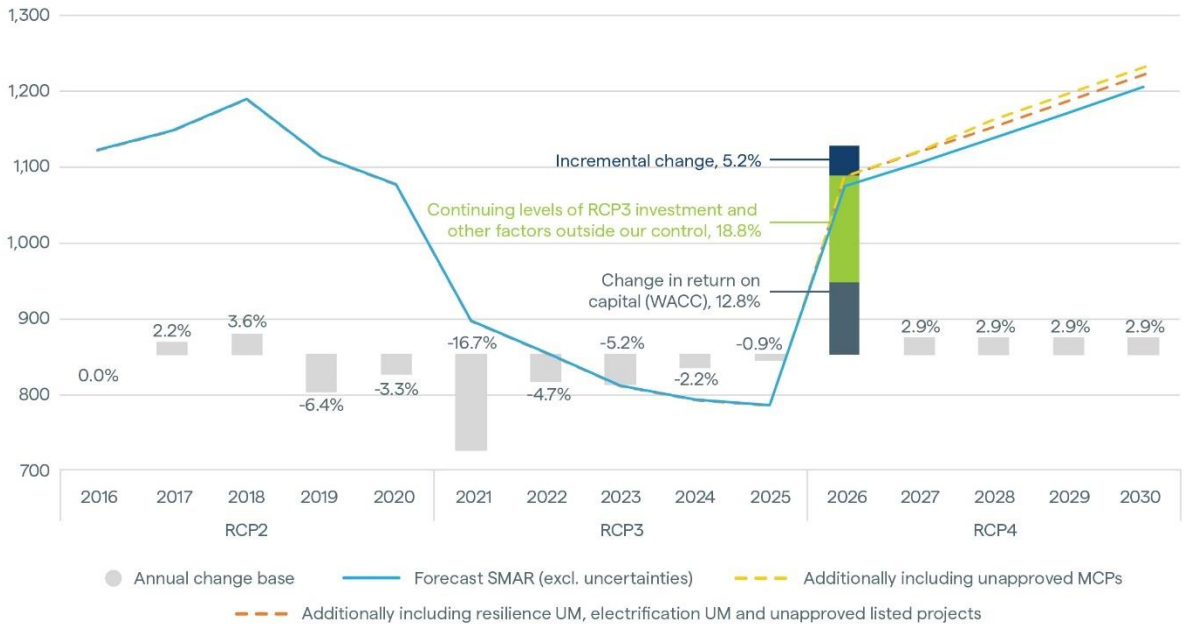
We use nominal prices for revenue forecasting, ensuring that the forecast impact of changes in input costs (e.g. labour and materials) are included in the forecasts, along with general inflation.

To forecast general inflation, we are required to use Reserve Bank forecasts of movement in the CPI. To forecast changes in input costs, we use independent forecasts developed by the NZIER.

[62] Note, differences to the totals in the text above result from the smoothing of revenue.

With interest rates and inflation rising, our revenue requirements for RCP4 are significantly higher. However, excluding inflation, we forecast revenue in real terms to be similar to our revenue requirements in RCP2, when interest rates were at a similar level.

Figure 66: Smoothed revenue forecast 2016–2030, real



12.4.1 Transmission charges

The Commission determines how much revenue Transpower can recover for transmission lines services, but it does not decide who pays. The way Transpower allocates charges to its customers – electricity distribution networks, generators, and large industrials – is determined by transmission pricing rules set by the electricity market regulator, the Electricity Authority.

On 1 April 2023, a new transmission pricing methodology, set by the Electricity Authority, came into effect. We must apply this transmission pricing methodology each year to allocate the revenue amount set by the Commission between transmission customers (i.e. how much each customer pays), but it has no impact on the overall revenue that Transpower receives.

The 2022 transmission pricing methodology requires us to allocate revenue in the following way.[63]

- **Connection charges**: recover the cost of assets that connect individual customers to the interconnected grid and are paid by those customers.
- **Benefit-based charges**: for new and some historic interconnection investments, paid by the customers who are expected to benefit from them.
- **Residual charges**: recover residual revenue (MAR less all other transmission charges). Residual charges are allocated according to each customer's gross load, whether the load is supplied from the grid or from embedded generation, and regardless of season or time of use.

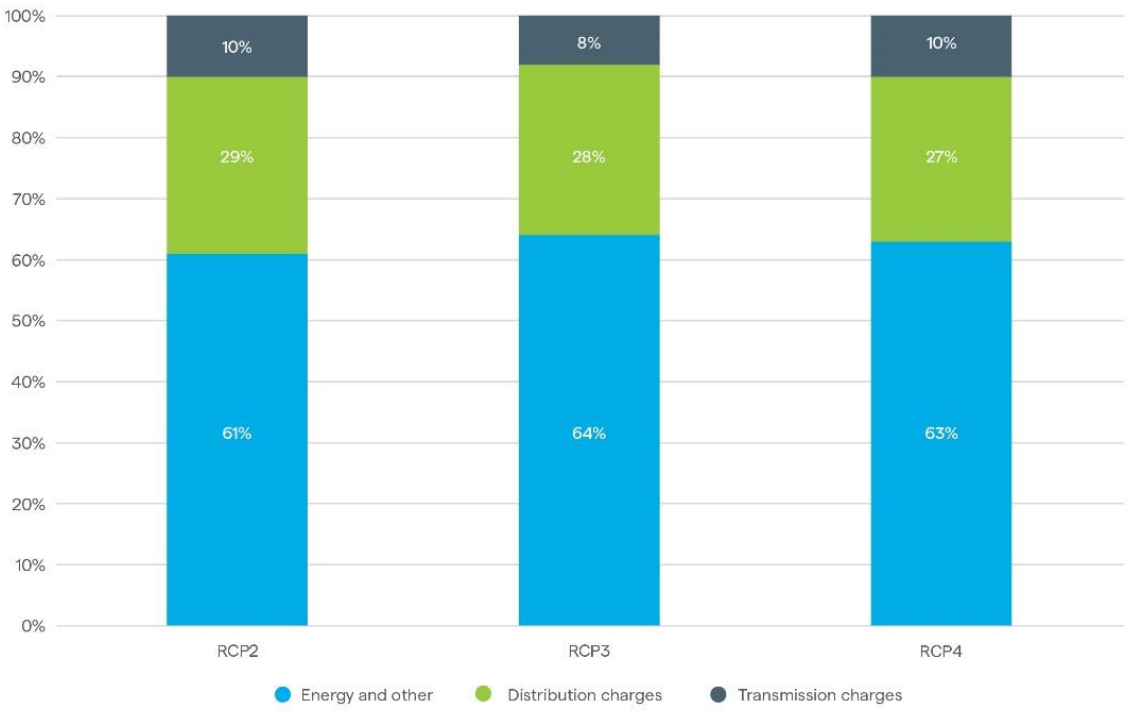
Additional information on different components of the transmission pricing methodology is available here: Transmission Pricing Methodology | Transpower.

We have calculated aggregate indicative charges for customers based on our forecast revenue. These are provided in the RCP4 Indicative Transmission Charges workbook.[64] Actual charges will be based on the value and location of the investments made during RCP4 (and during the remainder of RCP3). Therefore, charges *will change* between now and when they are notified to customers for each pricing year.

For a typical domestic or small business consumer, transmission currently makes up around 8 per cent of their bill. We are forecasting that this proportion will go up slightly in RCP4 to around 10 per cent, based on assumptions that retail and distribution costs do not increase and average household consumption stays the same.

[63] Please refer to our *Guide to the TPM* for more detail.
[64] Note, we will publish updated indicative charges when pricing year 2024 is finalised in December 2023.

Figure 67: Breakdown of a residential electricity bill

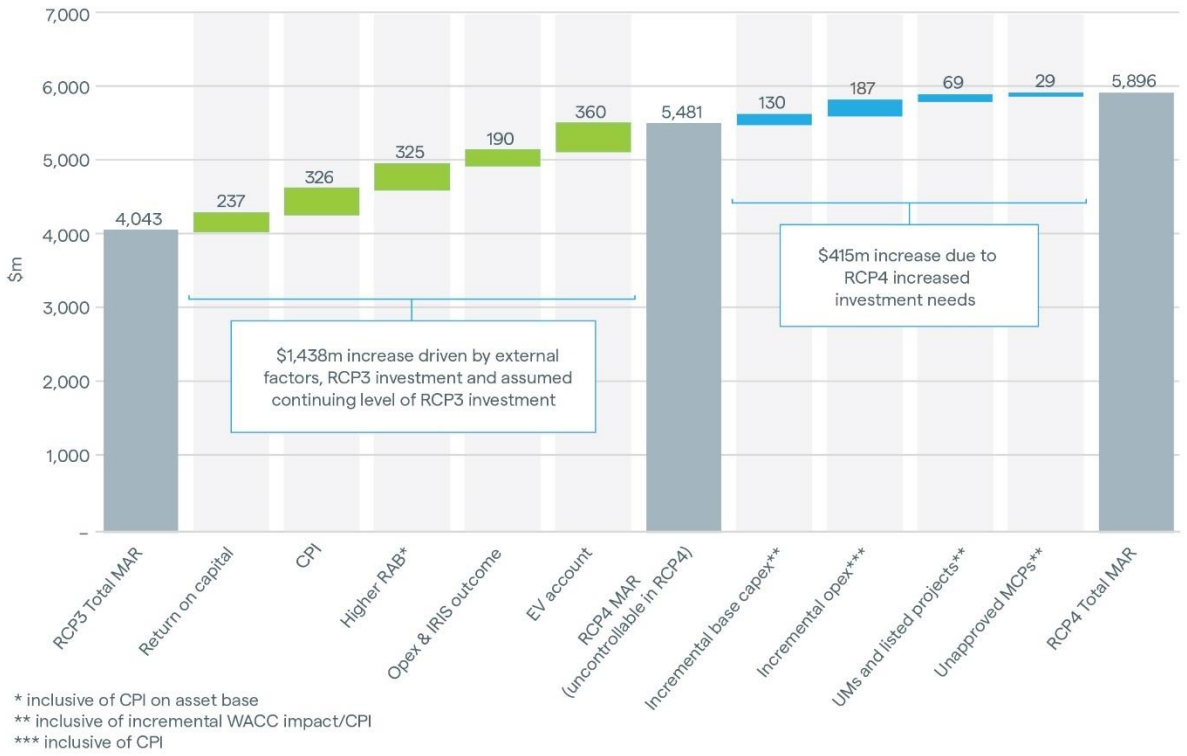


12.4.2 Revenue forecast with an indexed RAB

In June 2023, the Commission announced its input methodology draft decision to index our RAB. In simple terms, this means that, rather than recovering increases in the CPI each year through the rate of return, it would be added to our RAB, and we would recover it over the life of our assets. This approach pushes revenue recovery further into the future, i.e. 'backends' our revenue recovery.

The Commission's final decision is due in December 2023, after this proposal is published. To provide stakeholders with an indication of the impact of indexation if the Commission decides to index our RAB, in Figure 66 we set out our smoothed revenue requirements for RCP4.

Figure 68: Smoothed revenue forecast 2016–2030, indexed RAB, nominal



* inclusive of CPI on asset base
** inclusive of incremental WACC impact/CPI
*** inclusive of CPI

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