Customised price-quality path (CPP)

Main Proposal

12 June 2017

Executive summary

This section provides an overview of our CPP proposal and the main drivers for our planned investments.

EXECUTIVE SUMMARY

We are proposing to increase investment to secure better outcomes for our customers in the near term, and better long-term price outcomes.

This Main Proposal forms part of our application for a Customised Price-quality Path (CPP). It outlines the expenditure we need to operate and maintain our electricity distribution network safely, reliably and efficiently. It presents our investment plans for the CPP Period (1 April 2018 to 31 March 2023) for consideration by the Commerce Commission (Commission). These plans will enable us to undertake prudent investment in our electricity network so that we can continue to meet our customers' service expectations and support the communities we serve.

Our proposed investment plans will lead to a modest increase in the prices our customers pay. We have explained the proposed increase to our customers and stakeholders. We also consulted extensively on our planned investments (and alternatives) and the potential impact on future electricity prices.[1] Our forecasts of expenditure requirements take into account the feedback we have received from our customers.

If our plan is approved, revenue will increase by 5.7% at the start of the CPP Period and annually in line with inflation during the period.[2] To place this in context, this 5.7% increase would add about 79c per week to a typical household customer bill. As an alternative, we could smooth the increase over the whole of the CPP Period, which would equate to an annual increase of around 1.9% per year, plus inflation.

In developing this CPP proposal, we have carefully analysed the underlying health of our assets, how this has been trending over time and how it is predicted to trend in the future. We have also reviewed our maintenance and vegetation management practices in light of industry good practice and our compliance obligations.

We are committed to further developing our overall asset management capability to meet internationally accepted good practice standards, and the investments in this CPP proposal are important enablers of that goal. These improvements will support the future efficiency gains we are targeting from improved work processes and optimised investment and operational decision-making. Accordingly, we have set ourselves an ambitious goal to be fully compliant with the internationally recognised asset management standard, ISO 55000, by 2020.

Our plans have been independently challenged to verify that they are prudent and efficient.

We have consulted extensively on our planning with customers and a wide range of stakeholders. Our proposed plan has also been challenged by independent technical experts and tested against the "expenditure objective" defined in the CPP Input Methodologies (IMs). These expert reviews have looked at whether the proposed investment is necessary, efficient, and prudently timed. This rigorous process of customer engagement and independent review has helped us ensure our final CPP proposal strikes the right balance between keeping bills affordable and investing in our assets for the benefit of today's customers and future generations.

The work involved in completing this proposal, and progressing through the mandatory pre-application independent assessment process (verification and audit) has been challenging. We have complied with the Commission's detailed information requests, as set out in the various Part 4 IMs.

Our CPP application comprises this Main Proposal, supported by a comprehensive and updated Asset Management Plan (2017), together with a suite of technical supporting documents.

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1 Reference to 'price' here acknowledges that retailers' tariffs determine how actual distribution charges are passed through to end consumers of electricity.

2 Relative to the revenue we expect to recover if we continue on a default price path.

We have developed this document to enable stakeholders to understand the rationale for our proposed investment plans and the services we will deliver to customers both over the short and longer term. The other supporting documents and the accompanying financial model contain more detailed information to assist the Commission and its technical consultants.

We are now seeking approval from the Commission to deliver the service outcomes our customers expect.

An integral part of our CPP application is the independent verification report by Farrier Swier and WSP. These specialist consultants worked for the Commission to independently assess our approach and resulting expenditure forecasts.

We are committed to continue working constructively with the Commission and other stakeholders to explain why this proposal delivers the best price-quality outcome for our customers in light of the challenges we face.

We have reached a point where a CPP has become imperative

Electricity is a key enabler for economic prosperity and a modern lifestyle. Our core business is to ensure that it is delivered to our customers safely, reliably and efficiently. As such, it is essential that we invest appropriately to ensure our assets are of appropriate condition and capacity, and meet the needs of our customers.

Previous regulatory allowances have constrained our ability to invest adequately in the network. This is no longer sustainable.

Over the past five years, despite our regulatory price constraints, we have lifted investment by almost 60%[3] to manage the ageing of our asset fleets and in support of economic growth in our communities.

However, even this increased level of investment is not sufficient to address the mounting pressures on our network.

- Asset health, fault rates, and supply quality are deteriorating.
- Supply security levels have progressively degraded, putting major load at risk.
- The level of deferred maintenance works has increased to unsustainable levels.

Looking forward, the challenges we face will increase if we remain on a DPP, leading to declining network performance and increased safety risk.

Looking forward, we are forecasting increases in the number of assets at risk of failure, and also expect continuing growth on parts of our network with strong population and economic growth. In addition, we anticipate increasing volatility in electricity demand and changes in the way our network is used, as our customers respond to the opportunities presented by emerging technology. This will have major implications on the way we build and manage our network, for which we have to prepare.

If we do not increase investment our network performance will continue to deteriorate until we can no longer provide the safe and reliable service our customers expect. We will also not be able to evolve to meet our customers' future expectations of increased technology options and supply flexibility. Our CPP proposal is designed to prevent this from happening by enabling us to make prudent investments that minimise long-term costs for consumers.

Asset performance will decline to unacceptable levels under the DPP

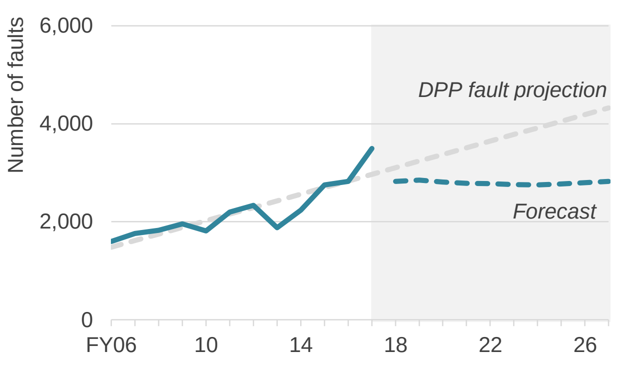
If we do not lift investment materially above the level supported by the Default Price-quality Path (DPP) revenue allowance our existing trend of declining asset performance will continue, and likely worsen.

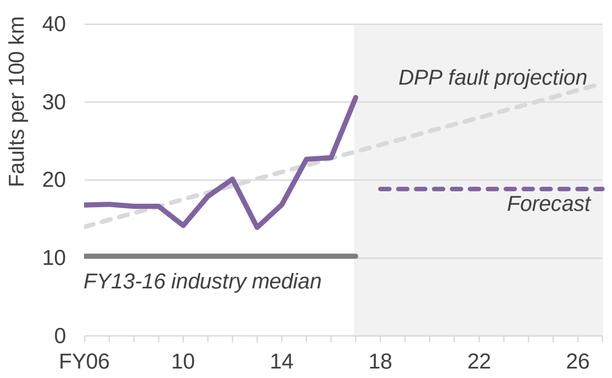
The following charts show leading indicators of long-term network performance. Our historical trends have been deteriorating, and our modelling indicates significant further decline if we do not lift investment to improve the health of our assets.

[3] This compares total network expenditure (Totex) from FY12 to FY16 with that from FY07 to FY11.

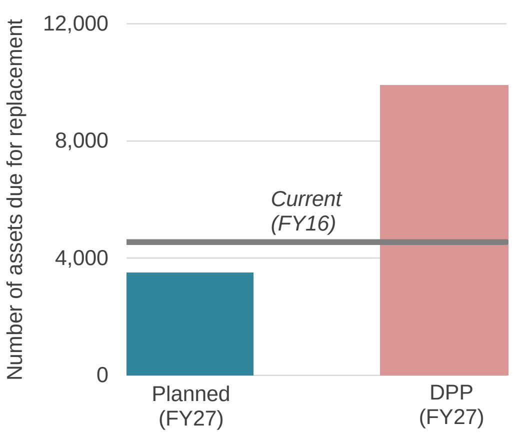
Counterfactual charts – trends in leading indicators of long-term network performance

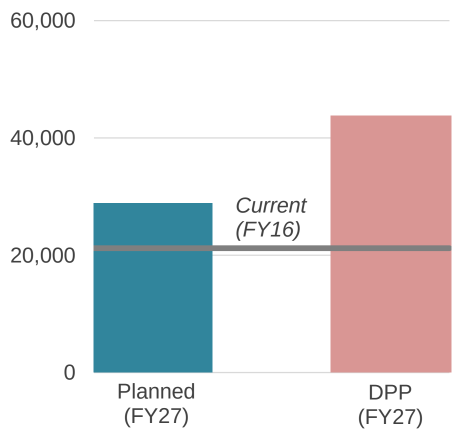
Overall network faults	Distribution overhead line faults





Insufficient investment will lead to an unsustainable number of poles in need of replacement.	Insufficient investment will lead to an unsustainable number of crossarms in need of replacement.





What the charts show

Overall network faults

- Network faults have more than doubled over the last decade and, more recently, the fault trend appears to be accelerating.
- If expenditure remains at current levels, network faults are expected to continue rising. The CPP proposal aims to stabilise faults at current levels.

Distribution overhead line faults

- This chart shows the number of faults per 100 km.
- The performance of these lines (our largest asset category) is deteriorating and the trend is projected to continue (or potentially worsen) under the DPP.
- Conversely, our proposed CPP expenditure aims to arrest the trend.

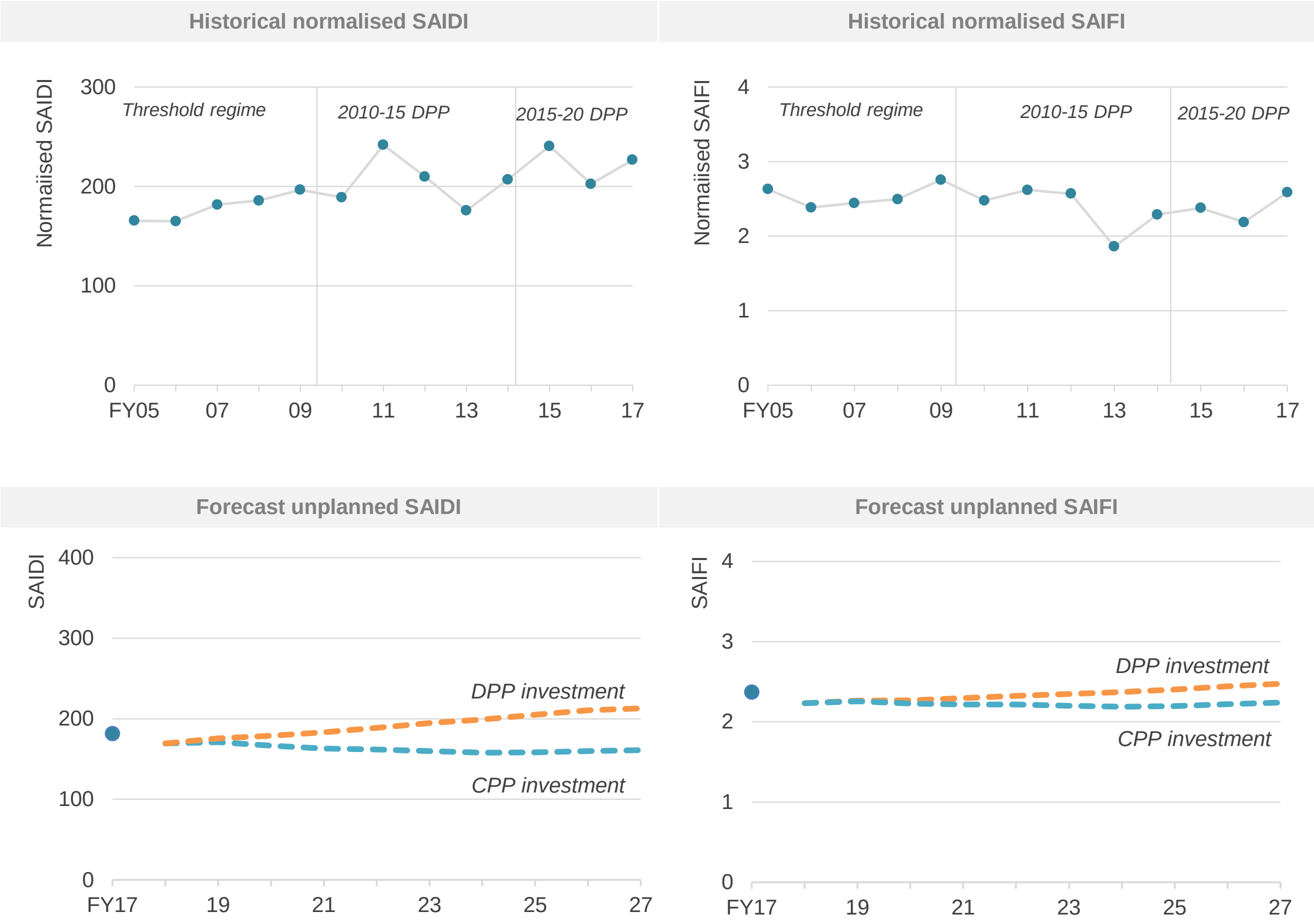
Asset health indices

- The proportion of assets in poor condition and requiring replacement is substantial.
- At current expenditure this proportion will increase to unacceptable levels.
- Our proposed CPP expenditure will stabilise health at levels where it can be effectively managed.

The current performance of our network and assets is poor and deteriorating – a trend that will persist under a DPP.

Over time, these leading indicator trends will translate into worsening network reliability for our customers. Our long-term network reliability (SAIDI and SAIFI)[4] trends are shown below. We also show the anticipated unplanned[5] SAIDI and SAIFI over the CPP period and beyond, should we remain on the DPP, as compared to proposed CPP investments.

SAIDI and SAIFI – historical and forecast values[6] [7]



4 SAIDI (System Average Interruption Duration Index) indicates how long an average customer is off supply in a year. SAIFI (System Average Interruption Frequency Index) indicates how many times an average customer is off supply in a year.

5 Planned SAIDI and SAIFI are forecast to substantially increase over the CPP period, reflecting the increases in proposed construction and maintenance works on the network. Underlying network performance is therefore better assessed through unplanned reliability trends.

6 The historical values shown are as per compliance statements, except for FY15-17 where figures relating to planned outages are unweighted to allow comparability over time. (Since FY15, for Information Disclosure and compliance purposes, planned SAIDI and SAIFI are weighted at 50%). All figures are normalised to avoid the impact of Major Event Days distorting trends.

7 Note that reliability performance is subject to significant annual variation – reflecting the impact of external events, particularly the impact of weather on overhead assets. Forecasts are by necessity based on point values, as indicated. However the actual outturn for any year will vary around the forecast line.

What the charts show

SAIDI

- Our historical overall SAIDI has deteriorated over the last ten years, albeit at a significantly slower rate than network faults. This positive difference was mainly achieved by investing in network automation technology, which is a cost-effective short-term measure to improve SAIDI. Network automation reduces the average number of customers affected by a fault, as well as allows many supplies to be restored quicker when faults occur. This shielded consumers from the full impact of increased age-related network faults. We have also built more distribution feeders to reduce the average number of customers affected when a fault occurs.
- However, there is a limit to what can be achieved with this. While there is still some short-term scope for further automation, as included in our proposal, the remaining opportunities will be increasingly less cost-effective in the longer term. Automation can also not fully compensate for the impact of an ageing asset base.
- If we continue to invest at DPP levels we will not be able to mitigate the increasing fault rates associated with ageing assets and SAIDI will deteriorate materially.
- Conversely, the proposed CPP investments will help stabilise SAIDI at current levels, or slightly improve[8], enabling us to meet our customers' reliability expectations.

SAIFI

- Average SAIFI has improved over the last ten year – again mainly an outcome of investment in automation and distribution feeders.[9]
- However, as with the SAIDI, under DPP allowances we will not be able to mask underlying asset performance trends, and we expect SAIFI to worsen.
- The CPP investments are intended to stabilise this situation, as shown.

Worsening asset performance trends are putting significant pressure on network reliability, and in the longer term under a DPP, SAIDI and SAIFI will deteriorate.

Our CPP proposal is focused on addressing underlying network issues before they translate into unacceptable reliability outcomes. These outcomes would impose substantial and unacceptable costs on our customers resulting from loss of supply as well as higher costs associated with increasing levels of reactive response.

We want to address the underlying network issues before they cause reliability issues for our customers.

Our CPP investment plan will minimise long-term costs for our customers

We have made sure our investments will meet customer requirements at the lowest long-term cost. We can illustrate this by considering the long-term cost impact of two alternative scenarios:

- 'Invest now' a scenario that reflects our CPP investment plan and timing
- 'Invest later' a scenario that defers investment for five years.

In assessing these scenarios, it is also necessary to take into account the wider implications of these two options, particularly in relation to network reliability, safety and our ability to realise cost-efficiencies through new technologies.

Stylised 15 year period expenditure profiles for these two investment scenarios are shown below.

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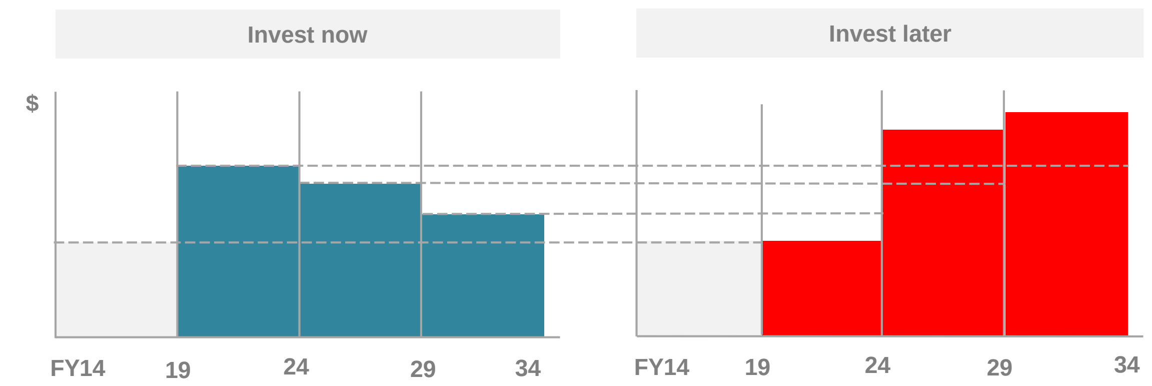
8 While it is not our direct goal, the work proposed to arrest declining asset performance, and bring maintenance and vegetation management to good practice standards may, as a secondary effect, lead to a small improvement in reliability. However, it should be noted this improvement is small, falling well within the margins of error of our model.

9 More recently, SAIFI appears to be trending up, but the number of data-points is insufficient to allow a firm conclusion.

Stylised expenditure profiles



The expenditure profiles that we modelled are as follows:

- **Invest now:** represents the proposed CPP expenditure over FY19 to FY23, followed by lower expenditure as the benefits from the initial investments are realised. This is the expected outturn from our proposal.
- **Invest later:** represents remaining on the DPP until FY23, followed by substantial catch-up expenditure. This catch-up expenditure will be less efficient than the CPP proposal because of the serious issues projected to arise from deferment, including increased safety risk and significantly deteriorated assets with associated reliability and cost impacts.[10] Maintenance costs, especially reactive, are anticipated to escalate greatly by the second period (FY24 to FY29), as the deterioration in asset condition worsens at an increasing rate.

Our analysis shows that over the longer term, our proposed CPP investment will deliver the least overall cost to consumers.

What our analysis of the expenditure scenarios show

We constructed a model to compare the cumulative (NPV) cost to customers between our CPP proposal (Invest now) baseline and the Invest later option.

The model relies on a large number of inputs, many of which are variable and some of which require a significant degree of professional judgement to forecast. To moderate this uncertainty, our modelling considers all inputs over a likely range. This means that the model outputs also fall within a range.

Our modelling shows that, given the current state of our assets, increasing expenditure now will deliver substantial savings in future years.

Our modelling results show that:

- When considering a 15 year investment period, the Invest now scenario has a much lower cost impact on consumers than the Invest later scenario. This outcome holds over the whole modelling output range, and the average of the outputs suggests a net cost of more than $200m higher for the 'Invest Later' scenario. This relative benefit of the 'Invest now' scenario increases further if a longer investment period is considered.
- If the comparison investment period is reduced to ten years only (which is unrealistically short, given that we invest for the long term), the results are substantially the same, with only low-probability outlier scenarios showing the potential to result in an equivalent or marginally lower cost outcome compared to the 'Invest now' scenario.

In the longer term, the overall cost to customers of the proposed CPP will be substantially lower compared to deferring the required catch-up.

Accepting the limitations of this type of long-term modelling, the analysis shows it is not prudent to materially defer investments needed to restore the health of our assets.

Our proposed CPP expenditure profile balances the desire to minimise price increases today against the need to deliver safe and reliable network services at the lowest long-

10 This includes spending a higher proportion of Opex (vs. Capex) as more maintenance and reactive response will become essential to address issues associated with escalating failure rates and poor asset condition.

term cost. In doing so, it delivers substantially higher longer-term benefits to customers than deferral-based alternatives. The CPP mechanism is designed for these circumstances

We are regulated under Part 4 of the Commerce Act (1986). In applying this framework, the Commission, as the sector regulator, acts in the long-term interests of electricity customers to determine the maximum amount of revenue that EDBs can recover.

The current rules have been in place since 2010 and include two mechanisms:

- The first is the low-cost DPP that is set for each company for five years. The current DPP was set in 2015 and extends to 2020. A DPP only partially takes into account the specific circumstances and needs of each business.
- The second is the CPP, which allows companies to make an application for a bespoke price path if the revenue allowance set under a DPP is considered to be inadequate to meet the long term needs of the business.

We are now at a stage where we require a CPP. As already explained, at the current DPP settings we cannot sustain current service levels over the longer term, or continue to ensure the ongoing safe, reliable and sustainable operation of our network.

History is important to set the context for our CPP

The history of the process for setting the revenue allowances for electricity network businesses is important context for our CPP application. This history spans three notable periods:

- **2001 – 2010: Threshold-based regulation**

  At the outset of price regulation, no calibration of prices to business needs was undertaken. After the initial setting of prices, annual price adjustments were based on historical costs and CPI inflation, less an adjustment for assumed future efficiency savings. This mechanism took no account of future investment requirements. This period resulted in expenditure allowances that were insufficient to meet the long-term needs of our network.

  We managed through this period by driving substantial efficiencies into our business, being very selective in our investment decisions, deferring major expenditure, and ultimately, managing our assets for the short-term within the constraints of the regulatory mechanism.

Historically, our regulated revenues have been constrained and have not changed in line with our network requirements.

- **2010 – 2016: Introduction of the DPP and CPP mechanisms**

  The introduction of the DPP and CPP mechanism was a positive step. While the DPP takes into account future investment needs to some extent, allowances are based partly on generalised industry assumptions. The alternative CPP mechanism was designed to address situations where those generalised assumptions were inadequate. We supported this mechanism as it aligned the Commission's regulatory framework with the more mature incentive based regimes operating internationally. However, the new mechanism was initially introduced with some significant uncertainties that made it impractical for us to pursue a CPP.

  Since 2011, operating within a DPP, we have continued to drive efficiencies into the business. However, we have had to take an increasingly short-term approach to asset management and accept that an increasing proportion of assets would need to be operated near to and at times beyond their prudent life. Such an approach is not sustainable over the long term.[11]

[11] In fact, over the period 2011-2016 we exceeded our DPP allowances to maintain service levels for customers.

– **2016: Amended CPP mechanism**

The CPP process was updated and improved by the Commission through its 2016 review of IMs. These important decisions have enabled us to pursue this CPP proposal.

Managing investments to best account for the long term needs of customers, and achieve lowest 'whole of life' cost outcomes requires a long-term approach, tailored to the actual needs of a network. Since our historical regulatory settings never considered these needs, and have not been substantially revised since their inception, there is now a considerable gap between our expenditure allowance and what is needed to effectively manage our network.

Through this CPP proposal, we are seeking to establish a new, sustainable expenditure level for our network.

A positive outcome of the cost pressures we faced from 2001 to 2016 is that we have been required to operate lean, and as result have become a leading business in terms of the cost efficiency of our operations. Our CPP plan builds on this efficient base to ensure we will deliver our future programme of work at an efficient cost to customers.

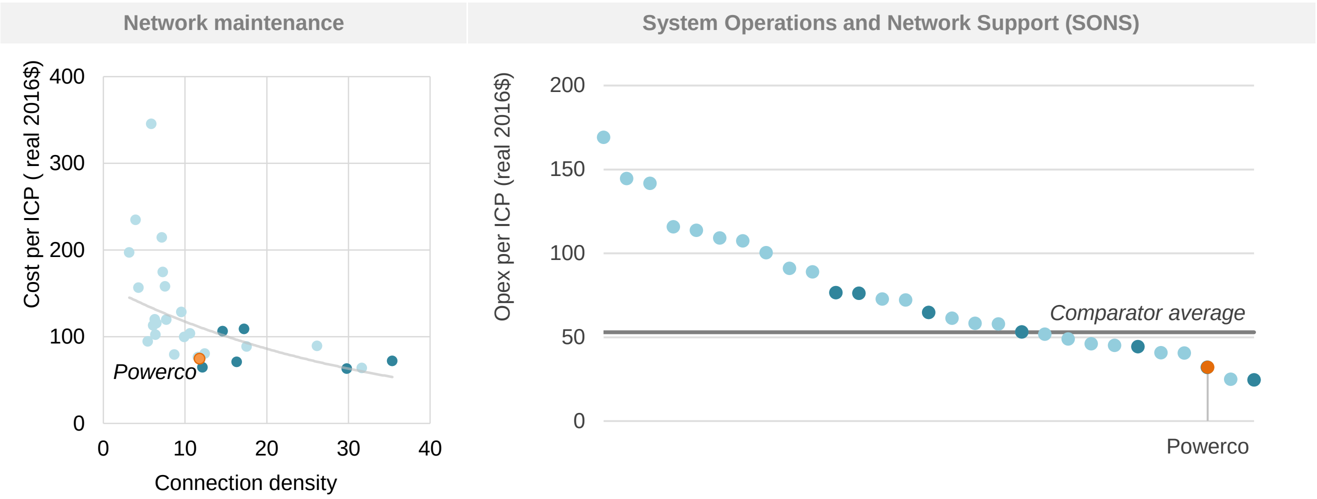
The historical downward pressure on expenditure has been managed by our proactive effort to drive efficiency into our business.

Current network performance and emerging issues

Operating within the DPP has dictated a need for targeted capital rationing. Despite this constraint, our investment (Capex and Opex) has actually increased by almost 60%, in real terms, over the period 2007 to 2016. Put simply, we have invested more in our network than the regulations have allowed and this overspend has not been fully reflected in charges to customers over the years.

At the same time, we have worked hard to drive efficiency into our design, procurement and delivery to make sure that we maximise the value of the funds we have had available. This has resulted in us becoming a leading performer on cost and productivity among New Zealand EDBs, as illustrated in the benchmarking examples below.

Opex benchmarks (FY13-16 average)



What our analysis of the expenditure scenarios show

To provide an appropriate comparator across companies of varying size, expenditures are normalised to a per ICP basis. We also highlight the six largest EDBs as they are the closest peer group to which we can be compared – having similar scale and facing similar challenges of managing higher customer numbers and large networks.

- Our maintenance spend is among the lowest in the country. This is despite our relatively low network density, which typically leads to higher maintenance costs.
- Our SONS activities are also very efficient compared to other EDBs, including our closest peer group.

Our operations are at the forefront of cost efficiency in New Zealand.

The limitations of DPP allowances for our business circumstances have resulted in our network and asset performance deteriorating. This performance is now at risk of falling below what is acceptable for a prudent operation.

We have already shown the overall increase in network faults, and the relatively poor asset health situation above. The trends we are seeing are clear. Left unchecked it is inevitable that the decline in operational performance will continue to accelerate and ultimately lead to unacceptable safety and network performance outcomes.

Our CPP has been shaped to meet our customers' expectations

Our CPP proposal has been developed around three themes, reflecting feedback we received from customers through our annual engagement and reinforced via a customer survey in FY16. The three themes are:

- **Safety and reliability**: In recent years, we have seen clear and material degradation of our network operating position and condition, evidenced across a range of leading indicators (e.g. asset health). In-service asset failures are rising, and condition is degrading across a range of asset fleets, particularly in our overhead network. This requires us to focus on the underlying condition of our network (rather than focusing on short-term reliability alone) and to maintain and replace equipment in a prudent and timely way.
- **Supporting communities**: We play a critical role in facilitating economic growth in the regions we serve. We support diverse communities across the north island of New Zealand by providing a secure, cost-effective and reliable electricity supply. The communities we serve continue to experience strong economic growth driven by population growth, and enhanced commercial and industrial activity. To meet the needs this poses, we have to increase our levels of investment to provide sufficient capacity, and appropriate supply security.
- **Network evolution**: New technology and service offerings combined with increasing consumer willingness to take control of their energy options are leading to changing asset management requirements. Opportunities for more cost-effective network solutions are also emerging. To stay abreast of these developments, and to ensure the continued stability and efficiency of our network, we need to invest in trials and pilot schemes of new solutions. This will be key to ensuring the long-term interests of customers.

The CPP proposal is designed to address the main issues we now face:

– Declining safety and reliability

– Supporting community growth

– Positioning the network for the future

Our three investment themes are supported by customers and stakeholders.

Customers and stakeholders told us what they were most concerned about.

Our stakeholders rightly expect us, as a minimum, to be able to demonstrate that our networks are safe, reliable, and efficient. We too consider these as givens.

Over the past 12 months, we have engaged extensively with customers and stakeholders to explain our current network performance, the emerging issues we are seeing and the investment that is needed to address these issues. While good and safe engineering practice dictates where a large part of our future investment is targeted, our plans have also been shaped to reflect the expectations and value preferences of our customers.

We have consulted our customers and stakeholders and listened carefully to their views.

As a key part of our CPP consultation, we published a detailed consultation document that explains the investments we proposed to balance service outcomes and cost. This was supported by a comprehensive customer survey, an explanatory video, public discussion forums, a large number of bi-lateral meetings, direct advertising, as well as information made available to customers via digital media.

At the outset, we set ourselves an ambitious task of making a connection with all of our customers and stakeholders during our core consultation. We substantially achieved this aim, as the following summary statistics illustrate:

- We sent out over 110,000 newspaper inserts to residential customers across our entire operating region
- We ran a digital media awareness and "invitation to comment" campaign (Facebook and Twitter) – targeted at nearly 100,000 subscribers and supported by a 30 second CPP overview video (60,000 views)
- We met individually with over 200 customers and stakeholders
- We held CPP forums in Wellington, Auckland, Tauranga and New Plymouth
- PwC and Colmar Brunton surveyed over 1,500 residential and business customers to establish their overall service preference and willingness to pay
- We received over 4,300 visits to the "Have your say" CPP website

Throughout our numerous interactions, our customers consistently tell us that the "quality" of service we provide matters greatly to them and that overall, they would not accept deteriorating service levels. However, at the same time, there is no widespread desire to improve network performance, especially if this comes at a cost. (Although customers on the worst performing parts of our network generally hold a different view.)

Naturally, customers are price conscious. In general, however, customers did not express a view on whether particular price outcomes were appropriate or not. Instead, customers wanted to understand how our plans would be tested to ensure that our investment plans are justified.

In relation to service quality, different customer and stakeholder groups were concerned about different bundles of 'service' attributes, which tended to be significantly broader than the regulated quality measures.

Our customers are diverse and take a more holistic view of quality and service levels than the regulatory service quality measures and price-quality trade-offs.

We found that the key issued raised by different customer and stakeholder groups varied significantly. In particular:

- **Residential and business customers** were concerned about price and reliability. They value reductions in unplanned outages and expect better information when outages do occur – including through effective use of mobile communication and social media.
- **Retailers** were concerned about communication protocols with customers and the importance of avoiding confusion. They want to see a more transparent process for identifying contestable services. Retailers expect the Commission to review our plans, and do not want to examine the case for increased expenditure in detail.
- **Federated Farmers** supported initiatives such as the management of fault calls by us (the network owner) rather than retailers that do not have responsibility for the assets, investment to address worst served feeders, and the transfer of service lines to us. While supporting growth, they are concerned that the costs of new investment should not fall disproportionally on farmers. In relation to vegetation management, farmers would prefer to see trees around lines removed altogether.

– **Councils** supported investment for growth, but wanted to make sure that cross-subsidies between areas did not occur (this view was shared by MEUG[12]). There is concern about affordability, but they also recognise the importance of security of supply and network resilience to storms and other hazards. Some councils want to be consulted on undergrounding overhead lines on a case by case basis.

We plan our future investment to meet appropriate service standards[13], but we must sometimes balance a range of competing, and potentially conflicting objectives, in relation to the services we provide, the costs we incur, and the impact on prices, to promote our customers' long-term interests.

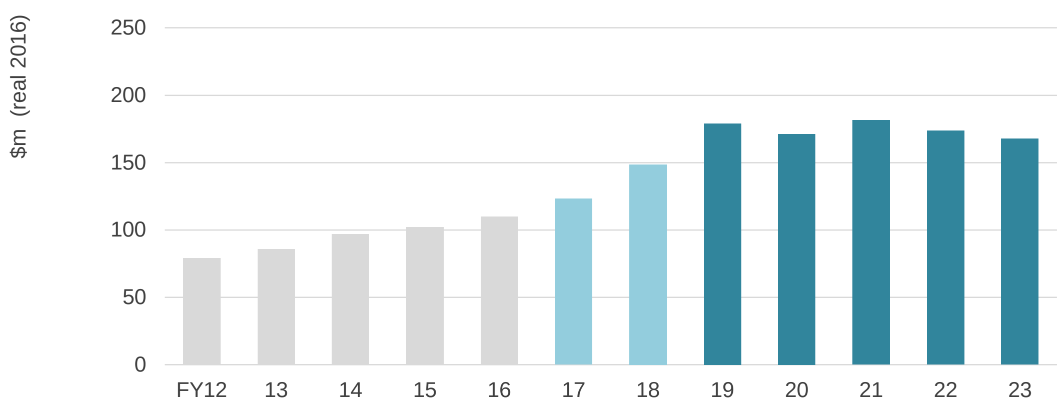
We also need to make these decisions within the context of the very clear messages given to us by our customers on the value they place on different aspects of our services, the compliance and mandatory standards we must meet (e.g. environmental, health and safety), the broader requirements of the regulatory framework, good engineering practice, and our overall assessment of acceptable levels of safety and risk.

We believe that our CPP proposal strikes the right balance between keeping bills affordable and investing in our assets for the benefit of today's customers and future generations.

Investment summary and the expenditure objective

Our expenditure forecasts have been prepared based on a rigorous combination of detailed 'bottom up' analysis and considerable 'top down' challenge, through substantial external expert review, as well as our own management and board challenge.

Proposed Capex over the CPP



What the additional Capex will be invested in

– Asset renewal levels need to increase substantially – approximately 60% above FY12 to FY18 levels. This reflects the large proportion of assets constructed from the late 1950s through to the 1970s which are now reaching end-of-life and are contributing to the worsening performance trends discussed above. The main asset classes affected are overhead conductors, overhead structures and zone substations.

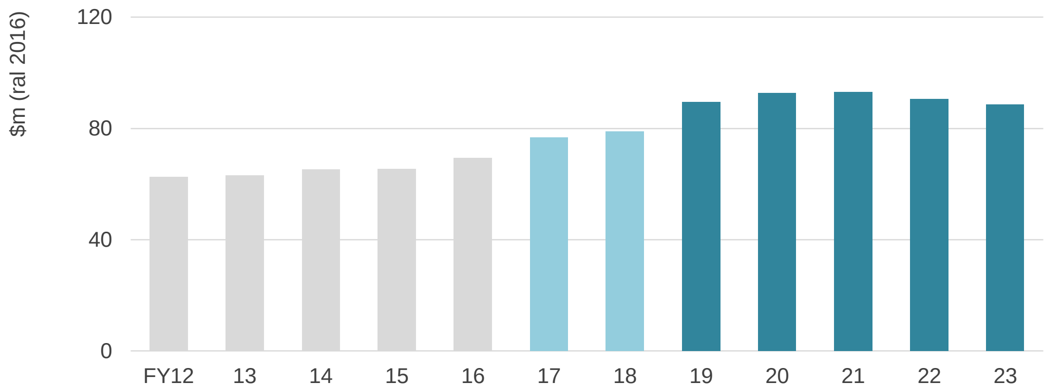
Our Capex is mainly focused on asset renewal, and investment to support growth in the communities we serve.

12 Major Electricity Users Group

13 This is an integral component of the expenditure objective which our investment is required to meet.

- Network growth investment to reduce the excessive demand currently at risk, and also to provide the capacity required to service growing communities in parts of our network area.
- Customer connection numbers are increasing, along with associated costs to reinforce supplies.
- We intend to implement a new ERP system in the early part of the CPP Period.
- Increased expenditure on SCADA, communications and remote monitoring early in the CPP Period.
- Implementation of our network evolution plan, to allow research and development, and testing of new and innovative network and non-network solutions. While this initially represents increased expenditure, it is anticipated to reduce network expenditure in the future.

Proposed Opex over the CPP



What the additional Opex will be spent on

- The backlog of outstanding maintenance defects has been growing due to DPP expenditure constraints – we intend to bring this under control and reduce the size of the pool to appropriate levels during the CPP period.
- Improved inspection techniques will be adopted, to better understand actual asset condition and network risks. Data and information management practices will be enhanced.
- We plan to bring our vegetation management practices up to good industry practice by adopting a cyclical inspection regime, and risk-based assessment of out-of-zone trees.
- We are proposing substantial improvements in the way we practice asset management, to reflect industry good practice and to realise improved efficiencies in the future. To achieve this, we intend to bolster our internal capabilities and skills.
- As part of our asset management improvements, we intend to achieve ISO 55000 certification by 2020, bedding in the proposed improvements for our customers.
- Our project delivery capacity will need to be increased in proportion to the uplift in construction and maintenance work proposed under the CPP.
- Additional business support staff to support increased business complexity and demands due to enhanced IS systems and increased work volumes.

Our Opex targets a stabilisation of our defect backlog, better vegetation management, and investments to improve our future efficiency.

Challenge and review of our plan to reflect customer and verifier feedback

Following the core consultation we reviewed our plans extensively and made substantial adjustments in direct response to customer feedback, verifier input and internal challenge.

We have introduced expenditure reductions and efficiencies compared to our initial proposals so that overall price increases are more affordable. While customers did not press for a reduction, we have responded to concerns regarding affordability and specific feedback from the verifier.

These adjustments have contributed to a reduction in the scale of average price increase associated with our initial plan compared to the final CPP proposal: a reduction in average first year price increase from 8.7% down to 5.7%.

This outcome aligns with feedback we received from customers that we should focus on affordability and efficiency of spend.

Examples of the adjustments we made include:

- Deferred 36 km of distribution conductor renewal to beyond the CPP period (3.2% reduction overall).
- Delayed reaching 'steady state' replacement of LV conductor to 2023 (was 2020), removing 30 km of conductor from the forecast predominantly earlier in the CPP period (16% reduction overall).
- The vegetation forecast has been rephased to reflect the staged introduction of the new cyclical and risk based vegetation management strategy. This change reduces the expenditure in the CPP period; and was made in response to the verifier's feedback.
- We made a reduction in corrective maintenance to reflect the volume of assets proposed to be renewed during the CPP Period.

In response to the verifier's feedback, we have also included efficiencies arising from business improvements we plan to make during the CPP Period:

We have applied efficiency allowances to our forecasts across most of our expenditure portfolio.

- **Asset management improvements:** This reflects the various asset management improvements we intend to make, which will also culminate in our ISO 55000 certification. It includes expanded capacity for network analytics and data management; investment optimisation; and condition based risk management. These initiatives will help us drive down future costs through improved investment and operational decision making, better risk-management and prioritisation, and improved work-flow processes.
- **Scale:** This reflects the potential cost efficiencies that could be realised through increased purchasing power linked to the uplift in work associated with the CPP.
- **Future network applications:** We have reflected the increased network utilisation and deferred augmentation benefits we expect to achieve through our application of new technology. This factor reflects the potential gains that could be realised late in the period.
- **Commitment term:** This factor reflects the cost savings we may be able to achieve by providing multi-year work commitments to service providers (once the CPP scope is approved).

The impact of these efficiency-based reductions on our base forecasts is summarised below.[14] As a result of including these factors in our projections, we will need to achieve increasing efficiencies across our business to deliver our CPP work programme within the proposed expenditure allowances.

[14] This is measured against a counterfactual of expenditure reflecting our current asset management practices (which by themselves already reflect the improvements made in preparing for the CPP).

Efficiency allowances built into the CPP forecasts

	FY22	FY23
Capex		
Efficiency adjustment	$6.5m	$13.0m
Percentage reduction	3.6%	7.2%
Opex		
Efficiency adjustment	$1.8m	$3.3m
Percentage reduction	2.0%	3.5%

We have tested each element of our expenditure plans to ensure that they satisfy the Commission's expenditure objective.

We manage our networks and investment to deliver appropriate service standards centred around security and reliability but more broadly to ensure compliance with applicable legislation, regulations and codes of practice.

Our proposed investments meet the expenditure objective

In developing our long term investment proposal we have used the expenditure objective, defined in the CPP Input Methodology, as a reference point to challenge the robustness of our planned expenditure:

> *"**Expenditure objective**: efficient costs that a prudent regulated EDB would require to: meet or manage expected demand at appropriate service standards; and comply with applicable regulatory obligations"*

Our CPP investment plan has been rigorously tested against the various components of the expenditure objective, as summarised in the table below:

EXPENDITURE OBJECTIVE COMPONENT	HOW WE'VE TESTED OUR PLAN
Efficiency Proposed expenditure reflects the lowest, long-term, sustainable cost of providing our services while meeting required safety and quality standards	– Benchmarked as efficient across a number of key efficiency metrics (e.g. SONS) – External / expert challenge of cost structures processes, models and process / practice – Built ongoing and increasing efficiency allowances into our plan, putting efficiency 'stretch' into our base budget
Prudency Our investments are the right ones delivered at the right time	– Individual portfolio investments mapped back to key drivers and targets for safety, resilience, security, growth and future technology developments. – Alternative investment scenarios modelled to assess the impact on short and long term outputs – Cost / benefit model developed to test different investment timing profiles
Expected demand Ensure capacity, security and resilience is maintained to meet expected demand under a range of plausible future scenarios	– Model forecasts applied to stress test investment plans under different demand scenarios[15] – Updated our demand forecasting model and tested inputs / model logic and outputs against peers. – Developed bottom up regional specific forecasts as part of individual network area plans

[15] The scenarios are based on the forecasts included in the EDGS model developed by the Ministry of Business, Innovation and Employment.

EXPENDITURE OBJECTIVE COMPONENT	HOW WE'VE TESTED OUR PLAN
Appropriate service Standards Manage the condition of our assets to deliver maximum service life, but avoid in-service failure Deliver levels of service that customers expect and value over the short and long term Adopt industry accepted security standards Deliver stable and sustainable pricing outcomes for our customers. Ensure compliance with applicable legislation, regulations and codes of practice.	– Engaged extensively with customers to establish their short and long term value preferences and service expectations. – Benchmarked security standards against NZ and international practice – Developed a suite of asset health indices to model the expected remaining life of an asset and act as a proxy for probability of failure and as an indicator of long term network performance – Challenged and moderated (downwards) our preliminary plan to reflect verifier and customer feedback – reduced overall price impact of CPP – Quality (SAIDI / SAIFI) model developed to appropriately link proposed investment to the level of future planned and unplanned interruptions – Proposed investments ensure compliance with: • electricity regulations • updated tree regulations • safety standards • environmental standards • electricity markets rules (participation code)
Efficient price of delivery Ensure our contracting arrangements deliver efficient and market tested prices and incentivise leading performance	– Our delivery arrangements are outsourced to providers with sufficient scale. – The prices we pay for fault response, maintenance and minor capital works were market tested in 2014. – Our larger capital projects are tendered providing assurance of efficient market outcomes and competitive tension amongst suppliers. – We have arrangements in place with our key service providers to scale up delivery arrangements.

Our proposed investment plan reflects our customers' feedback on the services they value

Our investment plans reflect what our customers have told us.

To deliver electricity safely and efficiently, we have to adhere to a range of technical, safety and commercial regulations. Meeting these requirements is a basic and essential part of our business, and therefore a key input to our CPP proposal.

Less prescribed, but equally essential, is how we reflect our customers' requirements in the range of services we provide and our target performance levels.

The table below summarises how we factored this into our expenditure plans.

INVESTMENT FOCUS / SERVICE STANDARD DRIVER	FEEDBACK FROM CUSTOMER ENGAGEMENT
Ensure minimum acceptable standards are achieved Voltage levels within regulation limits Power quality within regulation limits Network clearances within regulation limits Retire unsafe assets	Being compliant with technical and safety regulation is a baseline requirement

INVESTMENT FOCUS / SERVICE STANDARD DRIVER	FEEDBACK FROM CUSTOMER ENGAGEMENT
Providing a safe and reliable service Stabilise asset health Stabilise asset fault rates Address maintenance backlogs Stabilise reliability Ensure stable network performance	Safety should never be compromised Current levels of reliability should at least be maintained Expectation that assets are kept in appropriate condition
Invest to support customer growth Match capacity to growth Stabilise security compliance Address high loads at risk Facilitate customer options	Networks should support economic growth in our regions Networks should support emerging technology such as EVs and PVs
Improve customers' service experience Enhance outage communication Lift fault response performance Enable future energy markets Modernise digital interaction	Communication channels and interaction with customer should reflect modern standards Expectation that prices will be cost reflective and reflect efficient delivery Good communication during outages is highly valued by all customer groups

Our proposed quality path (unplanned)

Our proposed investment plan seeks to arrest deteriorating asset performance to ensure that reliability of supply does not deteriorate from current levels.

To deliver our investment plan, we will need to undertake a significant increase in the amount of construction and maintenance work across most parts of our network. This will involve additional planned outages.

Customers accept that we need to increase planned outages to deliver the work programme.

Feedback from our consultation programme indicates that customers generally accept the need for planned work to maintain, replace and upgrade our network assets.[16] The additional planned outages will mean that we cannot operate within our current reliability limits while this work is ongoing. We are therefore proposing a quality path for the CPP which will focus on unplanned outages only – leaving us the required flexibility to successfully complete the additional programmed work. The incentive to retain underlying network reliability (unplanned outages) will remain in force.

Our CPP planned quality targets are aimed at stabilising network performance over the longer term. The targets therefore focus on unplanned outages, with the aim to keep them at historical levels over the CPP Period.

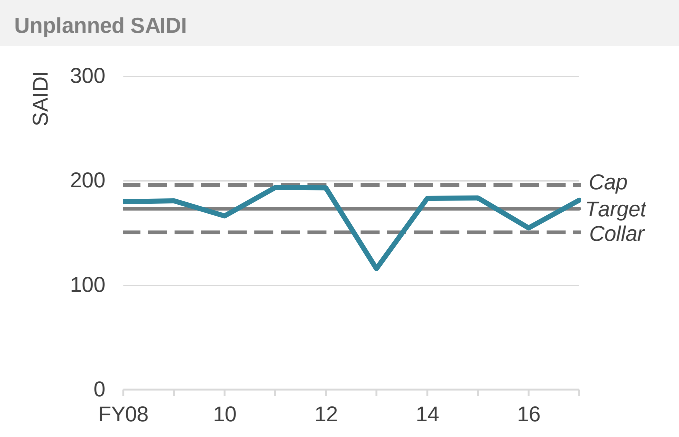
Our proposed quality path is largely based on the existing DPP methodology and retains SAIDI and SAIFI as its basis. Existing incentive and compliance approaches would remain in place, but we propose that planned outages be afforded a 0% weighting during the CPP period (as opposed to the current 50% weighting).

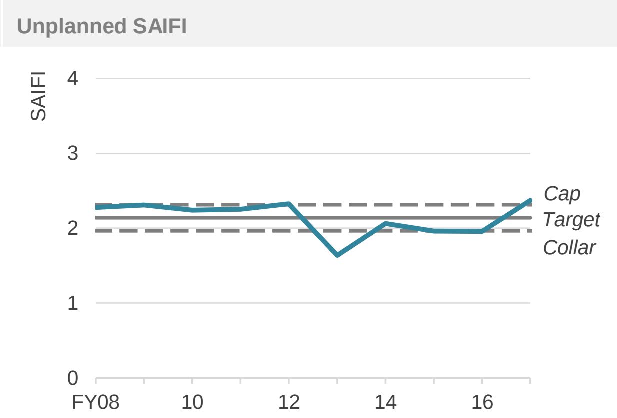
This will remove any incentive to not deliver the required works uplift under the CPP, as could arise in years when we are under pressure from high numbers of unplanned outages. It will also allow more efficient forward planning and field workforce utilisation, as constraints on planned work will then not adversely impact work scheduling or availability of shutdowns.

This proposal will be simple to implement and monitor and it supports the efficient delivery of the uplift in work required for the CPP, while retaining the incentives and sanctions to ensure that underlying network performance does not deteriorate.

16 Reflecting customer feedback we will focus on further improving our communications around planned outages.

Proposed quality path





What the charts show

- historical SAIDI and SAIFI based on normalised, unplanned outages only
- the proposed SAIDI and SAIFI targets superimposed on our historical performance
- the proposed cap and collars

The proposed quality targets will ensure that the incentive to retain historical reliability levels remains.

We recognise that future targets based on historical performance may not at first sight appear to be especially challenging. However, it is important to note that the targets are being set against a backdrop of deteriorating asset performance. Importantly, reversing this trend can be expected to take some years, as there is a lag between increased capital and maintenance works to address the legacy of DPP spending constraints and seeing the results. In this context, stabilising current levels of performance is in itself a considerable challenge for us during the CPP period.

We also realise that our customers care about a much wider range of service measures than just SAIDI and SAIFI. To address this, we will report annually (in our asset management plan) on our performance against a much wider suite of service measures.

We have proven delivery capability

We have a strong track record on delivery, supported by well-developed working arrangements with our external service providers.

Our delivery arrangements are outsourced to contractors of proven capability and scale. These include (among others) Downer, Northpower, Electrix, and ABB. We actively manage our supply chain and limit our working relationships to those service providers who have the necessary capability and management systems to consistently deliver a safe, high quality, and cost effective service.

We are confident that our expenditure plans can be delivered efficiently and on time. Our strong record, our resourcing methodologies and modelling all indicate that our plans are deliverable.

The rates we pay our service providers are cost-competitive and market tested. We tested all of our fault response, maintenance, and minor capital works rates via a comprehensive market tender in 2014, which has provided confidence the rates we pay are competitive. Our larger capital construction works are market tendered providing us with real time market information, and ensuring a fair and efficient price of delivery.

Our forward work programme described in the CPP proposal indicates an increased resource requirement. We have taken measures to address this need by increasing our field delivery capacity (through our service providers) and taking steps to improve our internal capabilities. In particular, we have undertaken the following initiatives:

- Modelled our required resources (external and internal) and assessed gaps in current capability
- Tested increased requirements with service providers and suppliers and secured commitments
- Analysed and profiled our internal resource requirements to ensure that our expenditure plans are deliverable
- Taken steps to ensure that other resource requirements, such as plant and materials, can be achieved
- Identified risks to achieving our expenditure plans and established risk mitigation measures

Our analysis shows that our work programme can be delivered efficiently and on time. This is further reinforced through the in-principle agreements we have reached with service providers for the required support during the CPP period.

The counterfactual to our CPP proposal (remaining on the DPP) represents higher long-term cost and unacceptable safety and service outcomes

The concept of price-quality trade-off is an important element of the consultation requirements set out in the IMs. The regulatory rationale for this type of testing is that our plans should optimise the balance between better customer outcomes and higher network costs.[17]

Our consultation materials presented four alternative investment scenarios (including a DPP counterfactual scenario and our proposed CPP investment). We outlined the cost to consumers and the network outcomes (and resulting customer outcomes) that would result from each.

We have checked our proposed plans against the 'counterfactual' of expenditure remaining at the DPP level. This analysis confirms that increased investment is required to deliver the outcomes our customers expect.

We received widespread support for our indicative CPP plan and the three themes that underpinned it. However, customer stakeholder feedback was generally provided at a high level and engagement on the detail of the alternative scenarios was limited. That said, while customers did not support additional investment to increase network security and resilience beyond the levels proposed in our CPP plan, equally there was no feedback from customers' that our proposed level of investment was too high.

We did receive some very useful feedback from the consultation exercise, on the different aspects of our services that customers value and the wider service improvement they would like us to make. This feedback has helped shape our CPP proposal and the direction of our thinking on certain investments.[18]

In addition to the feedback from our consultation process, we considered the implications if future expenditure remained at the level set in the DPP. The following 'counterfactual' outcomes would result:

- Minimum levels of safety could not be maintained over the next five years and risks to our staff and the public would rise above that considered acceptable for a prudent network operator.
- Asset failure rates would increase and security of supply would erode to well below current levels, which would be unacceptable to customers or to a prudent network operator.

17 A clear finding from our consultation programme was that customers' take a more holistic view of 'quality', than is implied in the IMs, when considering the outcomes they receive from their network charges

18 For example, feedback we received from customers on the importance of better communication during outages has resulted in our strategy to bring fault calls in-house.

- Outages would become noticeably more frequent for many – especially in the already worst performing parts of the network, as replacement of assets is deferred or managed reactively.
- Current network architecture and solutions would largely be maintained, and customers would potentially be restricted in their application of new energy solutions, as we protect the integrity of the (conventional) network. In the longer term this will drive more and more customers away from the network, as they seek seemingly more effective solutions.
- Customers would be asked to fund the full cost of connection upfront, and connections of new load (e.g. business loads and electric vehicle loads) could be restricted where capacity is not available.
- Lower short term cost would be achieved at the expense of deteriorating resilience and security. To correct this in the future would require substantially higher levels of investment (and prices) beyond the five year period.

For the reasons already outlined, such outcomes would not be in the long-term interests of our customers nor consistent with the feedback we received through our engagement. It would also be inconsistent with the actions of a prudent and efficient electricity distribution business.

Revenue and price impacts

Our proposed increase in average prices is lower than originally proposed. We have responded to the feedback received to present the lowest increase that is consistent with customers' long term interests.

In deriving our required revenue for the CPP period, we have complied with all relevant IM requirements, including using a specifically developed (and compliant) revenue 'building block' model.

Our proposed total revenue requirement for the CPP Period is $1,241m.[19] This amount reflects the efficient costs of providing our distribution services and meeting the safety and service levels our customers expect and value.

ITEM ($M)	FY19	FY20	FY21	FY22	FY23
BBAR before tax[20]	266.4	288.6	294.2	307.0	319.8
MAR Smoothed Revenue[21]	282.3	288.4	294.4	300.4	306.4

The Commission will assess whether our proposed investments are prudent and efficient and will approve the amount of revenue we are allowed to recover through electricity distribution charges.

Under our plan, revenue will increase by 5.7% at the start of the CPP period and annually in line with inflation during the period.[22] To place this in context, if a 5.7% distribution charge increase is applied to a typical household customer electricity bill today, it would add around $0.79 per week.

This is a significantly lower price increase compared to our 'pre-consultation / pre-verification' plan – which was used for consultation. As a result of further challenge and moderation of our investment plan, following feedback from both the independent

19 Present value of proposed revenue requirement.

20 BBAR is the building blocks allowable revenue requirement and represents the amount of revenue we need to generate each year over the CPP period to allow us to invest in, operate and maintain our network efficiently and earn a reasonable return on our investment in providing the distribution services our customers value over this period.

21 The BBAR is 'smoothed' to derive our proposed maximum allowable revenue (MAR). The derived MAR is equal to the BBAR in net present value terms but takes out the lumpiness associated with annual variances in expenditures

22 Relative to the revenue we expect to recover if we continue on a default price path.

Verifier and customers as well as other ongoing refinements to our planning, the average price increase (or P_0) has reduced from 8.7% to 5.7%, reducing the increase to a typical household customer electricity bill from $1.18 to $0.79 per week.

We consulted with customers on whether they would prefer us to smooth-out any price increase, over the five year regulatory period, by applying an annualised increase (via an x-factor adjustment) rather than an initial step change increase at the outset.

Feedback from residential customers indicated a preference for smoothing but this was not a unanimous view across all other stakeholders groups. We remain open to this approach, subject to further feedback from stakeholders.

The process from here

We invite our customers and other stakeholders to participate in the Commission's review process. Details on how to get involved can be found at the Commission's website and our CPP-focused website www.yourenergyfuture.co.nz

In summary

Our network prices have not increased in real terms for an extended period of time. The analysis presented in this CPP proposal and the supporting documents indicates that current investment levels are unsustainable, but that a modest rise in average prices can remedy the situation and provide better long-term outcomes for customers.

Our proposed investment plans prudently and efficiently address the emerging safety and performance issues on our networks. Our plans include targeted investments to maintain our underlying service across the network including in new growth areas, in areas where assets are ageing, and in systems and capability to support the services our customers told us they value, now and in the future.

Our investment plans will ensure that we can offset rising fault rates, and can ensure the safe, secure and reliable distribution network services that our customers value.

For the reasons set out in this proposal, we strongly believe that our price-quality plans are in the long-term best interests of our customers and fully satisfy the Commission's efficiency and prudency requirements.

Contents

Context for our proposal

This section provides background on Powerco and its network. It explains the key reasons for our CPP proposal.

CONTENTS

1 INTRODUCTION

This document sets out our proposal for a Customised Price-quality Path (CPP) to apply for the five-year period 1 April 2018 to 31 March 2023 (CPP Period).

1.1 Regulatory context

As a non-exempt EDB[1], we are subject to a set of rules designed to ensure appropriate outcomes for customers, the community, and investors. This includes setting appropriate revenues and incentives to enable us to deliver an appropriate level of reliability, safety and customer service in an efficient and sustainable manner.

The Commerce Commission (Commission) in its role as our economic regulator determines price-quality paths for non-exempt distribution businesses, under what is called a Default Price-quality Path (DPP) mechanism. The DPP is designed to be a low cost way of setting revenue allowances.

The regime was developed to also provide EDBs an opportunity to propose a CPP, as an alternative revenue allowance and quality standard, to better meet its individual circumstances. For the reasons set out in this document we have chosen to submit such a proposal.

1.2 Overview of our CPP process

In Table 1.1 we set out the main milestones for our CPP application process. We expect the Commission to publish details on its consultation and review process in the coming weeks.

Table 1.1: Overview of our CPP process

2016 AMP	Early in 2015 we asked our residential and business customers what they thought about our performance and the value they place on our services. Informed by this feedback we developed our 2016 AMP.
CPP engagement	We engaged with customers and other stakeholders on our preliminary CPP proposal. This consultation continued until March 2017.
Independent verification	Our preliminary CPP proposal was reviewed in detail by consultants tasked with assessing our investments plans. Their report is included as part of our application.
Finalise proposal	After considering feedback from customers and stakeholders, and from the Independent Verifier, we finalised our proposal.
Submit application	On 12 June 2017 we submitted this document together with supporting documentation, which together forms our CPP application.
Compliance assessment	The Commission will decide within 40 working days of receiving this proposal whether it is complete. Once it has confirmed our application is complete the Commission will begin its review.
Commission determination	The Commission will review and consult with stakeholders on our proposal. It must make a final determination and specify our CPP within 150 working days of accepting our proposal as complete.

1 EDB refers to Electricity Distribution Business based in New Zealand.

During its review, we will work with the Commission to answer questions it or its advisors may have. This process will include consultation with customers and stakeholders. Following its assessment of our proposal and submissions from interested parties, the Commission will make a determination by 31 March 2018.

1.3 Information we are providing

The information we must provide when proposing a CPP is set out in the Input Methodologies (IM).[2] This includes the reasons for the proposal, any proposed variation to quality standards, forecast expenditure, details on our engagement with customers, and certain audit and assurance material.

We have submitted the following material to the Commission. These documents together form our application for a CPP.

- Main Proposal (this document)
- Main Application
- 2017 Asset Management Plan (AMP)
- Consultation Report
- Financial and Modelling Information (FAMI) report
- final Independent Verifier report.

In addition, we have provided versions of several supporting documents that were "relied upon" by the Independent Verifier. Updated versions, consistent with our finalised proposal, will be provided to the Commission to inform its review. A subset of these supporting documents is listed below.

- seven fleet management plans
- documentation explaining our large projects
- our maintenance and vegetation management strategies
- business cases for a number of non-network investments
- forecasting models.

A list of the documentation that the Independent Verifier relied on is included in its report.

Our Main Application sets out how we have complied with the CPP information requirements.

1.4 How to navigate this document

This document (Main Proposal) aims to:

- explain why we are proposing a CPP
- show how we've developed and tested our proposal
- explain our proposed capital expenditure (Capex) and operating expenditure (Opex) during the CPP Period
- explain the quality path we propose for the CPP Period
- set out the level of revenue required, our proposed Maximum Allowable Revenue (MAR), and explain the potential impact on customer prices.

Table 1.2 provides an overview of the structure and content of this document.

[2] Commerce Commission, Electricity Distribution Services Input Methodologies Determination 2012, 28 February 2017.

Table 1.2: Main proposal structure

	CHAPTER	DESCRIPTION
Part One: Context for our Proposal		
1	**Introduction**	This chapter.
2	**Overview of Powerco**	Describes our business, role in the electricity industry, and our networks.
3	**Why we are proposing a CPP**	Provides a summary of our reasons for applying for a CPP.
Part Two: How we Developed and Tested our Proposal		
4	**Development of our Preliminary Proposal**	Explains how we developed our Preliminary Proposal, which was used for our core consultation and reviewed by the Independent Verifier.
5	**Engagement on our Preliminary Proposal**	Describes how we engaged with our customers and other stakeholders on our Preliminary Proposal.
6	**Independent Verification of our Preliminary Proposal**	Describes the role of the Independent Verifier and sets out its key findings and how we responded.
7	**Development of our Final Proposal**	Explains how we finalised our proposal, based on consultation feedback and comments from the Independent Verifier.
8	**Deliverability**	Describes how we tested the deliverability of our investment plans and explains how we will ensure they can be delivered.
9	**Asset Management Improvement to support CPP Delivery**	Explains the asset management improvements we will make to ensure the efficient delivery of our work plan.
Part Three: Our Proposed Expenditure and Quality Standards		
10	**Overview of Proposed Expenditure**	Explains how we've presented our expenditure forecasts and explains some of the assumptions used to develop them.
11	**Network Capex – Renewals**	Sets out our investments to renew our asset fleets over the CPP Period to ensure appropriate asset health and condition.
12	**Network Capex – Growth and Security**	Sets out our investments to develop our network in response to growth and security drivers over the CPP Period.
13	**Other network Capex**	Sets out our investments to facilitate new connections and developments. It also explains our planned expenditure on technology trials.
14	**Non-network Capex**	Sets out investments we will make in assets that support the delivery of our electricity distribution service.
15	**Network Opex**	Includes our planned operating expenditure on network related activities during the CPP Period.
16	**Non-network Opex**	Includes our planned operating expenditure during the CPP Period on activities that support the delivery of our electricity distribution service.
17	**Our Proposed CPP Quality Path**	Explains our proposed amendments to our quality path.
Part Four: Revenue Requirement and Implications for Prices		
18	**Revenue Requirement and Price Implications**	Sets out our revenue requirement and the potential pricing implications for customers.

1.5 Feedback

We are committed to engaging openly and constructively with our customers, stakeholders, the Commission and its advisors to help ensure our proposal reflects our customers' preferences and promotes their long-term interests.

We invite our customers and other stakeholders to participate in the Commission's review process. Details on how to get involved can be found at the Commission's website and our CPP-focused website www.yourenergyfuture.co.nz.

2 OVERVIEW OF POWERCO

We are New Zealand's largest electricity distribution company by network size and network length, delivering electricity to 330,000 homes and businesses in the North Island of New Zealand. Our network covers two large, separate coastal regions.

We engage regularly with our customers to help us understand what is most important to them, and how we can improve. Their feedback has been a key consideration for our CPP proposal.

2.1 Our role in the New Zealand electricity sector

We are New Zealand's largest electricity distribution company by network size. We provide an essential service to more than 330,000 homes and businesses in the North Island from the Coromandel to the Wairarapa. We also own and operate a gas distribution network.

Our main role is to operate and maintain our distribution network so we can safely, reliably, and efficiently distribute electricity through the regions of the North Island that we serve.

Electricity is typically generated in locations remote from end consumers. It is generated across New Zealand using predominately hydro, wind, geothermal, gas and coal generators. This electricity is transported from generators to distribution networks using the national grid owned by Transpower.

From there, it is distributed to end-users' premises via distribution networks. We are one of 29 distributors in New Zealand. Retailers buy electricity from generators and sell it to homes and businesses.

Our position in the electricity industry is shown in the diagram below.

Figure 2.1: Our place in the electricity sector

In future, we expect that electricity will be increasingly generated within the distribution network – such as by solar photovoltaic (PV) units in residential homes and cogeneration plants used by large industrial customers. We see our role evolving to manage changes to technology, policy and market factors, as we continue to strive to meet our customers' energy preferences.

2.2 Our company

We connect residential and business customers to a safe and reliable electricity supply. Our key distribution activities include:

- ensuring our assets operate safely and reliably
- extending and upgrading the network so that the future needs of customers can be met
- maintaining and operating the network on a day-to-day basis
- controlling the public street-lighting system
- connecting new customers to the network.

Undertaking these activities safely, reliably and efficiently requires prudent asset management. This in turn requires investment in a range of assets, including poles, overhead conductor, zone substations, property and IT systems. This includes ensuring that these assets are maintained and renewed in a timely, prudent manner. It also involves contracting specialised service providers to operate, inspect, maintain and replace these assets. We must also promptly restore power when outages do occur and manage vegetation close to our assets.

2.2.1 Corporate overview

We are a privately owned utility with two institutional shareholders, Queensland Investment Corporation and AMP Capital. Our Board has overall responsibility for our corporate governance including the critical responsibilities of setting strategy, policy definition and compliance and monitoring of business performance. The Board has established a number of committees to assist in the execution of its duties.

Our investments must contribute towards our longer term strategic direction. This promotes 'line-of-sight' and ensures that our network planning and management objectives align with our corporate strategic objectives. All investments above $2 million are subject to review and challenge by the Board.

Further detail on our corporate governance is included in Chapter 6 of our 2017 AMP.

Our values

Our corporate values, shown in Table 2.1, define our identity, who we are, and what we stand for.

Table 2.1: Our values

Safe	We are committed to keeping people safe.
Trustworthy	We act with integrity. We are honest, consistent and ethical. We trust each other and our external partners and work to be trusted in return.
Collaborative	We work together with our partners, contribute our capabilities and provide timely support and consideration to achieve our collective goals.
Conscientious	We are proactive, hardworking, diligent and thoughtful. We are mindful of the needs of others and of the environment. We take ownership for our actions.
Intelligent	We make informed decisions for the best outcome. We continually seek improvement and innovative solutions from our suppliers and ourselves.
Accountable	We lead. We take ownership of our decisions and responsibility for our actions. We are proactive in identifying and resolving problems.

These values define the way we go about our work and what we can expect in our relationships with others. They help define our culture, inform our decisions and give authority to our leaders.

In line with our "safe" value, keeping our customers, communities, employees and our service providers safe has always been, and remains, our number one priority. We will never compromise safety. It is embedded in our culture and values. We have well-established renewal and maintenance programmes in place to reduce the probability of network assets posing safety hazards.

2.3 Our customers

We deliver electricity to over 330,000 homes and businesses in the North Island of New Zealand. Our mass market (residential and small business) customers make up more than 99% of our customer base and approximately 58% of electricity usage on our network. While small in terms of connection numbers, our commercial and industrial customers consume the remaining 42% of the electricity we deliver. Of these larger customers, 24 are directly-contracted industrials including large distributed generators. We connect over 4,000 new homes and businesses to our network each year.

2.3.1 How we engage with customers

We engage regularly with our customers to help us understand what is most important to them, and how we can improve. We receive customer feedback through several channels including:

- regular commercial meetings and phone contact
- agricultural field days, expos and trade shows
- annual surveys
- stakeholder meetings and focus groups
- community-wide consultation on specific projects or topics
- digital media (website and social media).

To inform our CPP proposal, we augmented these communication channels with a dedicated consultation process to ensure that our investment plans reflect customer preferences. Chapter 5 explains how we designed the process, what we heard from customers and other stakeholders, and how this has shaped our proposal.

2.4 Overview of our network

Our network covers two large, separate coastal regions of the North Island. Both our supply area and network length are the largest of any single distributor in New Zealand. The network supplies electricity to customers ranging from isolated farms in rural areas to heavy industry, regional and urban residential homes, and businesses in CBDs.

Our network is vast and complex and extends across difficult and remote terrain. Many of our assets operate in demanding conditions. Our network stretches for almost 28,000 circuit km, and includes 116 zone substations, 33,000 distribution transformers, and more than 265,000 poles.

Our operating environment is challenging as our network is located in some of the most difficult, diverse and remote terrain in the North Island. The network has a low customer density typical of a predominantly rural network at 11.8 customers per circuit km of line length. The long radial nature of our network has implications for the costs associated with replacing and maintaining assets across our network, as well as for quality of supply.

Much of our network was initially developed in the 1950s through to the 1970s. Many of these assets have yet to be replaced and are nearing the end of their useful life. As a result an increasing proportion needs to be replaced or requires increased maintenance. This is driving a need for increased Capex and Opex to meet safety requirements and maintain the service levels our customers expect.

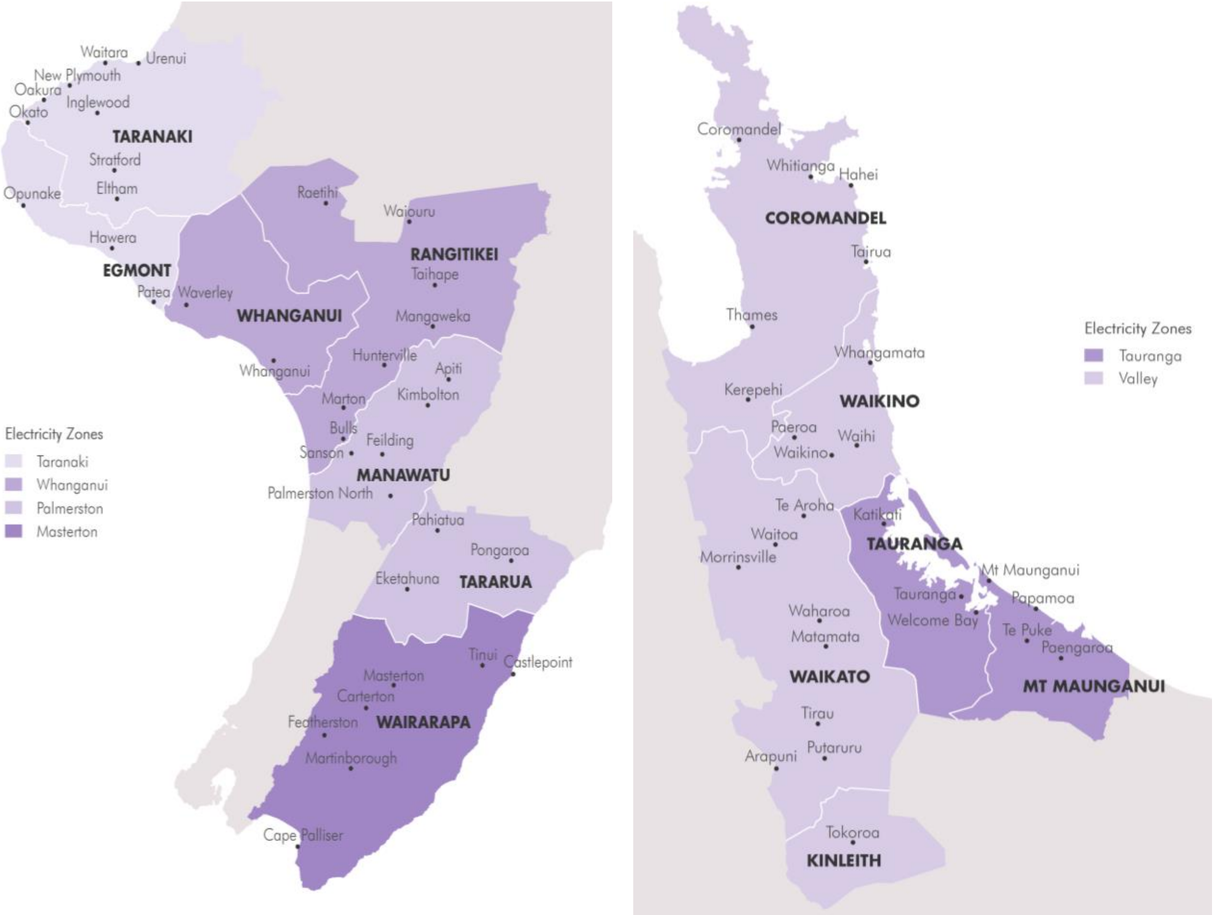
There are also pockets of high residential and industrial growth, particularly in newly established suburbs, driving increased demand in these areas. While we are forecasting modest growth in overall demand, we need increased investment to meet customers' future needs in these growing areas.

2.4.1 Our regional networks

Our network includes two non-contiguous parts, referred to as our Eastern and Western networks. Both contain a range of urban and rural areas, though both are predominantly rural. Geographic, population and load characteristics vary significantly across our supply area.

Figure 2.2 below provides an overview of these regions, showing our 13 planning areas and six pricing zones.

Figure 2.2: Areas served by our electricity networks



The make up of our networks results from the historical merger and acquisition of regional networks. This has led to a wide range of legacy asset types and architectures which requires an asset management approach that accounts for these differences, while seeking to standardise network equipment over time. As discussed in Chapter 12, we also see varying growth rates across the network areas we serve. Table 2.2 sets out metrics for our regional networks.

Table 2.2: Regional network metrics

CHAPTER	EASTERN	WESTERN	TOTAL
Customer connections	152,679	177,899	330,577
Overhead network length (circuit km)	7,196	14,557	21,754
Underground network length (circuit km)	3,227	2,923	6,150
Zone substations	48	68	116
Peak demand (MW)	463	447	906
Energy throughput (GWh)	2,382	2,427	4,809

3 WHY WE ARE PROPOSING A CPP

Our core business is to ensure that electricity is delivered to our customers safely, reliably and efficiently.

We are however increasingly constrained in our ability to maintain historical service levels, in spite of already spending more than our regulatory allowance. In the past five years we have lifted investment in our network by 60% when compared with the previous five years.

We need to further increase the level of investment in our network so that we can continue to meet our customers' service expectations and support growth in the communities we serve.

The combination of historical regulatory constraints and an asset base of which a large proportion is reaching the end of its useful life, has meant that our operating position has deteriorated markedly in recent years. In particular:

- the health of many of our asset fleets has deteriorated and is now of concern
- our security of supply has progressively degraded, increasing load at risk
- the level of deferred maintenance has risen markedly
- the number of faults on the network have increased substantially, at an accelerating rate.

The deteriorating trends we are seeing are conclusive. Left unchecked, we expect this decline in operational performance to further accelerate and ultimately lead to unacceptable safety and network performance outcomes. This is inconsistent with prudent network operation.

Looking forward, we face even greater challenges, as the number of assets reaching the end of their life will progressively increase, population and economic growth in our network areas is expected to persist, and we foresee increased variability in the way electricity is used and generated. Addressing the existing issues and ensuring our readiness for the future, consistent with the long-term interests of customers, indicates a need for strong and focused action. This requires a programme of structured and targeted investment above current levels, particularly in:

- asset renewal to maintain asset health and stabilise fault trends
- maintenance and vegetation management works, to repair defects, and address compliance and safety issues
- network reinforcement to reduce load at risk, and to facilitate economic and residential growth in our regions
- expanding our internal capabilities and strengthening our asset management, to ensure we can effectively deliver the CPP work programme.

If approved, our CPP investments, including the programmes above, will ensure that we can continue to deliver services that are in the long-term interest of our customers.

3.1 Context for our application

Below we set out background information to provide context for our CPP application.

3.1.1 Regulatory context

We are regulated under Part 4 of the Commerce Act 1986. In applying this framework, the Commission, as the sector regulator, acts in the long-term interests of electricity customers, to limit the amount of revenue that EDBs can recover, and to ensure that appropriate service levels are maintained.

The current rules have been in place since 2010 and include two main mechanisms. The first is a low cost, default price-quality path that is set for each company for five years. The current DPP was set in 2015 and extends to 2020. A DPP only partially takes into account the specific circumstances and needs of each individual business.

The second mechanism is the CPP. This allows EDBs to make an application for a bespoke price-quality path if the revenue allowance set under a DPP is considered to be inadequate to meet the long-term needs of the business and their customers. We are now at this point. Under the current DPP mechanism we cannot sustain current service levels over the longer term, or continue to ensure the ongoing safe, reliable and sustainable operation of our network.

3.1.2 Historical investment levels

Before 2010 the way revenue allowances were set by the regulator was very different to the current DPP/CPP process, and was focused on establishing a cap on average price movements. The price path we operated under from 2001 to 2010 was essentially an annual ‘roll over’ of prices that were in place when the rules were introduced in 2001.

At the outset, no calibration of our prices was undertaken, and the original price thresholds were never intended to represent an efficient level of distribution price nor were they designed to take into account specific future investment requirements. The price path that applied to us constrained investment levels, leading to a position from which we have not yet been able to fully recover. This is evidenced by the impact of capital constraints that we now have to address.

Over this ten-year period, the mechanism largely assumed that annual investment levels would remain broadly flat (or increase in proportion to increased volumes of electricity consumed) and that future expenditure levels would remain similar to those in the past.

In reality, prudent network investment is often cyclical or lumpy in nature. In addition, modern good practice asset management is focused on outputs and risk, rather than on expenditure levels. Managing investment planning to best take into account the long-term needs of customers, and achieve the lowest ‘whole of life’ cost outcomes requires a long-term approach, tailored to the actual needs of a network.

This is important context for our CPP proposal, as under the historical regime we were expected to run our business within a ‘flat’ price cap, which meant generally taking a more short term view of investment decisions, and accepting that an increasing proportion of assets would need to be operated near to and at times beyond their prudent service life. Such an approach is not sustainable over the long term.

3.1.3 Current performance and emerging trends

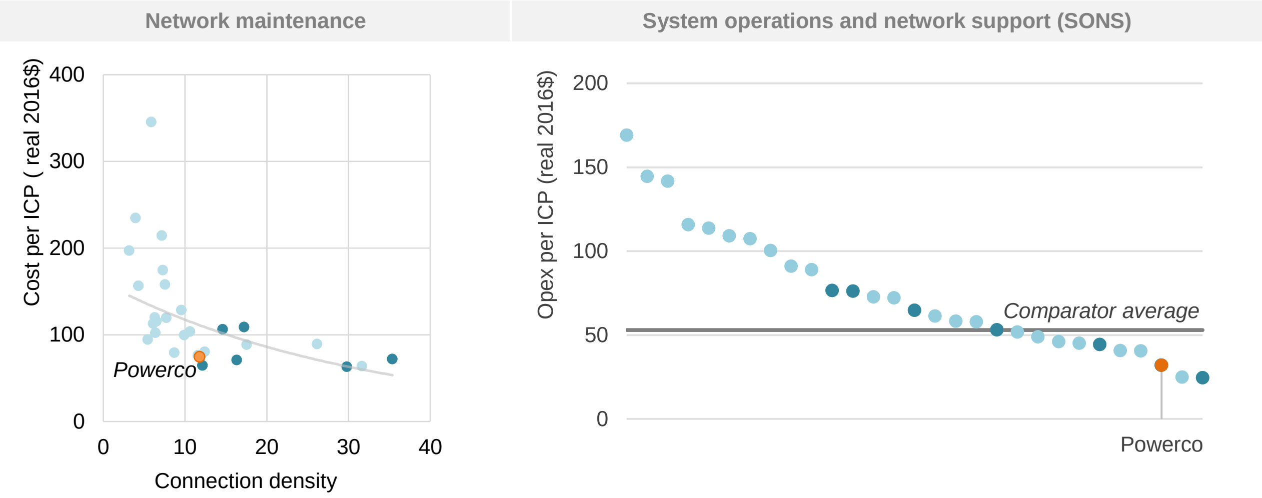
The practical realities associated with operating within the DPP (and earlier regulatory regimes) created a necessity for targeted capital rationing during the past decade. To counteract this we have invested more in our business than the regulations have assumed and this overspend has not been fully reflected in charges to customers during this period. Our investment (Capex and Opex) has increased by almost 60%, in real terms, over the period 2008 to 2017.[3]

At the same time we have worked hard to drive efficiency into our operations to make sure we maximise the value of the funds we have had available. This approach has enforced strong financial discipline, and ultimately ensured moderation of costs to our customers. Not surprisingly therefore, in terms of cost and productivity we currently benchmark very well with peers across a full range of investment and operational metrics. Examples of this are illustrated in Figure 3.1.[4]

3 This is derived by comparing total expenditure over the period FY07 to FY11 with that in the period FY12 to FY16.

4 Unless otherwise indicated, all benchmarking charts in this submission are based on data disclosed as part of EDBs’ annual Information Disclosure statistics (administered by the Commission).

Figure 3.1: Opex benchmarking (FY13-16 average)



When interpreting the maintenance benchmarking chart, it should be noted that:

- maintenance costs are normalised to a per ICP basis[5] to allow appropriate comparisons across companies of different sizes
- network density is a useful further normalising factor when comparing networks – those with lower consumer density are more rural in nature, with more assets to maintain per customer
- our position in the group is at the low cost end. This is also the case when comparing our cost with the closest comparator group (indicated in darker dots) – the six largest EDBs.

When interpreting the SONS benchmarking chart, it should be noted that:

- SONS costs are normalised to a per ICP basis to allow appropriate comparisons across companies of different sizes
- our position in the group of EDBs is at the low cost end. This is also the case when comparing our cost with the closest comparator group (indicated by darker dots) – the six largest EDBs.[6]

Importantly however, the low historical expenditure discussed above has led to the following issues:

- an increasing proportion of our assets remain in service well beyond their reasonable service lives, and we are experiencing increasing rates of in-service failures
- aggregate health of our asset fleets is degrading, leading to asset defect and renewal backlogs which heighten the risk of poor safety and network performance outcomes
- our security of supply position is slowly degrading, resulting in increased risk of outages for our customers and areas on our network, with high levels of load at risk
- deteriorating performance indicators such as fault rates and levels of deferred maintenance.

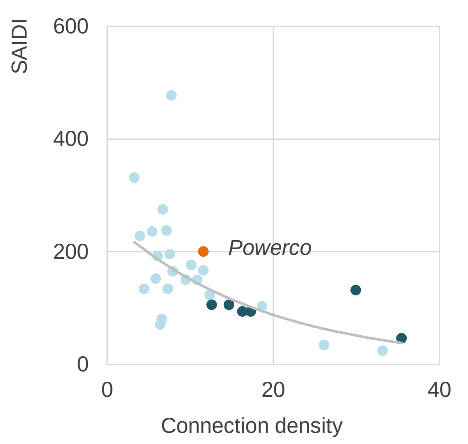
Our network therefore does not perform particularly well compared with that of other EDBs. Examples of this are illustrated in Figure 3.2.

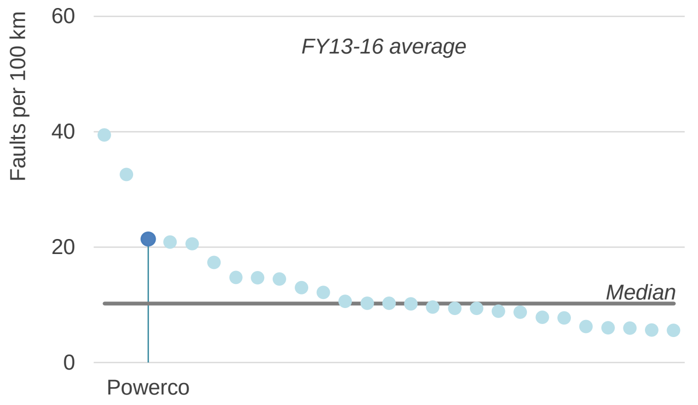
5 Alternatively it could be normalised to an asset volume measure, such as cost per km of line. Our relative position in the New Zealand market based on this benchmark is essentially the same.

6 We have also checked our relative position over time (i.e., FY13-16), which stays similar.

Figure 3.2: Our network performance benchmarked against other EDBs

SAIDI (FY13-16 average)	Distribution overhead line faults (FY13-16 average)[7]





These examples and charts are further explained in Sections 3.2.1 and 3.2.2, but it is clear that our current SAIDI and distribution overhead line faults are substantially higher than the New Zealand average.

Emerging issues

In addition to this poor starting point, our forecasting models and analysis have highlighted a range of emerging issues that need to be addressed. These issues, listed below, further underline the need to act.

- New Zealand's ongoing focus on health and safety will continue to 'raise the bar' to ensure appropriate levels of public and service provider safety
- a number of the communities we serve are expected to experience higher than average demand growth, driven by population migration, land conversion and economic growth in key sectors
- a large proportion of our assets were built from the late 1950s through to the 1970s, and so the number of assets reaching the end of their useful lives is progressively increasing over time[8]
- emerging technologies such as electric vehicles, distributed generation, and energy storage have the potential to materially change energy flows and the way our networks are used, leading to potential system instability.

It is critical that our investments enable us to effectively meet these needs.

3.1.4 Investing in the long-term interest of customers

Our CPP proposal is designed to achieve outcomes in the long-term interest of our customers.

The cost of our services to customers is directly linked to the level of investment we make in our network. Ensuring the right level and timing of investment is therefore a key focus for us. We aim to strike the optimal balance between the cost and the quality of the services we provide to our customers.

Our target service standards provide a framework to guide our investment approach. In many cases these service standards are set by regulations, but in some cases discretion is allowed. For the latter, we seek to tailor our approach to ensure we deliver to the expectations of customers. Our service standards and associated objectives and targets are set out in our 2017 AMP and summarised in Table 3.1. This reflects feedback we received from customers through our comprehensive engagement process.

7 Our average also includes FY17 data. FY17 information from other EDBs is not yet publically available.

8 The average useful lives of our assets vary between categories, but the overall average expected life is about 45 years. While condition rather than age is the basis for our replacement decisions, at a portfolio level condition and age are well correlated.

Table 3.1: How the required service standards are met

SERVICE STANDARD THEME	OUR INVESTMENT FOCUS	CUSTOMER FEEDBACK
Ensure minimum acceptable standards are achieved	- Meet required voltage levels - Manage power quality - Ensure safe network clearances - Retire unsafe assets	Being compliant with technical and safety regulations is a baseline requirement
Providing a safe and reliable network	- Stabilise asset health - Stabilise asset fault rates - Address maintenance backlogs - Stabilise network reliability - Ensure stable network performance	Current levels of reliability should at least be maintained We expect you to keep your assets in appropriate condition Safety should never be compromised
Invest to support customer growth	- Match capacity to growth - Stabilise security standard compliance - Address high loads at risk - Facilitate customer options	Your networks should support economic growth in our regions Your networks should support emerging technology such as EVs and PVs
Improve customers service experience	- Enhance outage communication - Lift fault response performance - Support customer solutions - Modernise digital interactions	The way you interact with us should reflect modern standards We expect your prices to be cost reflective and reflect efficient delivery Good communication during outages is highly valued by all customer groups

When we combine the regulatory essentials that we must achieve with the service expectations of our customers, the outcomes we need to achieve over the long-term are clear. We must ensure appropriate levels of investment to stabilise network performance and enable us to meet the future needs of customers, both in terms of increased demand and new services.

In the remainder of this chapter we explore the context for these themes, by considering them in light of historical and anticipated performance. First, we discuss the optimal timing for investment.

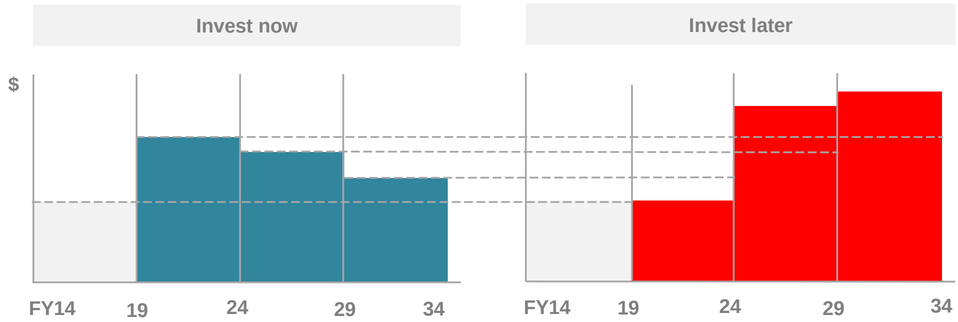
Investing now minimises the longer-term costs for our customers

Meeting the standards set out above is clearly important. However, the optimal timing of investment is also an important consideration – particularly the issue of whether investment can be delayed without adverse consequences.

The CPP will mean cost increases to our customers in the short term to fund the increased level of investment required. However, electricity investments are long-term in nature and network investments are therefore best assessed in terms of long-term benefit to customers.

We have modelled the longer-term cost impact on customers of two potential expenditure profiles. This also took into account the wider implications of these investment paths on network reliability and our ability to realise the potential cost efficiency benefits of emerging technology. The expenditure profiles for the two possible investment scenarios, over a 15 year period, are shown in Figure 3.3.

Figure 3.3: Stylised profiles of potential expenditure scenarios

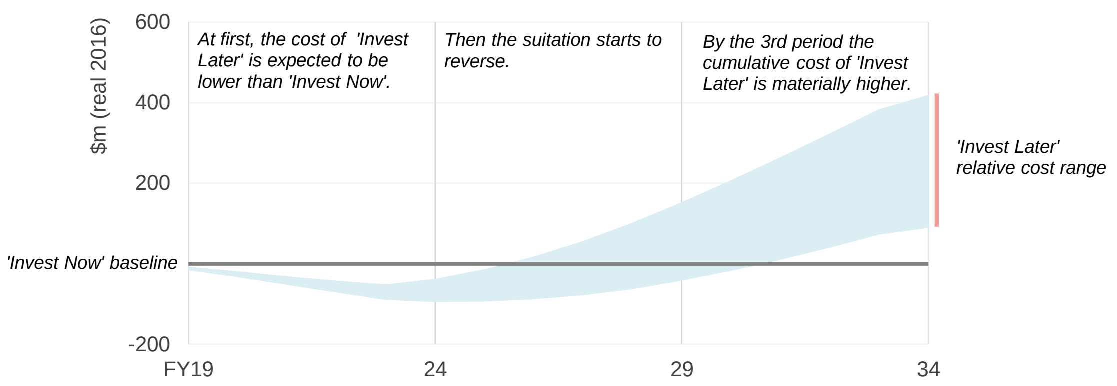


The two expenditure profiles modelled are described below.

– **Invest now:** represents the proposed CPP expenditure over the period FY19 to FY23, followed by lower future expenditure as the benefits from the initial investments are realised. This is the expected outturn from our proposal.
– **Invest later:** represents remaining on the DPP until FY23, followed by substantial catch-up expenditure. This catch-up expenditure will be less efficient than the CPP proposal because of the serious issues projected to arise from deferment, including increased safety risk and significant asset condition deterioration with associated reliability and cost impacts.[9]

Our analysis shows that our CPP delivers the lowest overall cost for customers compared with the 'Invest later' option, as shown in Figure 3.4.

Figure 3.4: Present value of cumulative costs for the 'Invest later' scenario, relative to the 'Invest now' scenario



The cumulative present value cost to customers of 'Invest later' is shown relative to our CPP proposal ('Invest now'). For each year the total discounted costs and benefits up to that year, relative to the 'Invest now' baseline, are shown.

The output from the modelling is a likely range, rather than a single point estimate. This reflects the inherent variability and uncertainty associated with the modelling inputs.

From the chart, the following is noted:

– when considering the 15 year investment period, the 'Invest now' scenario has a much lower cost impact on consumers than the 'Invest later' scenario. This outcome is true for the full range of modelled outputs and suggests average savings of around $200m under the 'Invest now' scenario
– if the evaluation period is reduced to only ten years, which is unreasonably short given we invest for the long-term benefit of consumers,[10] the results are substantially the same. Only low-probability 'outlier' scenarios showing the potential to result in an equivalent or marginally lower cost outcome compared to the 'Invest now' scenario
– only if the evaluation period is unrealistically reduced, to consider only the first seven years or less, does the 'Invest later' scenario present a lower net cost to consumers.[11] During the second five-year period the requirements for catch-up expenditure and the impact of deteriorating reliability is will start reversing this position. We expect maintenance costs, especially reactive, to escalate rapidly.

9 This includes spending a higher proportion of Opex (vs. Capex) as more maintenance and reactive response will become essential to address issues associated with escalating failure rates and poor asset condition.

10 The typical expected life of our assets is 45 years.

11 This is as anticipated, as for the first five years this scenario represents expenditure at DPP levels, while the 'Invest now' scenario is at CPP levels. The benefits from the CPP investment will only become evident later in the CPP Period, and in those following. Conversely the negative impact from staying at the DPP investment level, will continue to grow and by the end of the first period the situation will be substantially worse – a situation which will be rapidly accelerating at that stage.

Accepting the limitations of this type of long-term modelling, the analysis shows it is not prudent to materially defer investments needed to restore the health of our assets.

3.2 Delivering a safe and resilient network

We operate a network that is critical to communities across the North Island and to industries such as dairy, horticulture, agriculture, viticulture, and tourism.

Given the role our network plays, it is essential that we move to lift investment in renewal, maintenance, and vegetation activities. The current performance of our network already falls at the very limit of acceptability and, without substantial intervention, will move out of the acceptable range. We understand that this may be 'news' for some of our customers and stakeholders, however the position is underpinned by clear data, and the need for increased investment has been signalled for many years, such as in previous AMPs.

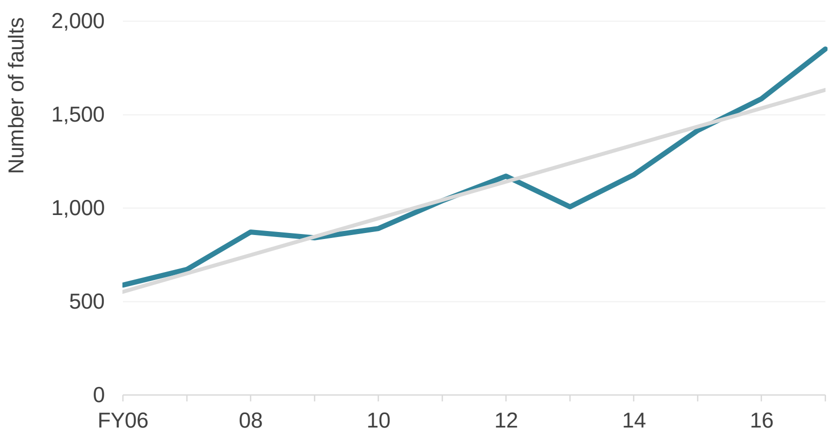
3.2.1 Deteriorating asset condition

As a manager of assets that provide a critical service, integrated into the very fabric of our local communities, ensuring appropriate asset condition is a priority.

Increasing numbers of assets are failing in service

We are concerned about deteriorating asset condition trends across a number of key asset fleets, particularly our overhead distribution network fleets. Such a situation carries serious risk, as deteriorating asset condition invariably leads to deteriorating network performance and increased safety risk over time. A key indicator of the condition of our assets is the number of assets which fail in service - the trend of which, since 2006, is illustrated in Figure 3.5.

Figure 3.5: Defective equipment fault trend[12]



From this figure it can be seen that the number of assets failing in service has approximately tripled during the past decade and continues to increase over time, at an increasing rate.

Increased faults are not only inconvenient to customers, but they also put pressure on the cost of electricity as repairs have to be carried out reactively – which is more expensive than planned work.[13]

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[12] Equipment faults that led to outages longer than one minute are included in the trend. These are the outages that contribute to SAIDI and SAIFI.

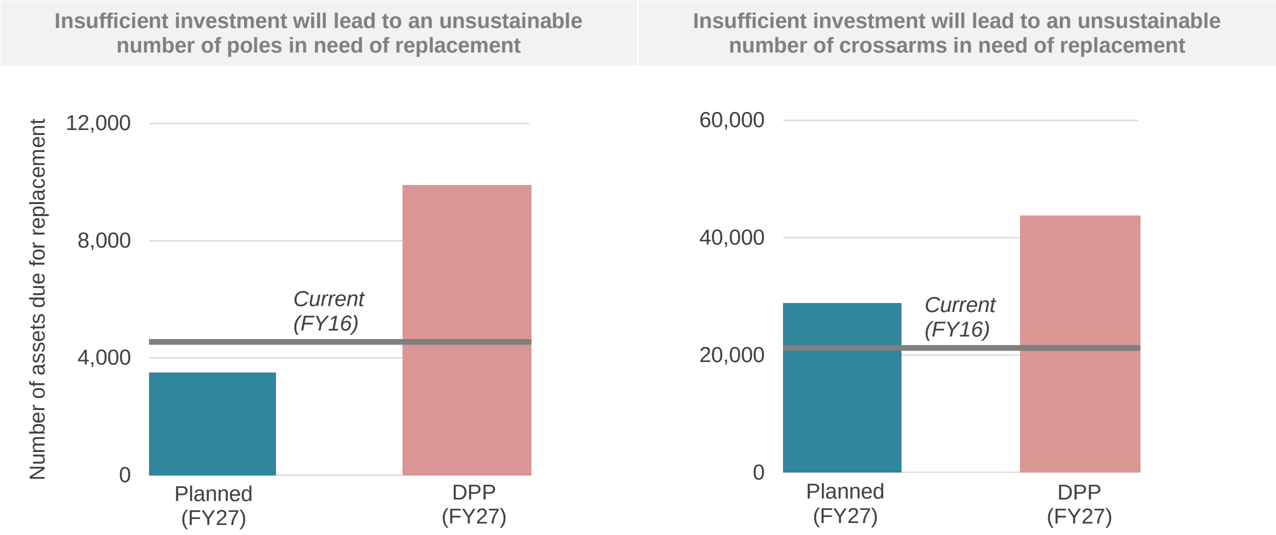
[13] Reactive work requires immediate response, which does not allow for advance scheduling. By comparison, planned work allows better optimisation of works schedules and reduced travel, improving workforce utilisation. In addition, reactive work is usually on a limited number of assets whereas planned work allows more assets to be worked on as part of one scheduled outage – thus reducing the average cost per asset of administration, switching, traffic management and the like.

Unacceptable asset condition trends

This pattern of increasing in-service asset failures is consistent with the deteriorating condition and asset health trends we see in most of our key asset fleets. Our preventive asset inspections indicate a high number of assets needing replacement – a situation that will further deteriorate if targeted intervention is not undertaken.

Examples of the asset health trends we are seeing are given in Figure 3.6, which shows the current number of wooden poles and crossarms requiring replacement, as well as the anticipated outcomes by FY27 under CPP (planned) and DPP scenarios.[14]

Figure 3.6: Asset health of our wooden pole and crossarm fleets



Key points of note are as follows:

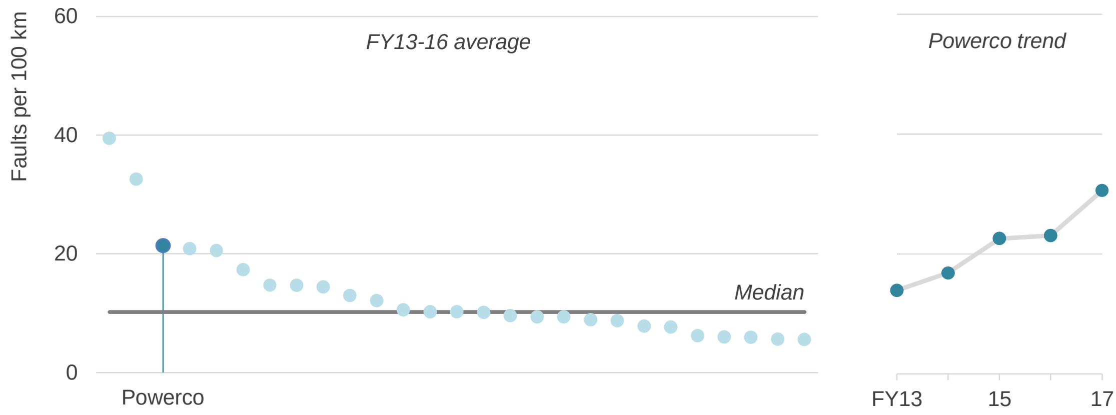
- the number of assets in poor condition and requiring replacement is substantial
- at current expenditure this proportion will increase to unacceptable levels
- our proposed CPP expenditure will stabilise health at levels where it can be effectively managed.

Consistent issues across key asset fleets

The issues that are apparent for our wooden pole or crossarm fleets are also apparent for other key asset fleets. A key concern is the performance of our overhead lines, particularly distribution feeders. These make up a large proportion of our asset base and their performance has a direct impact on our customers' service. The performance of our distribution overhead lines compared with that of the rest of New Zealand, and their worsening performance in recent years, is shown in Figure 3.7.

[14] More details on the condition of asset fleets and the requirement for renewal are provided in Chapter 11.

Figure 3.7: Distribution overhead line performance benchmarking and trend[15]



We note from the charts that, as a result of constrained funding for renewals:

- performance of our distribution overhead lines is at the low-performing end
- performance of these distribution overhead lines has deteriorated in each of the last four years.

The distribution line fleet is one of our largest, and we have more lines than any other EDB. In the majority of cases – especially in rural areas – there is no redundancy in this network and every fault therefore leads to customers being without supply. The performance of distribution lines is therefore a major contributor to overall network reliability. What makes this performance even more concerning is its consistent deterioration in recent years.

Discussion

The trends of deteriorating asset condition shown above are predictable and not unexpected. High levels of equipment installation occurred from the late 1950s through to the 1970s and these assets are now reaching the end of their expected lives.[16]

In aggregate, to arrest the deteriorating condition trends of our assets necessitates a targeted and focused increase in renewal expenditure. This is the only way we can stabilise asset condition, and manage performance appropriately over the long term, which is essential to reduce safety risks and help maintain the service provided to our customers.

3.2.2 Network reliability concerns

Given the deteriorating condition of our assets, it is unsurprising that our network reliability position is also a concern. The reliability of our network does not compare well with that of other EDBs.

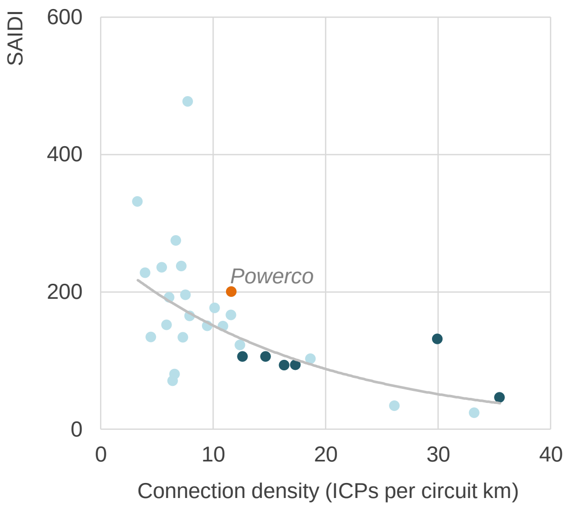
While our customers have indicated that they do not necessarily want us to improve reliability, it is also clear they would not accept worsening reliability. Given the concerning position of our network reliability, there is clearly no scope for further deterioration. However, as discussed above, that is exactly the situation we anticipate if we look at the performance trends and health of our assets. Without well-targeted intervention to address these trends, reliability will continue to deteriorate and fall even further outside the norm for EDBs. This would be an unacceptable outcome.

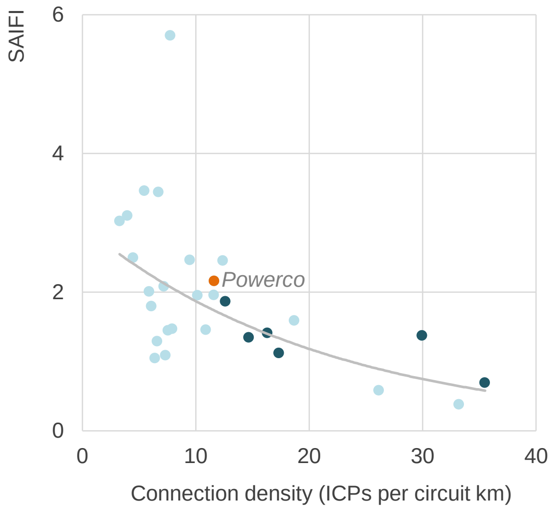
The seriousness of the situation can be seen when considering our reliability performance against that of our peers in recent years, as shown in Figure 3.8.

15 Our average also includes FY17 data. FY17 information from other EDBs is not yet publically available.

16 Supra note 8.

Figure 3.8: Network reliability benchmarking (FY13-16 average)





These charts compare the reliability performance of EDBs. SAIDI indicates the average duration that a customer on our network is without power every year. SAIFI indicates the average number of times a customer would experience an outage in a year.[17]

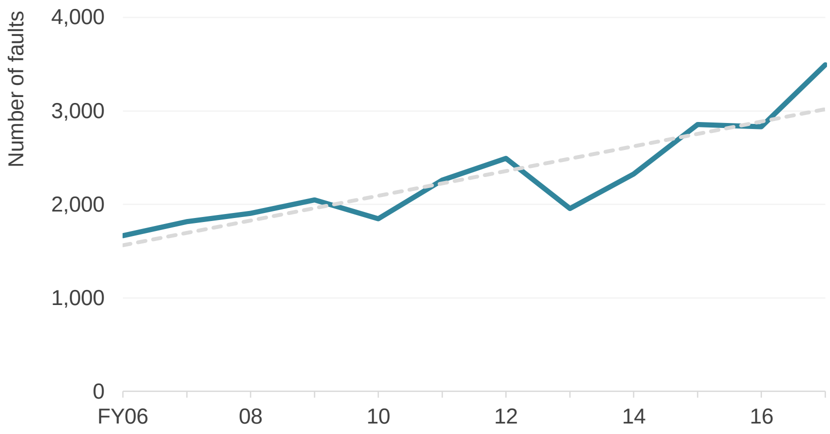
Key points to note from these charts are set out below:

- there is a reasonably good correlation between network density and average SAIDI and SAIFI. This broadly results from the fact that lower density networks are more rural in nature, and hence more exposed to the elements (and resulting faults) than urban feeders, which are often undergrounded and do not cross forested areas. There is also generally less redundancy or 'backstop' capability built into rural lines than urban feeders
- our network reliability is an outlier, especially in terms of high SAIDI, both against the New Zealand average, and against a peer group of larger utilities (shown as darker dots on the charts)
- comparing those networks with similar connection densities (i.e. around 12 customers per km of circuit), shows our customers spend more time off supply than customers at any other EDB
- comparing our network performance against larger EDBs shows our customers currently experience roughly twice the number and duration of outages.

Underlying the poor network reliability is the high, deteriorating fault rates on our network. In Figure 3.5 we showed the increasing rate of faults arising from asset failures. Figure 3.9 shows the overall fault trend on the network, which in addition to asset failures includes other causes such as third party damage or lightning strikes.

[17] In both cases, we only reflect outages lasting more than one minute and only those on our distribution or subtransmission networks (not low voltage). This is in accordance with Commission definitions.

Figure 3.9: Overall fault rate[18]



As with the asset-related faults, the situation is concerning. The following is observed:

- there is significant volatility in the annual fault rate – this reflects the impact of external events, especially the weather, on our largely overhead network
- despite the better network performance in relatively benign weather years such as FY13 and FY16, the underlying deteriorating trend is clear
- overall fault rates have more than doubled in the past decade
- the rate of increase in fault numbers has accelerated in recent years.

The main reasons that the underlying fault trends have not been directly reflected in overall network SAIDI and SAIFI trends is because of the effectiveness of our network automation programme, and the construction of more feeders in parts of the network. Both of these activities reduce the number of customers per feeder, and therefore the number of customers affected during a feeder outage.[19] While neither of these actions can avoid the growing fault rate, they help to reduce the average number of ICPs affected by an outage and hence improve high-level reliability statistics.

However, we are reaching a point where the effectiveness of these measures is diminishing. While there is still some scope for further automation, as included in our proposal, by the end of the CPP we will approach a stage where the remaining opportunities will no longer be cost-effective. Automation cannot in the longer term compensate for the impact of continually increasing network faults.

Network reliability, including our SAIDI and SAIFI trends, is discussed in more detail in Chapter 17.

3.2.3 Increasing pockets of unacceptable performance

The above discussion focused on the average performance across our network. Our position is even more concerning when viewed at a granular level.

Large parts of our network are rural or remote rural in nature. It is generally accepted that the reliability of rural networks cannot be economically maintained at the levels expected in more dense networks in or around towns and cities.[20] However, even after accounting for that, supply reliability in some of our rural areas falls well outside acceptable levels. On the worst performing parts of our network some of our

[18] Only faults longer than one minute are included, consistent with the Commission's definition of SAIDI and SAIFI measurement.

[19] Another contributing factor is our management of planned outages. In years where unplanned SAIDI or SAIFI is trending up, for example as a result of severe storms, we reduce planned work to avoid breaching the regulatory cap.

[20] To provide redundancy to rural networks equivalent to that of urban networks, significant additional investment would be required, the cost of which when considered economically (using a value of lost load) would outweigh the potential benefits.

customers are off supply for more than 50 hours per year. This is clearly inappropriate and falls well outside our own supply standards and targets.[21]

Our rural lines are increasingly supporting dairy, intensive horticulture, tourism and other high economic value activities. These activities lead to intensified electricity demand, and increasing reliance on a reliable supply. Customers and communities in these areas have expressed concern that the service they receive does not reflect the economic value of the activities they undertake. We agree with this sentiment.

While worst performing feeders are typically associated with rural and remote parts of our network this issue is not limited to these areas. We have targets for all our network categories and find that some feeders perform substantially below expectation in every category. The situation is illustrated with examples in Figure 3.10. The overall situation is also summarised in Table 3.2.

Figure 3.10: Worst performing feeders in our commercial, urban and rural categories

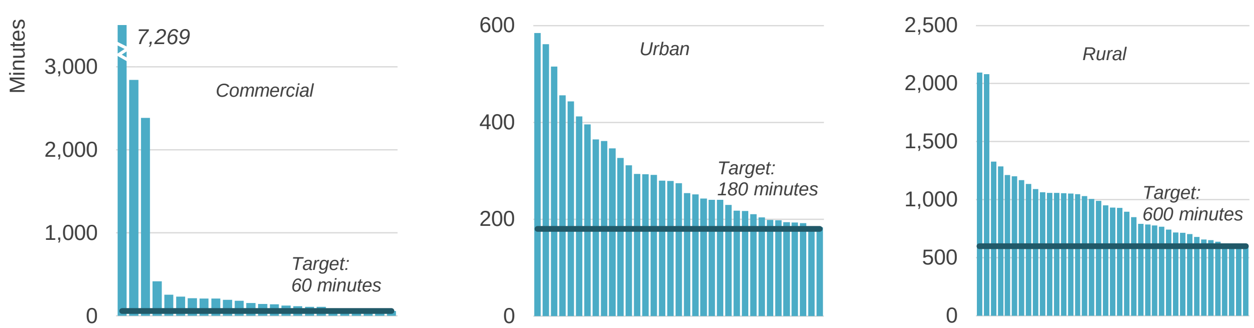


Table 3.2: Performance against feeder targets (FY16)

CONSUMER TYPE	LARGE INDUSTRIAL	COMMERCIAL	URBAN	RURAL	REMOTE RURAL
Feeder class	F1	F2	F3	F4	F5
FIDI limit (minutes)	30	60	180	600	1,080
Non-compliant feeders[22]	23	31	48	53	13
Total Feeders[23]	76	117	215	214	20
% compliant with standard	70%	74%	78%	75%	35%

Key points to note are as follows:

- the charts and table show feeder performance against target in FY16. The poor reliability on parts of our network is clear. The time spent off supply for those on poor performing feeders can be substantially higher than the network average
- there is a disproportionally large number of our feeders where the target levels are exceeded. As these targets were set based on what is considered appropriate in a New Zealand context, this indicates that many customers are experiencing a below acceptable level of service.

Many of our oldest assets are located in the worst performing areas, and so the situation is likely to deteriorate further if action to address poor condition assets is not taken.

[21] Our network security standards target outages not exceeding 10 hours per year on rural feeders, and not more than 18 hours per year on remote rural feeders.

[22] Note that some industrial, commercial and urban feeders extend outside towns into rural areas. When a single feeder fits into more than one category we categorise a feeder based on its main characteristic. The actual performance of those sections supplying denser areas would likely be assessed as performing somewhat better than shown in the figures.

[23] Feeders exclude those for our zone substation local service supplies.

3.2.4 Implication of the deteriorating trends

The discussions above highlight some concerning network trends, and provide some specific supporting examples of assets and locations where this is observed. These trends however are representative only, and we see issues across a large number of asset types and across the full range of leading and lagging performance indicators.

Table 3.3 provides a summary of the main indicators that reflect overall asset and network performance. These are all consistently poor and deteriorating over time.

Table 3.3: Network performance indicators

MEASURE	STARTING POINT	TREND
Network reliability	**Poor**: our SAIDI and SAIFI figures are twice the rate seen on the comparable large EDB networks.	Underlying performance is deteriorating, although we are controlling the overall performance in the short term through more network automation and by limiting planned outages.
Asset health	**Moderate to poor:** the percentage of end-of-life assets is already high.	As more assets reach end of life during the next ten years, overall asset health will rapidly deteriorate.
Failure rates	**Poor: o**ur failure rates on overhead lines is among the worst in New Zealand.	Significantly deteriorating. Overall fault rates have more than doubled in the last decade and are growing at in increasing rate.
Defect volumes	**Unacceptable: t**he number of defects requiring resolution is significantly higher than the level we consider prudent, when tested against the de facto industry standard of repairing amber defects within a year.	Defect volumes have grown considerably in recent years. This includes maintenance and renewal defects.[24]
Vegetation management	**Not meeting good industry practice**: we are unable to guarantee compliance with the Tree Regulations.[25]	Deteriorating. We are seeing increased vegetation related faults on the network.

At current levels of expenditure, we will continue to see deterioration in the key measures noted above, impacting reliability, and if not addressed judiciously, safety.

3.2.5 Delivering safe and reliable networks – our response

To address the increasing risks discussed above, our investment plans include a programme of targeted intervention to arrest these trends and ensure performance stays within acceptable bounds. Specifically we are proposing to:

- increase our renewals expenditure to address the increasing safety and network performance risks associated with declining asset health (see Chapter 11)
- increase our network growth expenditure, to arrest the increasing extent to which we breach our security standards and place load at risk (see Chapter 12)
- enhance our maintenance practices to reverse the upward trend in asset defects (see Chapter 15)
- adopt full cyclical trimming to ensure vegetation is appropriately managed (see Chapter 15).

24 See Chapter 11 for a discussion on asset renewals. Maintenance defects are discussed in Chapter 15.

25 See Chapter 15 for a discussion on vegetation management.

3.3 Supporting communities

As an electricity distribution company, we have a critical role to play in supporting our communities. One of our core functions is to ensure a reliable link between customers and generation sources and, in the future, increasingly between customers themselves.

Our planning processes are designed to anticipate and respond to changes in demand from our customers over time, and to ensure we respond to population and economic growth.

3.3.1 Supporting regional growth centres

A number of the regions we serve are experiencing a combination of population and economic growth and as a result (and despite demand remaining relatively flat on a per household basis) we are experiencing ongoing demand growth on our networks. In particular:

- Bay of Plenty: population growth and horticulture processing volumes
- Waikato: continued dairy intensification and a shift to snap chilling
- Taranaki: population growth and dairy intensification and snap chilling
- Manawatu: population growth.

We have close working relationships with the councils in each of the communities we support.

Through consultation and interaction with councils over recent years and more recently as part of our CPP consultation programme, feedback has been clear – they aim to promote regional growth and require a secure and reliable electricity network to do so.

3.3.2 A risk-based approach to network security standards

Network security standards dictate the degree of redundancy built into a network, and hence the impact the failure of an asset is likely to have on customers. Assets will fail from time to time, but effective security can limit the impact of those failures.

Our approach to network security investment seeks to balance the risk and economic impact of outages with the cost of network reinforcement. This approach is discussed in Box 3.1.

Box 3.1 – Our approach to security related investments

Our starting point is that we are prepared to judiciously accept more risk than many of our peer companies, where this helps us avoid cost increases to customers. This means that we may not progress security investments (identified as necessary under our internal security standards) where other options exist to manage the implications of asset failure within acceptable bounds.

In practical terms we do this via a two step investigation process. As a first step we use our security standards (which are aligned to good New Zealand practice) to trigger an investment review, including analysis of options and to assess the risk associated with an investment, and whether it is economically justified. We also look at options to defer investment, where we may identify appropriate risk moderations. For example, we may:

- accept the need to reconfigure our network (over a number of hours) in an urban environment, or
- accept the need to repair a line (over a day) in a rural environment where we can be reasonably assured we can access damaged equipment.

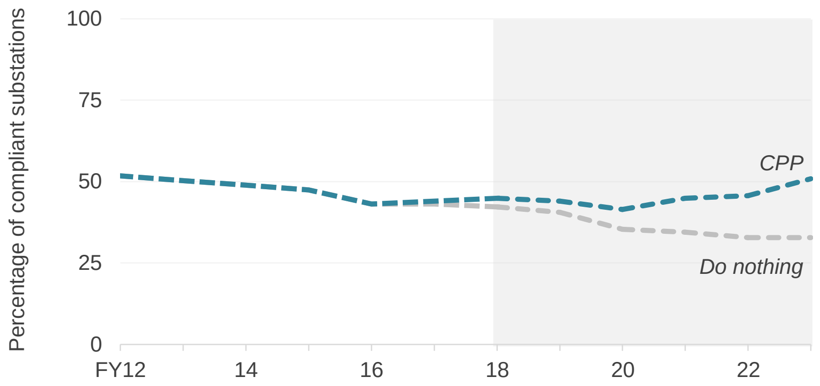
As a second step, we rank the required reinforcement projects (where alternative options are not feasible) according to their impact on reducing load at risk. The final selection of projects to include in the work programme is based on this consideration and the capital available to invest – ensuring those projects with the highest load at risk are done each year.

This approach helps moderate investment levels while still ensuring we do not accept a scenario that could result in multiple days of supply interruption for our customers. It also delivers a network architecture that is very ‘lean’, helping us moderate the cost of our service to customers.

However, the potential risk associated with this approach is that it leaves very little margin for further network growth, and that it places significantly more load at risk than would be the case if our security standards were strictly applied. Especially when capital rationing is applied (as it has been in recent years) more projects are deferred and security gaps and load at risk increase, which can have a material impact on our customers.

Substantial volumes of demand are now at risk across several parts of our network, particularly on the subtransmission network. This exposure is increasing as the demand on our network increases and has, in a number of instances, reached unacceptable levels. This is illustrated in Figure 3.11, which shows the extent to which security standards are breached at our zone substations.

Figure 3.11: Compliance with our zone substation security standards[26]



Key points of note are:

– compliance with our security standards has been falling since FY12. We now meet these at less than 50% of our zone substations

– since our approach is to accept some load at risk, not achieving security standards is often appropriate. However, at less than 50% compliance, we consider this exposure to be excessive.

Focused investment to reverse this trend and restore security to a level considered reasonable for a prudent network operator is therefore essential.

3.3.3 Responding to growth

Parts of our network continue to experience high demand growth. These growth rates are driven by fundamentals of population and economic growth, as demonstrated in recent years by:

– steady subdivision activity, in particular around Tauranga, but also in other key population centres such as New Plymouth and Palmerston North

– significant changes in demand from larger industrial customers, especially as a result of dairy intensification, but also from the oil and gas industry in Taranaki and horticultural activity in the Bay of Plenty

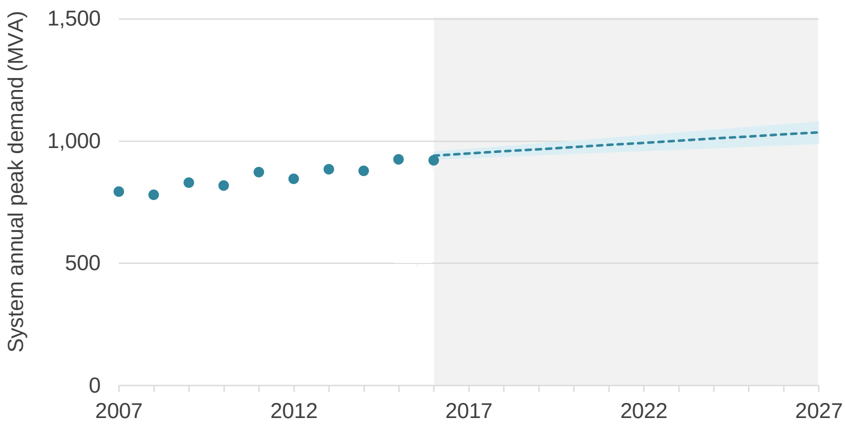
– smaller but material contributions for particular locations from irrigation developments, cool stores and other agricultural loads.

The trends we are seeing are consistent with population growth and GDP growth linked to the key industries we serve. Economic and population indicators suggest these trends will continue in the longer term.

This historical and forecast peak load on our network is illustrated in Figure 3.12.

[26] Our security standards compliance is presented against a 'do nothing' baseline. This isn't presented as a counterfactual investment (which could be the DPP), but instead as a useful reference or illustration to understand the full potential security over the forecast period.

Figure 3.12: Maximum network demand



The consistent and sustained pattern of load growth we are experiencing means we must continually invest to provide adequate network capacity and to avoid further deterioration to our security position, which would expose our customers to an excessive risk of outages.

However, we also recognise that uncertainty exists about future load growth trends as new technology emerges and energy markets evolve. We therefore undertake scenario analysis – testing our reinforcement investment plans under different future demand scenarios and selecting investments that would pose the least risk of asset stranding in future, or would provide most flexibility for future further incremental additions.

Our two step approach to security investment also implicitly helps ensure investments are made more on a 'just in time' basis, rather than in anticipation of load growth well into the future.

3.3.4 Supporting communities – our response

As a prudent network operator, we are committed to investing to support the requirements of our communities and regions. We will therefore ensure that the electricity capacity required by our customers can be effectively delivered. As part of the CPP work programme, we will also ensure that the current demand at risk is reduced and managed at appropriate levels – striking an optimal balance between investment levels and risk of supply interruption.

Our proposal therefore includes detailed and considered network development plans on a region by region basis. Key elements of these development proposals are set out in Box 3.2 below.

Box 3.2 – Overview of our major planned network development investments

REGION	PLANNED INVESTMENTS
Bay of Plenty	$40 million of targeted investment in the region during the CPP Period, including: – Capacity and security upgrades to the Papamoa region. – A range of upgrades around Tauranga to keep pace with growth. – Increased capacity to the Omokoroa and Pyes Pa regions.
Waikato and Coromandel	$140 million of targeted investment in these regions during the CPP Period, including: – Major security upgrades to the area around Putaruru, and Morrinsville – Major security upgrades to Whangamata – Capacity upgrades to the north of the Coromandel Peninsula.
Taranaki	$40 million of targeted investment in the region during the CPP Period, including: – Reconfiguration of supplies to the west of New Plymouth – Capacity upgrades to support growth to the east of New Plymouth – Capacity and security works around Hawera and Stratford.

Manawatu, and Tararua	$40 million of targeted investment in these regions during the CPP Period, including: – Major capacity and security upgrades to support Palmerston North city. – Capacity upgrades to support growth in and around Feilding. – Upgrades around the Sanson/Bulls area.
Other regions	$30 million of targeted investment in these regions during the CPP Period, including: – Capacity and security upgrades around Whanganui. – Capacity upgrades around Wairarapa.

Our network development proposals, covering both major investments and routine developments are set out by region and described in more detail in our 2017 AMP.

3.4 Evolving our networks for the future

Our industry is changing, as new consumer and network technologies emerge that will complement current arrangements. These technologies represent opportunities to enhance customer-experience, electricity distribution services and cost efficiency. However, if not well-integrated and managed, they have the potential, over the longer term, to cause disruption of supply stability and poor outcomes for our customers.

The New Zealand market is in a unique position. A very high proportion of our electricity is supplied from renewable sources and, based on current demand forecasts, we have adequate supply in the medium-term. This means, as a society, we can afford to let technology uptake be guided by its costs and delivered value to customers, rather than be driven by factors such as subsidies or feed-in tariffs.[27]

This creates a 'window of opportunity' for distribution networks to ready themselves for the likely future industry and market changes. Local and overseas studies[28] have consistently demonstrated that preparing early to avoid a reactive response later can materially moderate the costs of managing the transition to new arrangements or technology. We therefore consider it appropriate that we use the next five years to research, fully understand and evaluate the impacts and opportunities from major technology change, so that we can maximise the benefits to our customers, and be ready to deal with potential negative impacts on network operation as and when these arise.

Our vision for the future distribution network is one of a stable, open-access platform, which will not only continue to transport electricity from external sources as and where needed, but will also support energy transactions between our customers and other stakeholders.[29] Our proposed network evolution programme, and its associated research, development and piloting work, is aimed at achieving this goal.

Asset management is also benefiting from emerging technology, particularly the improvements in information availability and data processing capacity. As part of our evolution to the network of the future, we intend to significantly enhance our asset management processes and capability. This will be a key platform for continually improving investment and operational efficiency and decision-making.

3.4.1 A period of change

We see the emerging changes in the energy sector as broadly positive and are committed to supporting our customers by providing them the aforementioned stable, open-access platform over which to transact, and providing flexibility in how they make their energy supply and consumption decisions. This is something that many of our stakeholders have told us that they value highly.

We will focus on being ready for the changes in the sector as they emerge, and develop our network in a way that will accommodate these changes while remaining stable, safe and reliable. Electric vehicles,

27 We recognise however that this could change, given the potential future need for incentives to increase the use of renewable energy to ensure New Zealand can meet its obligations under the Paris climate accord, adopted on 12 December 2015 by the united Nations Framework Convention on Climate Change.

28 For example, the work done by EA Technologies for the UK DNOs, in developing the "Transform" model.

29 We refer to this future network as a Distribution System Integrator (DSI).

photovoltaic cells, and load shifting technologies such as batteries are beginning to find a substantial role in the industry, and other solutions will emerge in time.

Our plans are based on a view of how changes in the sector will impact our distribution networks as set out in Box 3.3 below:

Box 3.3 – The changes we expect in the energy market and what they could mean for us

As new technology finds a place on our networks and in our customers' homes and businesses, it will change the way we manage our distribution network. In particular, we see the traditional central generation model increasingly supplemented by local generation and energy storage, and new types of emerging load (such as electric vehicles). Increased automation, remote control, demand shifting and self-restoring networks are also likely.

Our challenge is to optimise our networks and our investment approach to best suit the emerging needs of customers, even where these are not yet evident.

We expect to see the following key changes:

- Information technology will increasingly support the availability of real time information. This would not only have network operations benefits, but would also mean that when supply is interrupted, our customers will expect real time information on what is happening, and updates on progress on restoration. Achieving this will require the use of various platforms, such as smart phone based applications, website updates, and call centres.
- Future demand could vary in increasingly unpredictable ways, with rates of growth varying across our network. To deal with this uncertainty, we must find ways to avoid excess investment and maximise future flexibility.
- Many customers will generate their own electricity and some may export electricity back to the network. This means two-way energy flows, with potential for network instability issues. We will need to find ways to manage these issues cost-effectively, and optimise the potential benefit from local generation.
- Emerging technology, on the customer and network side, is likely to offer opportunities to optimise network performance, enhance the services we can provide and, if applied judiciously, would lead to more cost-effective network solutions. We will be working with customers and other stakeholders to unlock these longer term benefits.
- Current rates of change are likely to continue to escalate, driving further innovation in the market, leading to new market players and services, and new ways for our customers to use our network. This means the status quo is unlikely to reflect the future and we must continually evolve, do research, collaborate with others, and encourage innovation.

3.4.2 The need for a considered approach

As a provider of essential services we cannot simply wait until certainty exists about future changes - we must continue to supply our customers, and anticipate changes (to the degree possible) before they occur. Investment under uncertainty require making 'least-regret' investment decisions that will retain most value under a range of future outcomes.

To achieve this, we will expand our research and analysis of future trends, and trialling of emerging solutions. This will be achieved through our own research, development and pilot projects, as well as by engaging with our customers, peers, academia and technology providers.

Failing to adequately prepare for and embrace emerging technology could risk our networks becoming an impediment to change, and undermining what should be a cost-effective, flexible platform to support customer needs.

3.4.3 Supporting our customers future energy choices

We see that our network will continue to play a critical role in distributing electricity to and between homes and businesses. Integrated, network-based solutions are inherently stronger and more resilient than standalone options, and the network can also provide an effective platform over which customers can transact with each other. Our role in this is to ensure our customers have unfettered access to a stable, reliable network, at pricing levels that they find attractive.

Under this future model, energy supply options will become increasingly diverse. While we see ourselves as providing and maintaining the platform that will support these energy transactions, we don't envisage being directly involved in them.

In addition, there is a range of emerging customer solutions and technologies we believe could play a role in future energy markets – such as energy storage, PV generation, and home energy control systems. Other solutions will invariably emerge over time. Our role is not to 'pick winners' regarding customer technology solutions, or to dissuade customers from making technology decisions for their own benefit. Rather it is important that we are able to support new technologies and effectively integrate them on our network.

The work required to evolve our network to the platform that will effectively support our customers' future energy choices is core to the network evolution programme proposed during the CPP Period.

3.4.4 Moderating network risk through technology

Technology offers benefits to customers and also provides opportunities to operate our network more effectively and efficiently.

We have always sought to apply new technologies to our network where it has made economic and financial sense to do so, and we already have a strong base of technology to work from. Planned Enterprise Resource Planning (ERP) works will further strengthen our capabilities in this area.

We are therefore reviewing a range of technologies which we anticipate could benefit our customers in the medium-term (5 to 10 year period), and plan to test their integration on our network (as pilot projects) during the CPP Period.

Box 3.4 – Technologies we intend to investigate during the CPP Period

INTENDED CUSTOMER BENEFITS	TECHNOLOGY AREA
A safe and reliable network	Advanced asset condition testing technologies have the potential to help ensure we safely maximise the service lives of our assets.
Effective network development programmes	Distributed generation, storage technologies and real time asset utilisation techniques have the potential to optimise utilisation of our assets.
Reduced impact from outages	Network automation, enhanced network control, and making improved information available in the field can help reduce outage impacts.
Appropriate oversight and planning	Increased application of real time measurement across our network has the potential to ensure we better understand and effectively manage network constraints.
Improved real time information	The combination of improved network oversight, and enhanced back end systems have the potential to support real time feedback on outages and outage response for our customers.

Our CPP plans include provision to test and prove these (and other) solutions to identify areas where their application can enhance operation and moderate future investment.

Importantly, we intend to collaborate widely in these investigations. Working closely with other EDBs, academia, research institutes and suppliers will enhance the efficiency of the programme – and avoid us 're-inventing the wheel' where others have already tried and developed solutions. Our customers, and those of other networks, are funding these activities, and we believe the benefits should be widely shared back across communities – so we are also keen to share our experiences with others.

3.4.5 Preparing for the distribution network of the future – our response

To realise the benefits discussed above, avoid the potential issues associated with variable local generation, and support the orderly evolution required to achieve our vision for the distribution network of the future, we propose several activities as part of our CPP work programme.

- **Targeted research and development:** and technology trials to test and prove new network and non-network solutions. We will identify and implement those that will support our customers' future energy choices or enhance the efficiency of our network and service offering (see Chapter 13).
- **Enhancing our asset management skills:** to leverage the major improvement opportunities arising from improving information management and analytics, risk management, investment optimisation and innovation (see Chapters 13 and 15).
- **Ensuring our ability to deliver efficiently:** the additional work required for the CPP programme, by streamlining our delivery and contract management processes and building up appropriate internal and external capacity (see Chapters 9 and 15).
- **Enhanced control room technology and customer support:** solutions to support effective oversight of our networks providing real time information to customers (see Chapters 14 and 15).
- **Enhanced ICT systems:** to support improved asset management, operations and support services (see Chapter 14).

How we developed and tested our proposal

This section explains how we developed our proposal, and how this has been challenged including our customer consultation process and the review by the Independent Verifier.

CONTENTS

4 DEVELOPMENT OF OUR PRELIMINARY PROPOSAL

Improvements to data quality and forecasting analysis since 2010 have provided greater insights into our future investment needs. This led to a recognition of the need for increased investment, which was signalled in our 2013 AMP, and reinforced in the 2016 AMP.

Since publishing our 2016 AMP, we have:

- refined our investment plans
- sought external specialist advice to review key elements of our proposal, and acted on their recommendations
- undertaken a series of internal challenges to test the basis of our expenditure plans
- consulted extensively on our proposed investment plans

Our **Preliminary Proposal** was completed in November 2016. This was used for our main CPP consultation and was reviewed, in detail, by the Independent Verifier.

4.1 Historical asset management plans

We have been signalling a need for increased investment since 2010, culminating in our 2013 AMP. The AMP identified the need for increased investment on our networks, and explained our understanding of the investment focus at that time. The process to develop the 2013 AMP resulted in an asset management improvement programme that included the introduction of improved medium-term forecasting approaches.

The 2013 AMP included a self-assessment of our asset management maturity using the Asset Management Maturity Assessment Tool (AMMAT). Our assessment highlighted the need to lift our asset management approach, which has been a focus since then.

4.1.1 Development of our 2016 AMP

Since publishing our 2013 AMP our focus has been on further developing our understanding of the health and risk associated with our diverse range of assets. To enable this, we made several improvements to our asset management practices, including:

- moving to a fleet management approach to better reflect our asset base and investment drivers
- developing an extensive suite of tailored forecasting models, including survivorship modelling approaches for key asset fleets
- adopted an asset health based approach and built associated models
- expanded and refined our demand forecasting and approach to security standards
- refined our management of growth projects including developing an area planning approach
- reviewed our vegetation management approach
- explicitly recognised the escalating changes to our operating environment and the need for research, pilot projects and innovation to keep up with this.

These improvements were instrumental in helping us quantify the scale of our network issues and how best to address them through increased investment and improved capabilities. This analysis formed the basis of our 2016 AMP.

4.1.2 2016 AMP

In our 2016 AMP we signalled the need to apply for a CPP as the DPP became increasingly inappropriate for our particular circumstances. The 2016 AMP underwent a rigorous challenge by the Powerco Board that included independent expert views on key areas to test our analysis and findings.

The picture that emerged from our improved analysis was concerning. We realised that we had to increase expenditure in critical areas, even though that meant spending above the levels provided for under the DPP. A key driver for this was the increasing underlying fault and outage trends driven by in our ageing asset base, which had started to affect our ability to maintain a safe and reliable service for customers.

2016 AMP consultation

In the lead up to developing our 2016 AMP, we undertook a major survey of our residential and commercial customers. This survey was developed and facilitated by PwC supported by Colmar Brunton. Both these firms have the extensive experience in electricity sector engagement necessary to develop a robust and targeted survey. This, together with our mature and leading practice business-as-usual consultation[30], informed our 2016 AMP investment plans.

The customer survey highlighted that households and small businesses are concerned about rising energy costs. However, it also showed that customers don't want us to store up problems for the future by not investing now, if it would lead to poor performance and higher costs in the future. Feedback indicated an expectation that reliability should be at least maintained, particularly for unplanned outages. Many customers put reliability and safety above cost considerations. They expect us to manage the safety and performance of our networks efficiently and prudently.

Table 4.1 sets out some of the messages we took from this consultation process and discussions with groups such as local councils.

Table 4.1: Main 2016 AMP consultation findings[31]

ISSUE	CUSTOMER VIEWS
Safety	The safe operation of our network is the most important consideration.
Reliability and resilience	Overall reliability should be at least maintained, particularly for unplanned outages. Our networks should be resilient enough to ride through storms.
Growth and security	Our networks should support and enable economic growth in our regions Targeted investment to support growing regions and industries is supported by customers.
Price and service quality	Price is important to all customers. Customers have a range of views on how we should balance service quality and costs.
Future choice	We should prepare for innovative technologies such as electric vehicles. We should enable customer choice including the use of solar panels.

Further detail on this engagement is provided in Chapter 5.

Key messages in our 2016 AMP

The 2016 AMP focused on ensuring our network is well-positioned to meet long-term service expectations of our customers and support their future energy choices. We identified the need to invest to maintain the health of our assets to continue providing safe and reliable services to consumers. We recognised that our network and service offering needs to evolve if we are to keep pace with the changing

30 See Chapter 4 of our 2017 AMP for a description of our BAU consultation approach.

31 Chapter 6 of our 2016 AMP includes further detail on the responses we received.

needs of our customers. We noted that achieving these outcomes, while minimising costs to customers, was central to our asset management approach.

The expenditure profiles in the 2016 AMP sought to achieve a sustainable long-term position for the network, and to deliver on customer needs.[32] These profiles were well above the DPP allowance.

These messages and views remain central to our CPP proposal.

4.2 Development of our Preliminary Proposal

Following the publication of our 2016 AMP we began preparing our Preliminary Proposal. First, we updated our 2016 AMP forecasts based on new information and feedback received on the AMP.

As discussed in Chapter 3, since publishing our 2016 AMP the performance of our network has continued to deteriorate. This led us to target an earlier set of investments than envisaged in our AMP forecasts. We identified a need to bring forward a number of programmes to FY19, including our increased vegetation management and investment to reduce the backlog of overhead line defects.

Following the Commission's draft decision[33] on 22 June 2016 to change the IMs and align the applicable WACC[34] between the DPP and CPP, we decided to expedite our application process and submit a CPP application in June 2017. This was formally communicated to the Commission on 17 January 2017, together with a public announcement on 17 January 2017 as part of our core consultation.

We then undertook a number of internal and external subject matter expert challenges on our proposed approaches and key business cases. We engaged external independent experts to review the 2016 AMP and CPP proposal. They considered a number of key asset management areas, including renewals, growth and security, network Opex, and non-network Capex.

We also reviewed our forecasts, particularly those relating to our overhead lines fleets, for deliverability over the CPP Period. We appointed a group of general managers to a CPP Governance Group (CGG) who were joined by senior managers within the business as required. The CGG was established to provide oversight of our CPP development process, test the proposals, and act as a decision-making body for key issues.

Forecasts approved by the CGG were also reviewed by our executive management team and the Board.

The process we used to develop our Preliminary Proposal is summarised in Figure 4.1.

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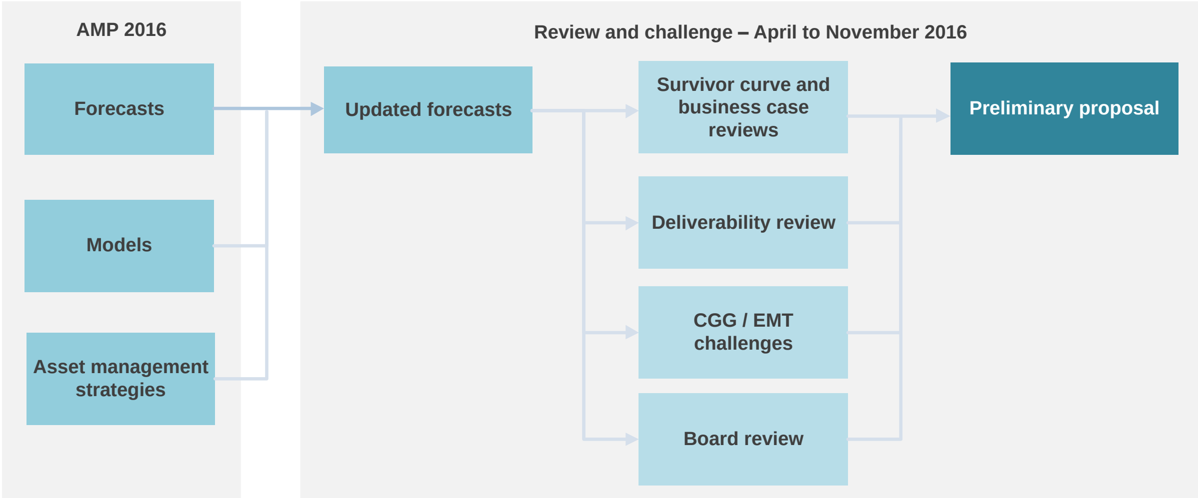
32 It should be noted that the 2016 AMP assumed a FY20 to FY24 period for our CPP.

33 http://www.comcom.govt.nz/dmsdocument/14367

34 The regulatory Weighted Average Cost of Capital.

Figure 4.1: Process to develop our Prelinary Proposal



The main reviews during the review and challenge process were as follows.

– **Renewal modelling and network Opex reviews**: our forecasting models and maintenance approaches, including our survivor curves, were reviewed by external specialists.

– **Business case review**: a number of our business cases were reviewed by external specialists, including our planned non-network investments.

– **Deliverability review**: as part of our deliverability workstream (see Chapter 8) we assessed our capacity to deliver the proposed investments. This review was used to refine our forecasts by shaping activity levels and profiles to align with feedback from service providers.

– **CPP Governance Group**: challenged our updated forecasts and ensured the recommendations of other reviews were fully considered and acted on.

– **Executive management team**: forecasts were submitted to the executive management team, including our CEO, and approved for submission to our Board.

– **Board CPP committee**: provided guidance and challenge on our investment plans to support the development of our Preliminary Proposal during three workshops across October and early November 2016.

– **Board Review**: the expenditure forecasts were submitted to the Powerco Board for review on 23 November 2016 and were approved for use in our consultation and review by the Independent Verifier.

Reflecting these reviews, we made a number of refinements to our Preliminary Proposal, as set out in Table 4.2.

Table 4.2: Review and challenge feedback and our response

REVIEW AND CHALLENGE STEPS	HOW WE RESPONDED
Survivor curve review	Revised our methodology for a number of models and updated our forecasts.
Network Opex	The review focused on our planning processes and forecasting practices for network Opex. No directly actionable issues were raised.
Growth and security Capex	The review focused on our demand forecasting processes, security standards and proposed investment for large growth and security projects. No directly actionable issues were raised.
Business case review	Our non-network investment proposals were revised and updated to reflect the feedback received from external advisors.
Deliverability review	Following discussions with service providers, we reviewed our forecasts to ensure they aligned with available resources.

REVIEW AND CHALLENGE STEPS	HOW WE RESPONDED
CGG / EMT review	We moderated a number of forecasts targets based on recommendations by our executive management team.
Board review	Our forecasts were challenged by the Board resulting in a number of moderations and revisions to our planned investments. The risk profiles presented by different expenditure scenarios was a key consideration.

Following these steps, the approved Preliminary Proposal forecasts were used as the basis for:

- our customer consultation, as discussed in Chapter 5 which explains how we engaged with our customers and other stakeholders on our proposal
- the proposal provided to the Independent Verifier for review, as discussed in Chapter 6, which explains the review undertaken by the Independent Verifier and our response.

Chapter 7 explains how we developed our Final Proposal including how we reflected feedback from customers and the Independent Verifier.

5 ENGAGEMENT ON OUR PRELIMINARY PROPOSAL

We regularly engage with our customers and stakeholders both directly and at a community level.

In preparing our proposal we engaged extensively with customers and stakeholders through a series of targeted workshops, meetings and mass market consultation material.

These engagements were designed to allow us to better understand their priorities and preferences.

We received valuable feedback from this process, which we have considered in our decision making.

We have taken account of our customers' affordability and other concerns and tried to minimise any adverse pricing impacts.

This engagement has helped us develop a CPP proposal that reflects our customers' long-term interests in terms of our planned investments, quality standards, and affordability.

5.1 Our business planning is shaped by what our customers tell us

Customer and stakeholder engagement is vital to the operation of any high performing company and we are no exception. Our electricity networks provide an essential service to over 330,000 homes and businesses located across large parts of the North Island. We regularly engage with our customers and stakeholders both directly and at a community level.

Over the years we've sought and received direct feedback on how our business is performing as well as regular commentary on the services we provide. We use this feedback each year to help shape business planning and improve our delivery processes. Overall, customers tell us that they place high value on a safe and reliable electricity network, and that we generally meet their expectations in providing this. They also tell us that the price they pay for their electricity and associated services is very important.

Over the past 18 months, we have undertaken a comprehensive programme of customer research, consultation and direct engagement with all our key stakeholders and the majority of our customers.

5.2 Our CPP engagement went beyond regulatory requirements

Our consultation framework went beyond the mandatory requirements specified by the IMs. We took guidance for our consultation and engagement approach from electricity distributors in Australia, operating under the relatively mature Australian Energy Regulator (AER) regulatory framework; and found that our approach compares positively.

We set ourselves the ambitious task of connecting with all our customers and stakeholders during the core consultation. We achieved this aim, as the following summary statistics illustrate:

- we published a detailed consultation document entitled, "Investing to ensure safety, security and resilience", which explained our proposed CPP investment and the alternative options we considered to ensure the optimal balance of service outcomes and cost over the long term
- we sent over 110,000 newspaper inserts to residential customers across our operating region
- we ran digital media awareness and invitation to comment campaigns (Facebook and Twitter) – targeted at nearly 100,000 subscribers and supported by a CPP overview video (60,000 views)
- we met individually with over 200 customers and stakeholders
- we received over 4,300 visits to the "Have your say" CPP website and customers responded to an online survey which sought feedback on our proposal
- PwC and Colmar Brunton received survey responses from about 1,500 residential and business customers and assessed these to establish their service preference and willingness to pay
- we held CPP forums in Wellington, Auckland, Tauranga and New Plymouth.

Throughout our interactions, our customers have told us consistently that the 'quality' of service we provide matters greatly to them, and that overall, they would not accept deteriorating service levels. However, there is limited desire to improve network performance, especially if this comes at a significant cost; although customers on the worst performing parts of our network generally hold a different view.

Naturally, customers are also very price conscious. In general, however, they did not express a view on whether particular price outcomes were appropriate or not. Instead, they wanted to understand how our plans would be tested to ensure that our investments are justified. In relation to service quality, different customer and stakeholder groups were concerned about different bundles of service attributes, which tended to be significantly broader than the regulated quality measures.

This chapter provides a summary of our customer and stakeholder engagement process, which has been unprecedented for an EDB in terms of its scope and scale. We also explain that the CPP consultation process has not been conducted in isolation – it has been supported by significant learnings from earlier engagement initiatives.

5.3 We built our engagement around our existing processes

Over recent years we have worked hard to develop a closer relationship with our customers and the many stakeholders and partners who support us or have an interest in our business operations. We engage on an ongoing basis with our customers in a number of ways and use the feedback we receive to inform our annual business planning process and asset management plans.

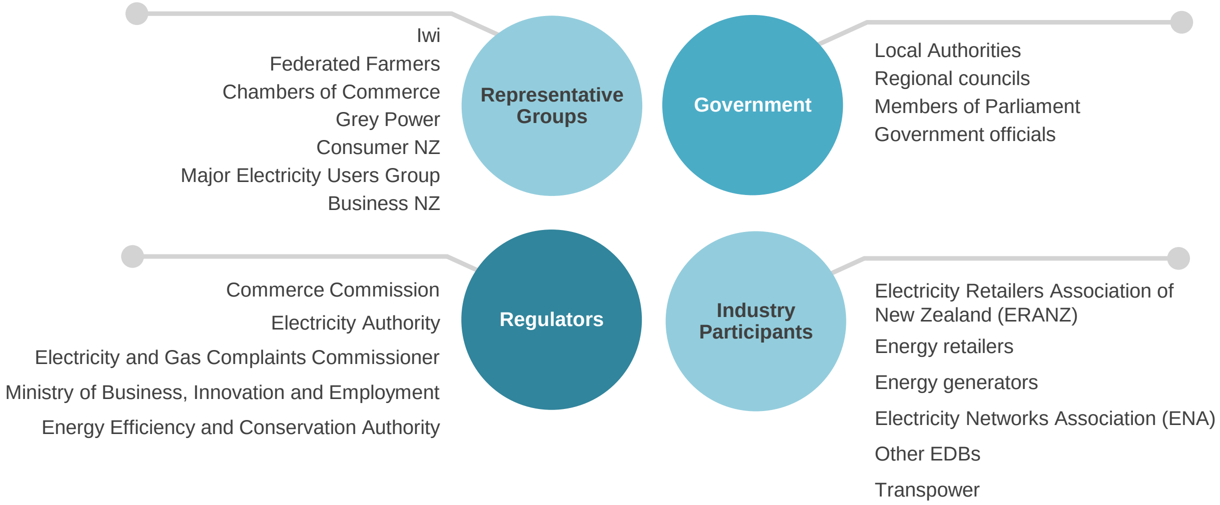
Our engagement is a two-way process. We use the process to provide relevant and timely information to customers about our business and the services we provide and to seek specific feedback about how we're performing and their expectations regarding future service requirements.

5.3.1 Our customers and stakeholders

We consult with a wide range of customers and stakeholders using a variety of communication channels and mechanisms.

- **Our customers**: recipients of our services including residential, small to medium businesses, large business, individually managed customers and directly affected customers.
- **Stakeholders**: individuals or organisations that have an interest in our services and the prices charged including, retailers, advocacy groups, elected councils, government and regulators, media, contractors and other market participants.

Figure 5.1: Overview of our stakeholders



The channels we use to engage with customers and stakeholders

To enhance the effectiveness of our consultation we use different communication channels to meet the needs of different customer or stakeholder groups. Over many years of engagement, we have developed the following suite of communication channels, which we applied to our CPP consultation programme.[35]

Agricultural field days, expos and trade shows – Each year we have stands at the Mystery Creek and Central Districts agricultural field days. We also attend various expos and trade shows across our network area. Attending these events provides customers with an opportunity to have face-to-face discussions with our staff. This allows for a highly constructive exchange of information.

Commercial and account management interactions – We employ a team to maintain regular dialogue with our larger commercial and industrial customers so we remain well informed of their needs, plans, and expectations.

Surveys – We survey customers face-to-face, online and by post about the quality and price of their electricity supply. Each year we survey around 5,000 to 6,000 customers.

Stakeholder meetings and focus groups – We meet regularly with key stakeholders and customer representative groups. We also hold focus groups, which provide us with valuable insights on different customer demographics.

Website and phone – Our website and free phone number – www.powerco.co.nz and 0800 POWERCO (0800 769 3726) – allow customers to contact us easily and provide feedback.

Consultation documents – We produce documents to keep stakeholders and customers informed and to generate discussion.

Community-wide consultation – We conduct community-wide consultation to address specific regional issues and to seek feedback on specific major projects or regional medium and long-term network development plans. Campaigns involve a mixture of the above engagement methods, in addition to media advertising and information kiosks.

Consultation videos – We develop short educational videos and publish them on YouTube to help customers understand our industry and to facilitate more meaningful feedback.

35 As part of the CPP Engagement programme, Key Research were engaged to survey customers' preferences for different channels of communication.

5.4 CPP consultation objectives

Our CPP consultation programme was centred around the following broad objectives:

- help our customers and stakeholders gain an understanding of the role we play in the electricity sector and why their feedback on our proposed investment plan is important
- communicate the details of our proposed investment plan such as the reasons for the level of expenditure proposed, regional impacts, and the network performance and customer service levels we are aiming to deliver
- discuss the investment options we considered when developing our investment proposal and the implications (in terms of network performance, service levels and long-term network risk) of spending more or less
- build on the engagements we routinely have with our customers to deepen our understanding of their views and value preferences/priorities particularly in relation to the different aspects of our services
- understand any concerns that stakeholders and customers might have in relation to our current services and our proposed plans for the future
- provide appropriate opportunities for stakeholders and customers to provide direct feedback on our investment proposals, and use the feedback to help shape our regulatory proposal
- provide an ongoing platform to develop our future engagement activities.

5.4.1 Specific regulatory requirements for consultation

The Commission's IMs requires us to consult with our customers on our intended plans, including the revenue and quality impacts. In addition, the IMs requires us to explain the trade-off choices we have made on behalf of customers, and the other expenditure options we considered.

Our CPP consultation approach extended well beyond the mandatory requirements specified by the CPP IMs. We adopted a broad consultative approach so that customers and stakeholders were able to engage on those matters that are of most interest to them and at a level of detail that suited them best. With this objective in mind, we employed a range of different communication channels tailored to different customer and stakeholder groups.

5.5 CPP consultation

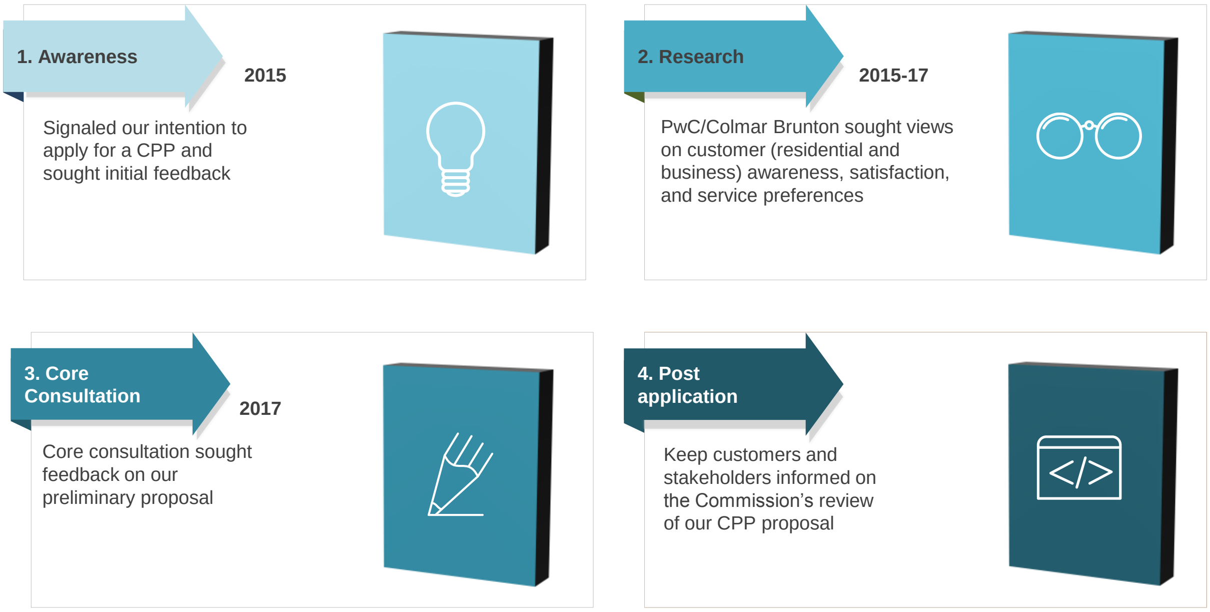
Our approach to our specific CPP consultation and engagement has been referenced against what is generally considered best practice customer engagement processes applied by electricity distributors in Australia, operating under the relatively mature AER regulatory framework. It compares positively. It also compares positively with leading practice from the UK.

The engagement framework has been implemented in parallel to the development of the investment plan and was designed to allow customer feedback to inform our thinking from the outset.

5.5.1 Overall approach

We structured our CPP engagement into four stages, building on our already well developed annual customer consultation and engagement processes. Three of the following four stages of engagement are now complete.

Figure 5.2: The four stages of our CPP consultation and engagement programme



During the first three steps, we have:

- surveyed customers to understand which aspects of our service they value most highly
- consulted on our indicative CPP plans which reflected our understanding of customers' price-service preferences
- notified stakeholders and customers of our intention to apply for a CPP
- consulted on alternative investment options considered and how these impact on long-term network performance and cost to customers
- finalised our CPP plans to address the feedback received from our customers and stakeholders, taking into account also the initial feedback we received from the independent verification of our preliminary CPP proposal.

5.5.2 Stage 1: Awareness: context setting and invitation to engage (2015)

The aim of this relatively resource intensive initial stage was to collate existing feedback from our customers (i.e. research, complaints information etc). We built on established relationships and met with key stakeholders in order to provide them with an initial context for the drivers underpinning our future investment requirements. Consultation covered

- our emerging thinking on the investment plan that was being developed for the 2016 AMP
- sought general feedback from stakeholders on their current level of awareness of Powerco
- their perceptions of our services
- their expectations in terms of future levels of input to our investment planning processes.

The consultation took several months and involved a combination of face-to-face briefings (circa 25 key stakeholders) and mail-outs to around 50 stakeholders.

5.5.3 Stage 2: Customer research (2016, updated 2017)

Building on prior research a programme of preliminary CPP customer research was conducted in 2016 and updated in early 2017.

Qualitative research

Colmar Brunton conducted a series of one-on-one in-depth interviews with residential customers and held focus groups with small businesses. The goals of this qualitative research were to:

- develop an in-depth picture of how customers use electricity and react to power cuts
- understand consumer language and concepts to improve the design of the quantitative online survey
- capture any new concerns or issues that could be included in the survey.

Quantitative research

PwC undertook on our behalf a customer survey, receiving responses from about 1,500 customers.[36] The survey focused on:

- how much do customers know about their electricity supply? How engaged are they?
- who are the customers in terms of standard demographics as well as power usage and interest in technology?
- what are their opinions on asset management and maintaining the network over both the short and longer term?
- what their electricity service is worth to them and what trade-offs they are prepared to make?

The survey included contingent valuation questions and a series of choice models. The choice models explored consumer preferences for price and quality e.g. do customers prefer to retain the status quo or are they willing to accept changes in levels of price and quality? This allowed PwC to determine consumer VoLL (value of lost load) for a range of different scenarios.

The feedback we received from customers through our stage 2 research (and Stage 1 invitation to engage meetings) was used to help us develop our AMP 2016 and subsequently our preliminary CPP proposal. It all also helped us to develop and focus the Stage 3 Core Consultation.

5.5.4 Stage 3: Core consultation and notification of CPP application

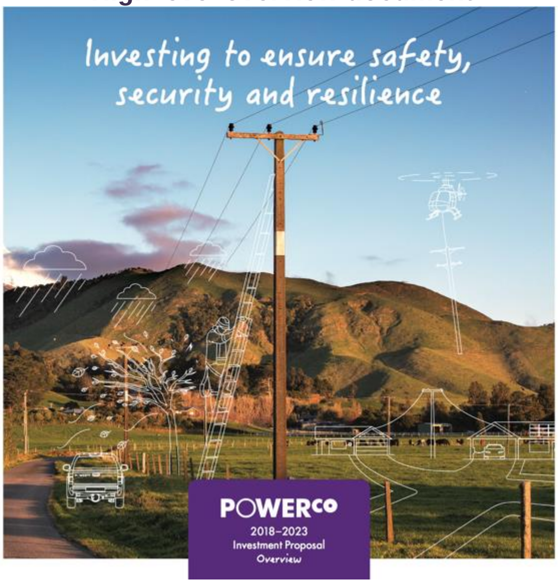
This was the main consultation stage on our preliminary CPP proposal. We commenced core consultation in January 2017, immediately following our formal announcement to progress a CPP application.

To support the core consultation, we published two consultation documents under the title "Investing to ensure safety, security and resilience". The first was an overview, aimed at providing a simplified summary of our proposed five-year investment plan. This was accompanied by a more detailed consultation document entitled, "Have your say" which explained our investment proposal in more detail and set out the choices we had considered to balance long-term service outcomes and cost.

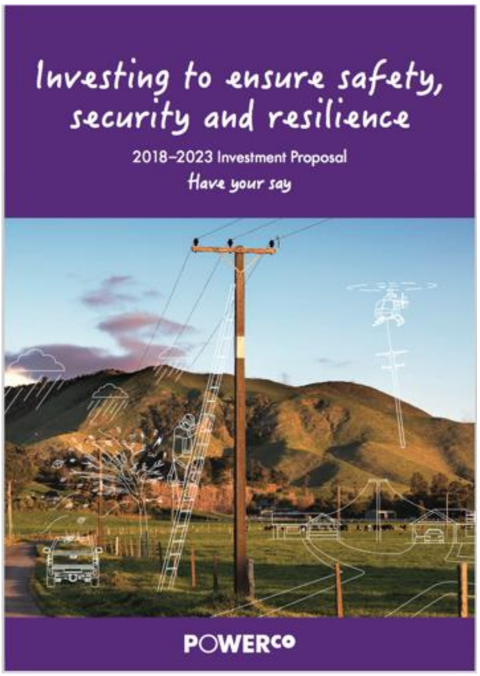
36 We received 750 responses from residential customers and 753 responses from business customers.

Figure 5.3: Our core consultation material

High level overview document



Detailed consultation document



Both core consultation documents were supported by a video, a number of public discussion forums, a large number of bilateral meetings, direct advertising as well as information made available to customers via digital media (e.g. Facebook, Twitter and the “Have your say” website developed specifically for CPP). The two documents are included in our consultation report.

Direct advertising targeted at residential customers

We developed a suite of newspaper inserts (each with a regional focus), which provided an overview of our investment proposal and an explanation as to why we were seeking feedback. This direct advertising campaign targeted close to a quarter of a million of our customers. We supplemented this with a parallel digital media advertising campaign based around Facebook and Twitter. An “invitation to engage” and provide feedback on our preliminary investment proposal was ‘pushed’ to nearly 100,000 subscribers; this used a shortened, 30 second, version of the CPP consultation video.

We set ourselves an ambitious task of making a connection with all of our customers and stakeholders and inviting each to engage with the process and ‘have their say’ on our preliminary CPP investment proposal. In terms of actual outreach our CPP consultation programme achieved this aim, as the figures below illustrate.

Figure 5.4: How we reached out to mass market customers

Advertising reach

110,200 newspaper inserts distributed with daily regional newspapers

159,400 rural publication advertising circulation

240,000 online advertising impressions with regional news websites (number of times advert is shown on the website)

Social media

92,000 social media users reached

94 likes & emojis on our Facebook advert

28 Facebook comments

Website

WEBSITE

4,314 website hits

1,490 website sessions

3mins average session duration

CPP "Have your say" website and video

We set up a website (www.yourenergyfuture.co.nz) to provide the main place where customers could read information about our proposal and participate in our consultation. The website included:

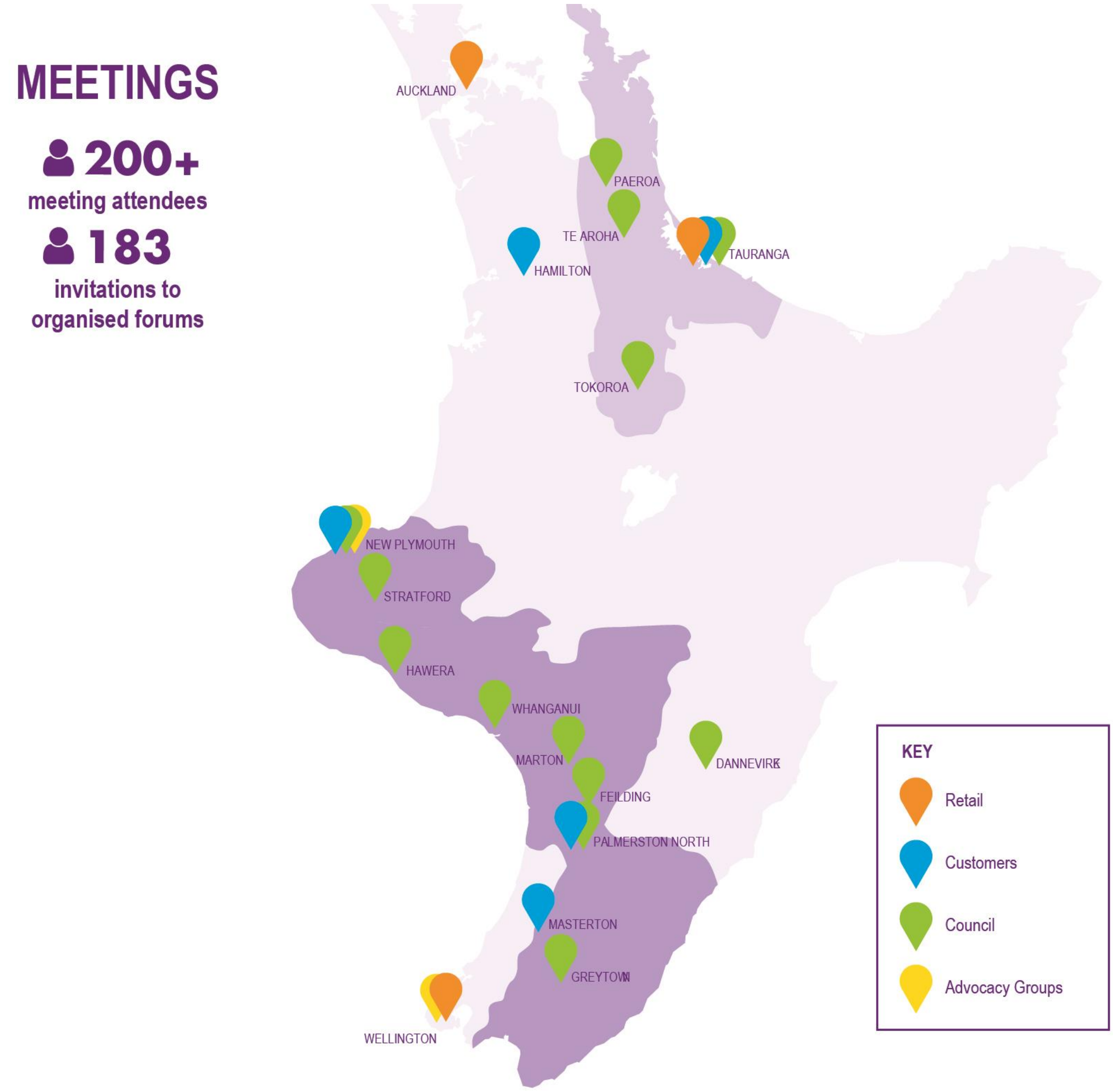
- our core consultation documents
- an information video
- area maps providing an overview of proposed investments in each area
- a feedback survey.

The website was promoted through online advertising; print advertising and social media paid advertising. We received 4000 'hits' onto the website but only 303 subscribers watched the CPP video in full (60,000 viewed the shorter version) and we received 55 online surveys, completed via the website.

CPP consultation forums and individual meetings

At the beginning of Stage 3 we wrote individually to our largest customers, the CEOs of over 20 electricity retailers, a number of government officials and Members of Parliament, fifteen regional and local councils, and a number of customer advocacy groups including, Consumer NZ, Federated Farmers, Major Electricity Users Group, Greenpeace, Electricity Retailers' Association of New Zealand and Grey Power.

Figure 5.5: Who we met and where



Over the period from 17 January to 3 March 2017, we convened a large number of face-to-face meetings with customers and stakeholders in numerous locations across our electricity network. In total, we met with over 200 people either one-on-one or through the various forums we ran across the North Island. Our aim was to make these meetings as accessible as possible to attendees and so we ran our meetings in local settings and at customer locations wherever practicable.

5.5.5 Stage 4: Post Submission: supporting the Commission's review

Following submission of our application to the Commission we will support the associated review process, part of which will involve consultation. Details on the Commission's process are expected to be released in the week following our submission.

5.6 What we consulted on

The regulatory rules require that information we provide to customers on our proposed investment should be provided in a manner that promotes consumer engagement. The Commission also expects that our expenditure plans should be consistent with the efficient costs that would be incurred by a prudent supplier facing our particular circumstances and require us to consider the costs and benefits of different levels of expenditure.

Customer feedback received prior to finalising the consultation plan guided our evaluation of investment options. The proposed plan we selected and consulted on was specifically designed to ensure safe, reliable and cost-effective network performance; while maintaining current average levels of network performance over the longer term. It was designed also to accommodate economic growth in our communities, and enable our customers' future energy choices.

Our consultation materials outlined the drivers and rationale for this investment, the target levels of performance and associated metrics that support both the quantum and timing of the proposed investment and the overall revenue and indicative price implication associated with the proposal.

We also presented three additional investment scenarios and summarised the impact of each option on customer outcomes in terms of cost, using the same network performance metrics summarised for our CPP proposal. While we sought feedback on each of the alternative options, we highlighted, in the consultation materials, that we consider our CPP proposal strikes the right balance between keeping electricity affordable and investing in our assets for the benefit of today's customers and future generations.

The three alternative investment / performance outcome scenarios, presented alongside our CPP proposed plan are set out in Table 5.1.

Table 5.1: Investment Scenarios

SCENARIO	DESCRIPTION
Alternative 1 DPP Expenditure In this scenario we set investment levels at the current regulatory allowances (noting that the DPP allowance is lower than Powerco's current spend)	Under this scenario minimum levels of safety cannot be maintained over the next five years. Risks to our staff and the public rise above the level allowed under industry safety regulations. The scenario is presented as not being considered viable or acceptable.

SCENARIO	DESCRIPTION
Alternative 2 Short term focus "must do" In this scenario we limit expenditure to safety critical items, and accept increasing numbers of assets failing service	Under this scenario, immediate safety risks are managed over the next five years, however asset failure rates continue to increase and security margins further erode below acceptable levels. Outages become noticeably more frequent for many and replacement of assets is deferred or managed reactively. Current network architecture is maintained and customers may be restricted in their application of new energy solutions. Customers are asked to fund the full cost of new connections and connections of new load are restricted where capacity is not available. This scenario provides a lower short term cost (compared to our CPP proposal) but at the expense of resilience and security and would require higher levels of investment (prices) beyond the five-year period.
Our CPP Proposal In our proposal we include investments that we believe will maintain safe, secure, resilient networks and minimise long-term costs	Under this scenario, safety risks are managed for the longer term on a prudent basis to ensure the long term safety of staff, service providers and the general public. Asset failure rates are stabilised and network performance (unplanned interruptions over the long term) are stabilised around current levels. New load is accommodated where it is economic to do so. New technology is evaluated and incorporated onto our networks to aid the connection of new energy solutions and to moderate the long-term cost of network operation. This scenario provides acceptable levels of reliability and safety and reduced long-term costs.
Alternative 3 Enhanced security and resilience Includes all security investments currently considered to best practice and additional; renewal investment to minimise outages	This scenario would include investment incremental to our proposed CPP plan. It repositions our approach to reflect best practice in electricity distribution (more immediately than our CPP proposal). Assets are replaced in way that reduces unplanned outages to a minimum, security is lifted and new technologies are rolled out at scale to position our networks at the forefront of technology. This scenario provides the highest level of network security, resilience and flexibility, but at the highest cost.

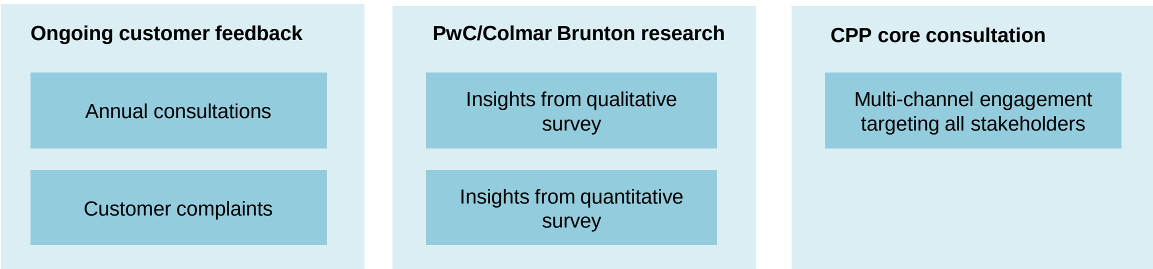
In addition to setting out our indicative CPP plans and alternatives in our consultation materials, we ensured that that customers and stakeholders were also presented with the opportunity to raise any other issues that were of concern to them.

5.7 We collated customer feedback from the three main sources

We received inputs to our CPP investment planning and development process from three main sources.

- Feedback from previous annual consultations which provided us with a deep understanding of customers' preferences and which informed the development of our CPP consultation plan
- Quantitative feedback from the specific CPP related customer research survey conducted by PwC and Colmar Brunton in 2015 / 16
- Feedback from the comprehensive, multi-channel, CPP core consultation and direct engagement programme undertaken in 2017

Figure 5.6: Feedback sources



5.7.1 Our annual consultations

As noted, the CPP investment proposal has built on previous planning and analysis undertaken as part of our annual business and asset management planning process. This in turn has been informed by the feedback we routinely receive from our annual consultation and engagement with customers and stakeholders.

The emergent themes, going back as far as 2010, that fed into our very early CPP planning and can be seen reflected in the investment themes in our preliminary CPP investment plan (safety, security, resilience and investing for customer growth), can be summarised as:

- customers generally had a low level of knowledge of the electricity industry structure and regulation
- customers were broadly satisfied with current levels of supply performance and unless recently impacted by a fault, customers perceive network reliability to have improved over recent years
- customers valued a reliable supply (this is confirmed most years - albeit qualitatively)
- customers had a higher tolerance for supply interruptions that are planned as compared to unplanned interruptions – knowing why supply has been interrupted is important
- customers generally perceive price as being high and there is little awareness of the different components of a retail electricity bill
- communication by the industry with end customers is perceived as being poor and uncoordinated.

We hear consistent themes

We know from our regular engagement activities that customers place a high value on avoiding outages. This is especially true for certain groups such as businesses. Resilience is similarly important, as our customers expect our network to be able to withstand storms.

Our surveys indicate that the majority of residential respondents and business respondents regard unexpected outages as worse than planned outages. This customer feedback highlights the importance of addressing asset issues, such as defects, before they result in a failure, even if the work involves a planned shutdown. Our customers value timely and accurate information about their electricity supply. Advances in mobile technology and social media have created an expectation that information should be readily available through a number of alternative communication channels.

An analysis of customer complaints also reveals consistent themes

During the FY16 year, we received 838 formal complaints from customers about the services they receive. Over 65% of these complaints related to either concerns around supply interruptions, and / or power quality related matters. This is consistent with the priority customers generally tell us they place on a reliable electricity supply.

5.7.2 Colmar Brunton qualitative research in 2015 (Stage 2) reinforced prior feedback

As noted earlier, as part of Stage 2 of our CPP consultation programme, Colmar Brunton conducted a number of focus group interviews with groups of residents and businesses from across different parts of our network. The goal was to develop an in-depth picture of how our customers use electricity and react to power outages, and capture new concerns or issues at a more qualitative (or subjective) level.

The key themes arising from the focus groups are summarised in the table below. Colmar Brunton's preliminary work reinforced prior feedback and helped us to subsequently understand the right language to use to improve the effectiveness of the quantitative customer questionnaire.

Table 5.2: Key themes

FAVOURABLE	LESS FAVOURABLE
– Residents and SMEs both consider it essential for the lines network to be maintained and upgraded to ensure current quality doesn't deteriorate – In terms of acceptability of outages, residents are more lenient towards planned outages because they can work around the outage – but timely communication is important. – People think current reliability is better than before (unless recently impacted by supply interruptions)	– General perception that the electricity sector is a money maker – There are perceptions that electricity prices are not reasonable and controlled – Some small businesses, in areas that had experienced outages, view maintenance and upgrade work as lacking

5.7.3 Feedback from PwC quantitative survey

The results from the quantitative survey of customers and stakeholders, undertaken by PwC in 2015 (updated 2017), were also consistent with the feedback we have received from customers in previous years. While this was not unexpected, the "willingness to pay" survey allowed us to supplement feedback, from existing attitudinal surveys, with a more robust quantification of customers' value preferences.

Table 5.3: Key insights from the PwC analysis

CUSTOMERS' VALUE A RESILIENT NETWORK	GOOD COMMUNICATION IS HIGHLY VALUED
Customers want a resilient network with fewer and shorter outages – Business customers value avoiding each of the first four outages at $251, $125, $84, and $63 per year – Residential customers value avoiding each of the first four outages at $50, $25, $17 and $13 per year	Everyone values communication about power outages – this was a key theme – Business customers value communication at $467 per year – about 7% of their electricity bill – Residential customers value communication at $140 per year – about 5% of their electricity bill Some residential customers seek compensation for planned outages, the value placed on avoiding future outages (via planned work) reflects this.
CUSTOMERS' PLACE A VALUE ON PLANNING	**CUSTOMERS TAKE A HOLISTIC VIEW OF SERVICE**
Customers see a distinction between unplanned and planned supply interruptions or outages. – Business customers are happy to trade reduced unplanned outages for more planned outages – Residential customers place a lower value on this trade-off but it is still evident	Customers view electricity supply and network services holistically – Customers are generally satisfied and even those least approving want to maintain quality and reliability of the network. – Specific service attributes are less important than overall performance.

5.7.4 Direct feedback from customers and stakeholders

We received specific and targeted feedback on our preliminary CPP proposal from the 200 plus people we met with at one-on-one-meetings and at the regional forums. We captured all of the feedback from each session. In summary:

- **All stakeholders** are price sensitive. Feedback from both the CPP customer survey and the face-to-face interactions with customers and stakeholders during the core consultation underlined that customers are price conscious. Affordability is an obvious concern. These general themes were reflected in the feedback we received from all stakeholder groups. We have clearly identified the very high value that customers place on avoiding an increase in outages (which our plan aims to deliver) and reinforced that customers broadly support the need for prudent investment and good asset management.

- **All stakeholders** take a holistic view of quality and consider that specific service attributes are less important than overall performance. Feedback seems to be influenced by both the level of awareness and the overall level of perceived satisfaction with our services.
- **All stakeholders** fed back an expectation that the technical justification and efficiency of our CPP investment case would be challenged by the industry regulator. The generally low level of engagement we received on the details of our investment proposal and the alternative options presented, probably reflects this common view.
- **Residential and business customers** are concerned about price and reliability and this was fed back though the online survey (core consultation survey) They value reductions in unplanned outages and expect better information when outages do occur - through effective use of mobile communication and social media. In relation to the profile of any future price increase, residential consumers (who mainly responded to our online survey) preferred a smaller annual increase over a larger initial price increase (47% vs 14%) - noting that 19% of respondent preferred no price increase.
- **Retailers** are concerned about communication protocols with customers and the importance of avoiding confusion. They want to see a more transparent process for identifying contestable services. Retailers expect the Commission to review our plans, and do not want (or feel technically qualified) to examine the case for increased expenditure in detail.
- **Federated Farmers** support initiatives such as the management of fault calls by us; investment to address worst served feeders; and the transfer of service lines to us. While supporting growth, they are concerned that the costs of new investment should not fall disproportionally on farmers. In relation to vegetation management, farmers would prefer to see trees around lines removed altogether.
- **Councils** support investment for growth, but wanted to make sure that cross-subsidies between areas did not occur. (This was a comment also received from MEUG, the Major Electricity Users Group).There is concern about affordability, but also recognition of the importance of security of supply and network resilience to storms and other hazards. Some councils want to be consulted on undergrounding overhead lines on a case by case basis.

5.8 How early customer feedback shaped our Preliminary Proposal

Our Preliminary Proposal which formed the basis of our core CPP consultation in 2017, was finalised in late 2016. We developed this ‘consultation plan’ around three themes, reflecting preliminary feedback we received from customers through our previous annual engagements and reinforced by feedback from customers we received via the quantitative willingness to pay survey in FY16. The three themes were:

- providing safe, secure and resilient networks
- investing for customer growth
- enabling customers’ energy choices.

This customer feedback is summarised in the table below.

Table 5.4: Summary findings from our initial consultation rounds

During our preliminary consultation you said…	Our indicative CPP plan which we consulted on…
PROVIDING SAFE, SECURE AND RESILIENT NETWORKS	
– The safe operation of our network is more important than price. – Our networks should be resilient enough to ride through storms. – We should replace parts of the network before they break. – Current reliability should be maintained or improved. – Price is important, and for some customers it may be more important than maintaining reliability.	– Ensured the safe operation of our network by addressing emerging risks. – Improved network resilience so customers are less likely to be affected by storms. – Replaced assets to address increasing failure rates. – Addressed underlying concerns regarding asset condition so that reliability does not deteriorate. – Adopted the expenditure option that delivers the best value, having regard to the long-term interests of customers.
INVESTING FOR CUSTOMER GROWTH	
During our preliminary consultation you said…	**Our indicative CPP plan which we consulted on…**
– Our networks should support and enable economic growth in our regions. – We should reduce the length and number of outages. – We should provide reliable electricity into the future.	– Addressed areas where capacity and security fall below target for towns and cities. – Utilised network automation and appropriate security measures to reduce the impact of unexpected equipment failure. – Monitored and provide capacity for growth in local communities and businesses.
ENABLING CUSTOMERS' ENERGY CHOICES	
During our preliminary consultation you said…	**Our indicative CPP plan which we consulted on…**
– We should prepare the network for new technologies such as electric vehicles and solar panels. – We should ensure that we use the most modern technology available.	– Ensured our readiness for new technologies so that we can facilitate, rather than impede, customer choice. – Enabled us to trial new technologies and solutions.

5.9 How our core consultation shaped our Final Proposal

Through the various interactions and engagements we have had with customers and stakeholders, we received some very constructive and broad ranging feedback. We have captured, reviewed and where appropriate reflected it in our thinking as we developed our Final Proposal. The table below provides a summary of the feedback we have received from our customers, from both the core consultation and in the period preceding the development of our Final Proposal.

An important conclusion is that our customers view electricity supply and network services holistically. "Price" includes a bundle of attributes broader than the level of the regulated price. "Quality" includes a bundle of attributes broader than the regulated quality measures. As a result, customers consider overall price, quality and service levels in their perception of value and assessment of whether their electricity supply offering is reasonable.

Another key finding is that our customers and stakeholders expect current levels of supply reliability to be at least maintained, but remain concerned about price.

Table 5.5: Key insights from the PwC analysis

FEEDBACK ON PRICING RELATED ISSUES	
During our core consultation you said…	**How our Final Proposal addresses the feedback …**
Price sensitivity:	
That you are price conscious and affordability is a concern for you. This general theme was reflected in the feedback we received from all stakeholder groups. Customers in general support the need for long-term planning, good asset management and expect current levels of services to be maintained, they also expect any investment we make to be prudent, efficient and timely and tested by external parties on their behalf.	**Forecasts reduced** Post the core consultation we reviewed our plan and moderated the expenditure forecasts downwards. These adjustments have been made across a number of expenditure portfolios and also adjust for future efficiencies. In summary, the headline P_0 has reduced from a 8.7% price increase for a typical residential customers ($1.18 per week) to a 5.7% price increase ($0.79 per week) for the Final Proposal.
Avoiding price shocks (smooth any distribution price increases over a five-year period)	
You preferred a smaller annual increase over a larger initial price increase (47% vs 14%) - noting that 19% of respondents preferred no price increase (larger residential respondents). Retailers expressed a largely neutral position but leaned towards a single initial increase (subject to size of increase and affordability considerations) on the grounds that this would facilitate better coordination and communication with end consumers on the reasons for any price increase.	**No change** Our proposal presents both pricing profile options for consideration by the Commission to enable further consultation with customers.
Communication and information to end consumers:	
You (retailers) had concerns about communication protocols with customers and the importance of avoiding confusion. This comment was made specifically in relation to pricing related communications.	**Process prioritised** Adjustments to our preliminary CPP proposal are not required in order to address this feedback. We will continue to work closely with retailers to ensure that consistent communications with end consumers are undertaken. We will also continue to engage with retailers during the Commission's assessment of the CPP.
FEEDBACK ON THE VALUE PLACED ON PREFERENCES	
During our core consultation you said…	**How our Final Proposal addresses the feedback …**
Value placed on network reliability:	
You (residential and business customers) placed a high value on avoiding a first outage ($251 business and $50 residential). The value that customers place on subsequent outages decreases with the frequency of supply interruption. You see a distinction between unplanned and planned supply interruptions or outages. Business customers are happy to trade reduced unplanned outages for more planned outage, while residential customers place a lower value on this trade-off but it is still evident.	**No change** One of the central themes is investing to provide safe, secure and resilient networks. This requires us to focus on the underlying condition of our network (rather than focusing on short-term reliability alone) and to maintain and replace equipment in a prudent and timely way. This focus for our investment is supported by the value that customer clearly place on a reliable electricity supply.
Value placed on effective outage communication:	
You (residential and business customers) placed high value on good communication around supply interruptions ($467 p.a. business and $140 p.a. residential.) (pre / during / post outage) and for both planned and unplanned interruptions.	**Process change and prioritisation** Our proposal for the future management of our services to customers, is to prioritise the development a Powerco Information Hub, which will directly respond to the CPP consultation feedback. We will work with retailers to seek feedback and cooperation to progress the transfer of fault call services from being retailer managed to Powerco managed.

Value of lost load estimate:	
You provided quantifiable feedback on attitudes, values preferences and willingness to pay. It enabled PwC to calculate at a high level the value that customers place on a secure and reliable supply. The average value that residential and business customers place on "lost load" - measured in $/MWh was $16.4k/MWh and $39.3k/MWh respectively.	**No change as already aligned** The VoLL figures estimated from the CPP survey align well with those previously published by the Electricity Authority - Powerco applies these as a cross-check to its own calculations where appropriate.
FEEDBACK ON INVESTMENT PRIORITIES	
During our core consultation you said…	**How our Final Proposal addresses the feedback …**
High level priorities:	
During preliminary consultation that your priorities were: a) The safe operation of our network is more important than price. b) Our networks should be resilient enough to ride through storms. c) We should replace parts of the network before they break. d) Current reliability should be maintained and e) price is important, and we note that for some customers it may be more important than maintaining reliability. These themes were generally supported by feedback from core consultation. You also told us that our networks should be capable of supporting regional growth and we should be prepared to support new technologies and customer choice,	**No change** We have not changed the underlining priorities and drivers for our future investment. As noted earlier, we have reduced our proposed expenditure in specific areas to reflect initial feedback we received from the verification process and to maintain a downward pressure on future prices - where this is possible without compromising the outputs we are seeking to deliver to maintain the level of networks services for customers.
Alternative investment / output options:	
We did not receive any significant feedback supporting lower (or higher) levels of investment than that Powerco proposed in its preliminary plan. Some customer groups and representatives (e.g. Federated Farmers) supported additional funding being directed to addressing worst served feeders.	**No change** Customers' focus on prudency and efficiency of investment has been addressed via the ongoing challenge and moderation of the preliminary plan post consultation.
Support for asset management journey:	
You (business and residential) broadly supported the need for prudent investment and Powerco seeking to embed good asset management practices (long-term planning) into its decision making.	**No change** We have not changed the underlying rationale for future network investment. The consultation feedback did not express any significant concern with the Preliminary Proposal. Our perception is that stakeholders are in the main concerned that our investment is prudent and efficient and has been tested by external experts.
Deliverability of the investment:	
You (retailers) specifically questioned whether the step up in the level of work proposed by our CPP plan is deliverable and enquired whether our contractors had sufficient and available resource capacity.	**Reduction in required resources** Our capability and capacity to deliver the proposed increase in the volume of work over the CPP Period, has been independently tested by consultants engaged by the company and by the verifier engaged by the Commission. Powerco has a strong track record of delivering on its plans. The moderated investment requirements have enabled us to reduce the resources that we had market tested for availability at a higher investment level.

FEEDBACK ON OVERSIGHT OF OUR ACTIVITIES	
During our core consultation you said…	**How our Final Proposal addresses the feedback …**
Concern around contestability and transparency of decision making:	
You (retailer) wanted EDBs generally to provide more visibility of how network and non-network solutions are assessed and some assurance that investment in new technology projects will be progressed on a level playing field. This comment was tied to a general comment from retailers around the level of regulatory oversight over EDB expenditure (and more specifically investment decision making) once a regulatory period has started.	**New process proposed** We propose to work with retailers to develop a Powerco communication and market engagement process which will set out how during the CPP Period we will review and progress investment options for projects meeting defined contestability criteria.
Expectation that investment case will be challenged:	
That you expected any increase in investment, which ultimately flows through to charges for distribution services, will be prudent, efficient and justified. This message was reinforced specifically by retailers and advocacy groups but was also an underlying theme from the consumer engagements. There is also an expectation that, given the technical nature of our investment plan and business operations, the CPP proposal will be appropriately tested by the regulator on behalf of stakeholders.	**Forecasts have been further challenged and reduced** Given the level of oversight and challenge of our CPP forecasts, Powerco's finalised forecasts will have been thoroughly tested for prudency, efficiency and overall justification. We have made a number of changes to the preliminary forecasts (post the core consultation) mainly to reflect the feedback we received from the verifier and the outcome of our ongoing challenge process. Our moderation and refinement of the preliminary forecasts reduced the size of the CPP price increase.

5.10 Verifier's independent assessment of our CPP consultation

In accordance with the IMs requirements, we engaged an Independent Verifier to verify our CPP proposal. In relation to our consultation process, the verifier's general observations are reproduced below:

> *"Powerco has undertaken substantial consumer consultation, and has prepared and made available significant material, consistent with clauses 5.5.1(2) and (3) of the IM. Much of this consultation is in line with, or goes beyond, that undertaken by other network businesses in other jurisdictions, such as Australia, as well as in New Zealand."*

In their final report, the verifier concluded that our consultation program was fit for purpose and considered how consumer feedback will impact our CPP proposal.

The verifier did make a number of specific observations relating to areas for improvement. In making these observations, the verifier concluded that our findings from the consultation process were unlikely to be affected by the improvement areas raised. The key areas identified were:

> *"Significant work has been completed by Powerco in consulting in various forums with many stakeholders, in providing various material (printed and on its website), as well as advertising broadly, which we believe generally meets the IM clause 5.5.1(2) and (3) requirements. Possibly at times too much information was provided which may have inadvertently discouraged consumer engagement. For example, the glossy brochure 'Have your say' is comprehensive but possibly too complex for the average residential customer to fully understand Powerco's CPP proposal. However, we expect that sophisticated consumers, such as retailers, appreciate more detail."*

> *"A stronger link could have been made by Powerco between the CPP forecast expenditure and the service measures."*

> *"Material presented on service quality is based on average performance over the last ten years, rather than current performance. We understand that that current performance levels are generally worse than the ten-year average, and are deteriorating further – especially when considering asset performance (which puts increasing pressure on SAIDI/SAIFI). Therefore, using the ten-year average may have understated Powerco's likely future position. Consequently, consumers may have been misled about likely future outcomes and therefore the imperative for*

> *change, potentially influencing their feedback to support measures taken by Powerco to target deteriorating service measures. This bias is not in Powerco's favour."*

In their closing observations, the verifier noted the challenges of consulting with a wide range of customers and concluded that our findings from the consultation process were unlikely to be affected by the improvement areas raised:

> *"We note that by its nature consumer engagement will result in different outcomes depending on the consumer group being consulted and the form of engagement undertaken, including the method for providing information. Whether the above matters would result in a different outcome is difficult to know but we expect that while some individual consumers or groups of consumers may have different views, Powerco's overall findings would remain materially the same."*

We agree with the verifier's conclusions. We regard our CPP consultation process as 'best practice', and in many respects it is unprecedented in New Zealand, in its scope and scale. While we acknowledge the verifier's views of limitations in relation to some aspects of the consultation, equally we would have been criticised if we had not provided detailed analysis or focused only on recent service performance. We also concur with the verifier's view that the outcomes from the consultation process are unlikely to be affected by these issues.

5.11 Summary

We designed our engagement process to go well beyond the consultation requirements in the Commission's IMs. We adopted a broad consultative approach so that customers and stakeholders were able to engage on those matters that are of most interest to them and at a level of detail that suited them best. With this objective in mind, we employed a range of different communication channels tailored to different customer and stakeholder groups. This supported achieving our goal of reaching all the consumers on our network and interested stakeholders.

While the IMs consultation requirements place particular emphasis on testing alternative price-quality scenarios, customers and stakeholders were generally not prepared to engage at this level of detail. This outcome was not unexpected and did not detract from the valuable feedback we received on our indicative plans. In particular, customers and stakeholders generally indicated strong support for our proposals and the themes that underpin them. One point of note that we have observed over the last two years of customer engagement, is that our customers have a more holistic view of the price-quality trade-off than just the regulatory view.

Customer and stakeholder feedback on our indicative CPP proposal provided clear guidance on a number of specific initiatives which we have now reflected in our updated CPP plans. Notably it was highlighted that concerns existed regarding network prices and affordability. In response, we have re-doubled our efforts to ameliorate the impact on network prices. In particular, our ongoing challenge and review of our CPP plan, post the core consultation, has reduced our expenditure over the CPP Period between the preliminary and the final CPP proposal. These changes reduced the P_0 impact from 8.7% to a 5.7% price increase for a typical residential customer.

Due to time constraints we opted to not consult or provide additional notification to our customers of the refinements made between the Preliminary and Final Proposal. We consider that the Commissions process will provide adequate opportunity for further feedback from interested stakeholders.

The verifier concluded that we had met the relevant IM requirements and undertaken a fit-for-purpose approach to consultation. The final verification report acknowledged the challenges in consulting with stakeholders with competing priorities. The verifier also indicated in their report that they broadly consider the investment associated with our proposal to be appropriate, and therefore preferable to the alternatives we presented in our consultation material. This view was echoed in the feedback to the price-quality trade-off options and alternatives we received from customers and stakeholders. While feedback indicated that affordability was a concern, the service level and safety expectations of our customers meant that the moderated version of our proposed option is the most feasible option of the four presented.

6 INDEPENDENT VERIFICATION OF OUR PRELIMINARY PROPOSAL

In consultation with the Commission, we engaged Farrier Swier Consulting[37] (FSC) to act as the Independent Verifier of our proposal.

FSC reviewed our Preliminary Proposal in accordance with the requirements in Schedule G of the IMs.

Due to time restrictions the review was carried out while we developed our Final Proposal and in some cases relied on draft documentation and interim forecasts. This created minor areas of uncertainty.

The process was constructive and their input has been beneficial to our proposal.

We have responded to their feedback in a number of areas, including moderating our Final Proposal.

Their final report has been included as part of our overall submission.

6.1 The role of the Independent Verifier

In consultation with the Commission, we engaged Farrier Swier Consulting to verify our Preliminary Proposal in accordance with the requirements of Schedule G of the IMs. The verifier's main task, with a duty of care to the Commission, was to test whether our proposed Capex and Opex for the CPP Period satisfied the expenditure objective, as set out in the CPP IM.

In addition to our proposed investments, the verification process also considered:

- our relevant policies
- key assumptions informing our proposal
- the extent to which we will be able to deliver our CPP work programme (deliverability)
- the extent and effectiveness of our consultation with our customers.

In our view, the main focus of the verifier should be to help ensure the quality and completeness of CPP applications, and to guide the Commission's review. The process should promote an efficient submission by assisting an applicant to produce a complete proposal with appropriate supporting evidence. The verifier's findings should assist the Commission by identifying aspects of a CPP proposal that warrant further review.

6.2 Verification process

Due to the restricted timelines available between the finalisation of the IM changes and our planned submission date the review was carried out in parallel with the development of our Final Proposal and overlapped with our main public consultation activities.

As a result, our interactions were iterative and dynamic. The verifier needed to make its assessments on our proposal and the sufficiency of evidence as they were being finalised and refined. During the process we provided over 350 responses to questions and information requests from the verifier.

While these circumstances were not ideal the overall verification process was constructive and provided an important external perspective that has helped us refine and improve our proposal. The main steps of the process are set out in Table 6.1.

37 Farrier Swier partnered with WSP Australia, who provided engineering support.

Table 6.1: Independent Verification process steps

DATE	ACTIVITY
16 December 2016	Tripartite Workshop held between Powerco, FSC, and the Commission to further define the engagement and relevant timelines.[38]
24 January 2017	The review commenced with the supply of initial information and Preliminary Proposal via a secure 'data room'.
February 2017	Throughout February, further material was provided to the verifier, including draft submission documents, business plans and policies and spreadsheet models.
6-10 February 2017	The Independent Verifier team made a site visit to our Wellington and New Plymouth offices for interviews and questions and answer sessions.
March 2017	A series of follow-up information requests and formal questions covering a range of topics were addressed through to the end of March.
10 March 2017	We were provided with a summary of the Independent Verifier's initial findings.
6 April 2017	A draft verification report was provided to us for comment.
April 2017	During April we provided further information and held several meetings with the verifier to address issues arising from the draft verification report.
7 June 2017	A final verification report was provided to us. This report has been included as part of our submission.

As set out in this document we used the outcomes of this process to enhance and refine our submission material and investment plans. For further detail on the changes we made see Chapter 7 and the expenditure discussions in Chapters 10 through 16.

6.3 Our views on the verification report

Our general view is that the verification process was constructive and undertaken in a professional and transparent manner by FSC and WSP. While the constrained timelines raised a number of challenges, the interactions have helped us submit a proposal that meets the expenditure objective.

The assessment threshold used was, naturally, informed by the verifier's experience in Australia and arguably leaned towards a standard aligned with a mature Australian utility. In some areas this led to expectations around levels of sophistication that may not be realistic or warranted for EDBs undertaking their first full building blocks regulatory proposal.

6.3.1 Key conclusions aligned with our proposal

Below we highlight a number of important areas where the verifier's conclusions were aligned with our proposal. These statements are included in the executive summary of the verifiers final report.

- **Drivers behind our proposal:**

  "The CPP includes the costs of capital and operating works to address a backlog of defects, meet vegetation management requirements, address deteriorating asset condition, stabilise network performance and equip the network for the future, among other requirements."

- **The need for increased investment:**

  "increased capex and opex spend is required to stabilise asset performance through addressing a rising number of asset defects as assets wear out and support best practice asset management such as on systems to provide better quality information and analysis, which are expected to reduce expenditure needs in the longer term

[38] The workshop was undertaken in accordance with the requirements of Schedule F5 sub-clause (2).

Powerco has an increased focus on managing and reducing risk; this is consistent with prudent practice. In some areas, however, current activities and expenditure is arguably below that associated with prudent practice, and some catch-up is required."

– **Opex forecasting**

"Powerco has used the Australian Energy Regulator's (AER) base-step-trend method to prepare most of its opex forecasts. We consider that this is a valid and reasonable method for forecasting opex, recognising that the underlying premise for it is that the revealed base year includes all efficient costs that a prudent operator would incur."

– **Consumer consultation**

"Powerco has undertaken substantial consumer consultation in preparing its CPP application, and has prepared and made available significant material, consistent with requirements of the IM. Much of this consultation is in line with, or goes beyond, that undertaken by other network businesses in other jurisdictions, such as Australia. While there are some areas for improvement, we do not believe that they would materially impact Powerco's overall consumer engagement findings, nor bias its forecasts upwards. Therefore, we believe that Powerco has complied with the IM consumer engagement requirements."

6.3.2 Summary of our response to verification findings

The process set out in the IMs allows for the verifier's draft feedback to lead to changes to the information or forecasts in a final CPP proposal. Reflecting the verifier's feedback we refined our models, updated and expanded documentation, enhanced our strategies (e.g. vegetation management), moderated our forecasts, and applied adjustments for expected efficiencies in our forecasts.

The following table sets out key findings raised in the draft report and how they have been addressed in our Final Proposal. Chapter 7 provides details on the moderations we made in response to the verifier's feedback.

Table 6.2: Summary of findings from the draft report and our responses

VERIFIER FINDINGS	OUR RESPONSE
Scope for future efficiencies (Draft Report) *Lack of evidence of proposed improvements to support more sophisticated risk management, better decisions about prioritisation of works, improved integration and increased innovation being included.*	**Addressed** We developed and applied adjustments for expected efficiencies to all of our expenditure forecasts.
Overhead line policies (Draft Report) *Some of Powerco's policies – if applied in practice – may lead to an over-forecast of capex, particularly in relation to inspection and defecting practices for wood poles and conductors.*	**Addressed** Conductor and associated overhead structure forecasts have been refined.
Growth and renewals overlap (Draft Report) *The growth and security program of works has an overlap with the overhead conductor renewal program that has not been reflected in the current forecast expenditures.*	**Addressed** We have updated our models to address this comment. The impact was minor.
Source of reliability improvements (Draft Report) *The reliability program does not consider the improvements in reliability associated with other programs of work.*	**Addressed** We have refined our automation forecast.
Model input refinements (Draft Report) *Some forecasting models overstate costs through application of inappropriate methodologies and input data*	**Addressed** We applied expected efficiency improvements, applied moderations and made a range of input and model refinements to reflect verifier, auditor and internal quality assurance feedback.

VERIFIER FINDINGS	OUR RESPONSE
Investment timing (Draft Report) *The optimal timing of expenditures has not been established*	**Addressed** We have used our (externally peer reviewed) cost-benefit model to add weight to proposed investment timing and used it as part of our 'top down' sense check.
Rationale for SONS and vegetation profiles (Draft Report) *The cost/benefit rationale for increasing expenditure above the base year expenditure does not appear sufficiently justified to us, especially for additional head count in areas of strategy and capability and for the change in vegetation management practice*.	**Addressed** We moderated our SONS forecast and changed the timing of our vegetation management strategy roll out across our regions. We provided business cases to the verifier that link strategy and capability to the efficiency savings we expect from these.
Interdependences between programmes and reliability (Draft Report) *It is unclear how the opex forecasts reflect:* *some important interdependencies between the expenditure programs or future cost savings or efficiencies resulting from these programs, albeit this may not be evident in the initial years of the CPP period* *the price quality trade-off, especially given that maintaining reliability and stablishing asset performance is identified as a key driver for much of the proposed expenditure* *the nexus between the expenditure objective and Powerco's strategy to transform the business (network evolution) for the new energy future.*	**Addressed** We have refined our maintenance forecast assumptions, allowing for expected savings from increased renewals (reflecting Capex/Opex trade-offs and efficiencies). We have also allowed for future reductions in Opex from improved asset management practices (and other future improvements). We have provided business cases for key network evolution programmes to the verifier.
Business case evidence (Draft Report) *We believe further assessment is required for several opex programs.*	**Addressed** We provided qualitative business cases to support the key Opex expenditure areas.

The following table sets out key areas that the Independent Verifier identified as ones the Commission should consider when reviewing our proposal. We also provide our responses.

As outlined in the table, we disagree with a number of the conclusions in the verifier's final report. Based on the evidence presented to the verifier we are confident that these expenditures have been sufficiently justified to meet the expenditure objective. If necessary, we will demonstrate this during the Commission's review process.

Table 6.3: Summary of the main areas discussed in the verifier's final report and our responses

VERIFIER FINDINGS	OUR RESPONSE
Interpretation of security standards *Application of the current security standard would result in the application of an N-1 level of redundancy with no load at risk. Powerco's current practice is to accept some load at risk, which in our view is appropriate; however, this practice is not currently formalised or undertaken on a quantitative basis but will be in the near future (1-2 years). This will lead to actual expenditures in the growth and security program being made on a different basis to forecasts.*	This is not material for the expenditure in our CPP Proposal. While adopting effective probabilistic planning standards is likely to result in reduced need for reinforcement compared to a strict deterministic N-1 standard, our approach already accepts some load at risk and we do not use a simple N-1 security level investment test. (The verifier acknowledged this.) In addition, the bulk of our major reinforcement investment planned for the CPP Period is to address situations where the existing load at risk is excessive – a situation that would not change even if (realistic) probabilistic standards were applied. Changing our standards, as we plan to do over the next two years, would not materially affect the expenditure requirement over the CPP Period.

VERIFIER FINDINGS	OUR RESPONSE
Conductor risk assessment *Powerco has not adequately assessed the risks presented by overhead conductor failures, including considering the probability of failure and likelihood of damage or injury occurring. Therefore, in our view, Powerco has not yet proven that the proposed expenditure is prudent. Additionally, some assumptions included in the replacement model did not appear to be supported.*	We disagree with this view. Our distribution conductor fault rate has been steadily climbing over the past decade, and our benchmark overhead line performance is poor compared to other EDBs. We have identified several types of conductor on our network that fail much more often than other types, and therefore carry increased risk of property damage or public injury. Our conductor investment plans are primarily centred on replacing this poor performing conductor. Though we have not quantitatively assessed this risk, our customers expect a safe and reliable network – something we are currently struggling to provide when compared to others.
Survivor curve data *The data used to calculate the survivor curves for overhead structures (inclusion of green defects) is likely to result in a higher probability of failure for young assets and therefore overstate the volume of replacements required.*	We disagree with this view. Green defects are a precursor to more critical defects, and ultimately asset failure. Green defects need to be rectified through renewal work. They are assessed by our field crew, using our overhead line inspection standards. Including green defects in our survivor calculations is necessary to ensure unbiased survivor curve estimates. Our modelling also uses conservative assumptions regarding the delay between defect identification and replacement.
Power transformers *Transformer replacements within the zone substation renewals category do not appear to be justified for five transformers based on the outputs of the asset health index model and consideration of the energy at risk at the substations.*	We disagree with this view. Our asset health modelling of power transformers clearly identifies the replacement need and a target replacement year. As there is some flexibility with replacement timing, we consider the timing of other zone substation works, asset criticality and other factors, and adjust the replacement date of the power transformer (within a five year window). Our overall power transformer forecast is consistent with the volume output of the health model – replacements are both delayed and bought forward. We don't directly consider energy at risk when planning power transformer replacements, but it is considered as part of our criticality modelling as part of the power transformer health model.
Automation *The level of expenditure proposed for the reliability program does not appear to be justified as the significant uplift in other expenditure categories, principally the asset renewals and growth and security capex programs, appears sufficient to meet Powerco's aim to maintain unplanned reliability without inclusion of a large reliability program. We note that some expenditure in the program relating to installation of earth fault neutralisers and an allowance for localised improvements appears appropriate*	We disagree with this view. Reliability expenditure (predominantly additional reclosers and sectionalisers), is in the interest of our customers. Continuing with this programme is a cost-effective way to manage the impact of unplanned outages on our customers. Without this spend in the short term the number and duration of outages experienced by customers would rise. The programme will also help us stay within regulatory SAID/SAIFI bounds. In the longer term, our proposed investments in renewals, maintenance and vegetation management will help stabilise network performance. Our quality modelling suggests that our planned work will stabilise network reliability (not materially improve it).

VERIFIER FINDINGS	OUR RESPONSE
Network Evolution *The level of proposed expenditure within the network evolution category appears higher than appropriate given the uncertainty in achieving the benefits*	The key benefits of work in the network evolution portfolio is reducing costs to our consumers of regulated services in the longer term, and providing the electricity distribution services we expect our customers to demand in the future. In general, we agree that there is considerable uncertainty around R&D and pilot programmes, and positive results cannot be guaranteed in advance. This reflects the nature of such work. However, if we do not undertake this work, our ability to identify and integrate successful emerging applications will be severely constrained. By not being able to apply innovative solutions, we will also not be able to respond efficiently to changing customer demand patterns, including variable generation levels. The expected benefit of this work outweighs the expected cost. It is prudent for a regulated service provider like us to undertake these activities, in pursuit of the long-term interest of our customers. It includes R&D and pilot works only, not major network roll-outs. While the total risk exposure of our customers is limited, it will allow us to undertake the work required for a managed network evolution. Only when successful trials indicate viable solutions for network issues, will we roll these out on a network scale. These solutions will generally replace traditional network expenditure, and will reduce costs to customers in the longer term.
SONS *Powerco has not demonstrated that the proposed increase in SONS FTEs are all needed to satisfy the expenditure objective. Although Powerco had provided us with a business case for these FTEs, there was insufficient quantification and certainty of proposed benefits for us to be satisfied about the total increase*	We disagree with this conclusion. The business case for increasing our internal skills and capability is primarily based on its scope for delivering future efficiencies. While the exact short-term benefits are uncertain, there are many local and international examples of how improved asset management practices, innovation and better analysis lead to better optimised investment and operational decision making that drive efficiencies. The verifier accepted this and indicated that it would expect to see our proposed improvements reflected in our expenditure forecasts. Taking on board these comments, our proposal factors in expected efficiencies. Achieving these efficiencies is not costless. Without the planned improvements in our asset management capability, our ability to expand our focus beyond current business practices will be seriously compromised, and the scope for efficiencies will be lower than that reflected in our CPP forecast. (As demonstrated in the benchmarking shown in our proposal, our existing resources are already very lean.)
Corporate Opex *The information provided was insufficient to justify the proposed increase in corporate headcount (i.e. full-time equivalents, or FTEs). Although we recognise that the increased activity resulting from other elements of the CPP expenditure proposal will likely require some increase in corporate FTEs (e.g. to deal with more recruitment, invoicing, and accounting), the business case for all 21 new FTEs was not clear to us*	We disagree with this conclusion. In our view we provided sufficient information. We provided the justification for all FTE increases, based on an assessment of the increase in activity for each area, and using the judgement and expertise of each business unit manager to determine the most efficient method to deliver the result (e.g. balancing internal versus external resourcing). Each FTE was costed using the job description to be filled and our remuneration policy.

7 FINAL PROPOSAL

We finalised our CPP proposal in late May, following Board approval of our refined investment proposals

This Final Proposal was moderated based on feedback from customers, the review by the Independent Verifier, the audit process, and our ongoing management challenge.

These moderations included:

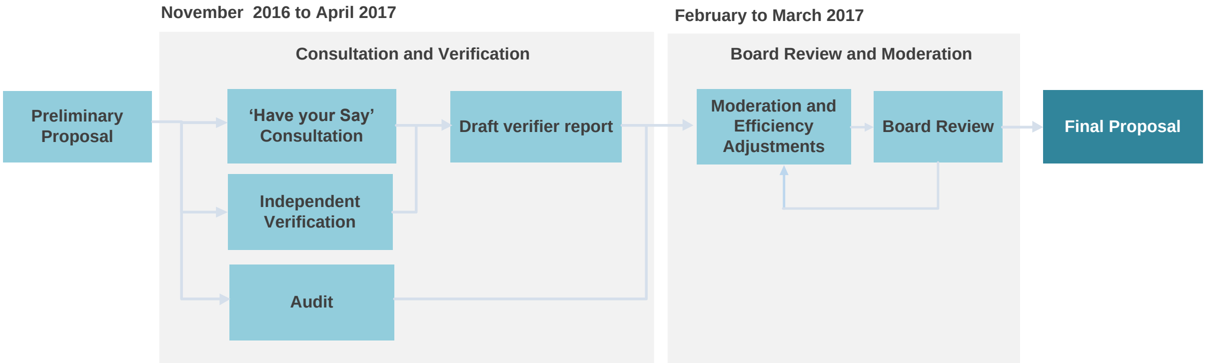
- adjustments to work volumes and project timing
- expenditure reductions to reflect model refinements and improved integration between asset fleets
- expenditure reductions in later years based on expected efficiency improvements

These moderations were revised based on Board feedback.

7.1 How we finalised our CPP proposal

The process we used to confirm and approve our Final Proposal is summarised in Figure 7.1.

Figure 7.1: Process used to finalise our CPP Proposal



The main activities during the review and challenge process were as follows.

- **'Have your Say' consultation**: as discussed in Chapter 5, our Preliminary Proposal was used as the basis for our Have your Say customer consultation. We took feedback from this process into account when moderating our Final Proposal.
- **Independent Verification**: as discussed in Chapter 6, our Preliminary Proposal was used as the basis for review by the Independent Verifier. Based on our discussions and feedback received we moderated our forecasts, as reflected in our Final Proposal.
- **Audit**: the role of the auditor was to audit historical financial and non-financial information to provide reasonable assurance that the information is free from material misstatement, and for forecast financial and non-financial information, that nothing has come to their attention which causes them to believe that the information is materially misstated.
- **Moderation and efficiency adjustments**: we undertook an internal review process to refine and finalise our investment plans. This included adjusting work volumes in certain portfolios and our allowance for efficiency gains to apply in the later years of the CPP Period.
- **CGG and EMT reviews**: (not shown) performed further challenges. The CGG coordinated the moderation process and in consultation with portfolio owners established the efficiency gains.
- **Board Review**: following our first moderation round our forecasts were submitted to our Board for review on 16 March 2017 and were finally approved on 25 May 2017.

Below we set out the outcomes of our moderation process.

7.2 Summary of refinements made in preparing our Final Proposal

We used the information and insights from our CPP engagement and our interactions with the Independent Verifier to inform our analysis and decisions on the key components of our proposal. We have adjusted our proposal to reflect this feedback.

Between our Preliminary Proposal and our Final Proposal— taking on board feedback from the draft verification report, our customers, the auditor, and the Board—we reduced our Capex forecast over the CPP Period by $51 million (a 5.6% reduction) and Opex by $23 million (a 4.8% reduction).

The feedback we received from customers, other stakeholders and the Independent Verifier was valuable in helping us better balance the issues we face when managing our network and the costs to make the required investments. Following this process, we are confident our proposal is in the long-term interest of consumers.

7.2.1 Moderation of our Final Proposal

Table 7.1 provides an overview of the key refinements we made to our Final Proposal.

Table 7.1: Network Capex moderation

FEEDBACK	WHAT WE HAVE DONE
Some concern around the scale of **overhead conductor** step change and ability to identify on the ground through condition assessment, and the quantum of assets predicted as requiring replacement by the models	Deferred 36 km of distribution conductor renewal beyond FY23 (3.2% reduction overall). Non-type issue conductor makes up 31% of the forecast to 2023, which is a combination of copper, aluminium and steel wire conductor. The moderation focused on these conductor types, especially aluminium conductor, where our condition assessment needs to mature to ensure we replace conductors in the worst condition. The non-type issue conductor replacement will be more towards the later stages of CPP, so sufficient time is available to complete our diagnostic conductor sampling programme and embed improved preventive maintenance and inspection techniques. Forecast reduced by $1.4m in the CPP Period. Delayed reaching 'steady state' replacement of LV conductor to 2023 (was 2020), removing 30 km of conductor from the forecast predominantly earlier in the CPP Period (16% reduction overall). This reflects a need to improve condition assessment processes early in the CPP Period to identify conductor requiring replacement. Forecast reduced by $1.5 m in the CPP Period. **Overall reduction of $2.9m during the CPP Period**
Significant component of the **overhead structures** forecast is driven by reconductoring (see above)	We aligned the pole and crossarm forecast with new inputs from the conductor models, reducing our expenditure requirement by $2.7m during the CPP Period. **Overall reduction of $2.7m during the CPP Period**
Past **reliability** expenditure has been focused on the eastern network, which has now limited scope for reliability improvements	We reduced recloser and sectionaliser forecast quantities from 35 to 25 per year on the eastern network. This reflects the saturation of devices in that region. **Overall reduction of $2.8m during the CPP Period**
Network Evolution benefits should be further considered	We reviewed our network evolution programmes and moderated those programmes where the potential benefits are more uncertain. **Overall reduction of $7.1m during the CPP Period**

Table 7.2: Network Opex moderation

FEEDBACK	WHAT WE HAVE DONE
The timing of the transition to cyclical **vegetation management** could be adjusted	Reflecting the verifier's feedback we updated our vegetation expenditure forecast model to better reflect our new vegetation management strategy. We changed the timing of introducing the strategy (we propose to do this in a staggered way across regions). We also directly modelled the expected cost savings from reduced reactive work and '2nd cuts'. **Overall reduction of $2.0m during the CPP Period**
Opex/Capex trade-offs are not incorporated into the **corrective maintenance** forecasts	We moderated new corrective maintenance programmes for potential overlaps with asset renewal programmes, or where increased renewal would reduce the scope of the programme. **Overall reduction of $1.8m during the CPP Period**
The cost/benefit rationale for increasing **SONS** Opex above the base year expenditure does not appear sufficient and should be further justified	We updated the inputs for the in-house call centre cost estimate. We have made an allowance within other portfolios for improvements associated with the proposed asset management enhancement (see Section 7.2.2 below). **Overall reduction of $2.2m during the CPP Period**

7.2.2 Efficiency adjustments

In response to verifier feedback that efficiencies should result from the business improvements planned as part of the CPP, we included efficiency adjustment factors to relevant portfolios (both Capex and Opex). The efficiencies are facilitated by a number of factors including:

- **Asset management improvements**: reflecting the various asset management improvements we intend to make, which will help us achieve our ISO 55000 certification.
- **ERP**: access to an efficient ERP will enhance renewals through improved information; and simplify processes, creating scope for some Opex efficiencies.
- **Scale**: reflects the potential savings from the overall uplift in work associated with the CPP.
- **Future network applications:** have the potential to increase network utilisation and defer augmentation Capex.

Table 7.3 provides an overview of the efficiency adjustments we applied to our Capex and Opex forecasts.[39]

Table 7.3: Efficiency allowance built into the CPP forecasts

	FY22	FY23
Capex		
Efficiency adjustment	$6.5m	$13.0m
Percentage reduction	3.6%	7.2%
Opex		
Efficiency adjustment	$1.8m	$3.3m
Percentage reduction	2.0%	3.5%

39 This is measured against a counterfactual of expenditure reflecting our current asset management practices (which themselves already include the improvements made in preparing for the CPP).

8 DELIVERABILITY

We have a strong track record on delivery, supported by well developed working arrangements with our external services providers.

Our work program for the CPP Period will increase our resource requirements. We have taken measures to address this need by increasing our field delivery capacity (through our service providers) and taking steps to improve our internal capabilities.

In particular, we have undertaken the following initiatives:

- modelled our required resources (external and internal) and assessed gaps in current capability
- tested increased requirements with service providers and suppliers and secured commitments from them
- analysed and profiled our internal resource requirements to ensure that our expenditure plans are deliverable
- taken steps to ensure that other resource requirements, such as consulting support, plant and materials, can be met.

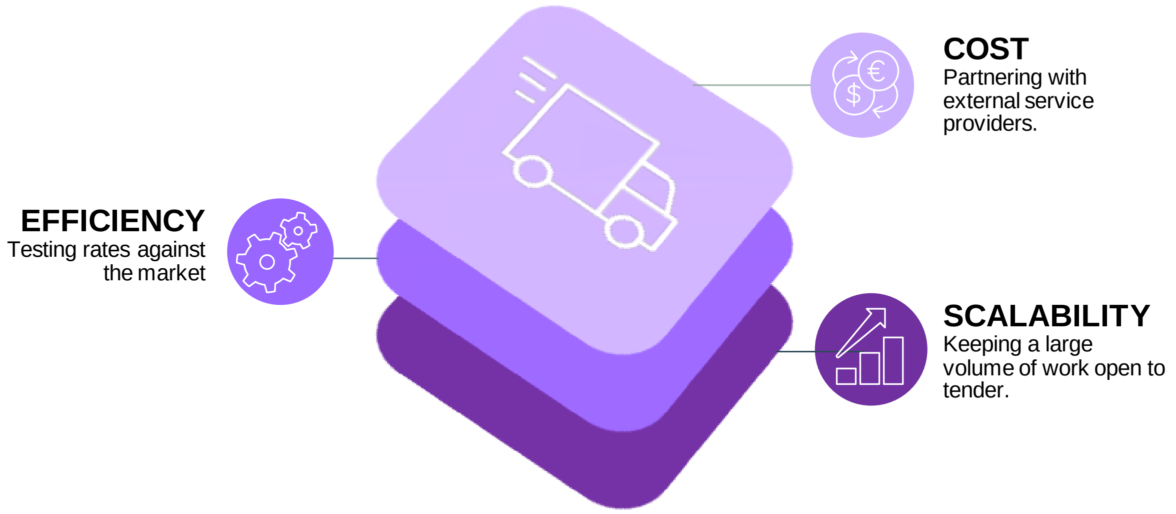
Our analysis shows that our work programme can be delivered efficiently and on time. This will be facilitated by supported by improvements and expansion of our operations centre.

8.1 Background

Our track record on delivery is demonstrated by our ability to plan, release and execute our annual work plans with our contracting partners. Over the last decade, we have significantly increased the amount of investment we make in our network and have successfully delivered the increasing work volumes.

In large part, our success has been underpinned by the strategic decision made ten years ago to outsource all of our field work to external service providers. This approach was designed to minimise cost, deliver efficiencies and enable scalability, as illustrated in Figure 8.1.

Figure 8.1: Our works delivery strategy - optimising cost, efficiency and scalability



Our approach enables us to sustain long-term commitments with key external service providers, while also enabling us to benefit from tendering significant volumes of work. The rates we pay through our long-term commitments have been proven efficient, having been tested against the market three years ago in a tender process for our main field service contracts.

Currently, the majority of our field work is delivered through two Electricity Field Services Agreements (EFSAs), covering our Eastern and Western networks. This approach achieves the benefits of close partnerships, allowing effective innovation, incentive and control mechanisms, while ensuring sufficient works are tendered to maintain competitive tension and improving pricing transparency.

More recently, we implemented a service provider panel, which is sized to address our future external resourcing needs for the CPP works programme, provide competitive tension, and provide flexibility to scale up or down as required. For capital works, we have a panel of three key providers supported by secondary suppliers in each region. Our panel providers are all tier one national service providers, who have experience on our network. We have confidence in their ability to help us deliver our CPP plans. The contractual arrangements provide mechanisms to ensure that our service providers are incentivised to meet our delivery needs and to do so in a safe and efficient way.

To supplement the EFSAs and retain competitive pressure, we use additional providers for larger (tendered) works and for specialist activities (including vegetation management and field-auditing).

We work closely with all our field service providers through our teams to ensure that we meet our obligations under the Health and Safety at Work Act 2015. Further detail about our safety and environmental policies and strategies can be found in the 2017 AMP.

In summary, our track record, together with the new panel arrangements, provide a sound foundation to address the required ramp up in the work programme over the CPP Period and beyond. The remainder of this chapter explains in further detail why we are confident that we have measures in place to deliver our work programme in a timely, cost effective and efficient manner.

8.2 Delivery strategy

At a high level, our works delivery approach has four main aims:

1. ensuring the safety of our staff, service providers and the public
2. ensuring we can build and maintain a safe, secure and reliable network
3. completing our work on time and on budget
4. delivering work in a cost-effective way.

The safety-focused aim underpins all our work and decision-making. We work closely with all our field service providers to ensure that we meet our health and safety obligations.

Our strategy is to achieve the benefits of close partnerships, allowing effective innovation, incentive and control mechanisms, while ensuring sufficient works are tendered to maintain competitive tension and improving pricing transparency. Further aspects of the approach include:

- clear accountability and role clarity between ourselves and our service provider
- integrated works programming, scheduling and governance
- visible end-to-end planning to improve delivery efficiency
- centralised coordination and management of scheduled maintenance
- appropriate fault and emergency processes (e.g. defined response times)
- improved procurement, safety management and information processes.

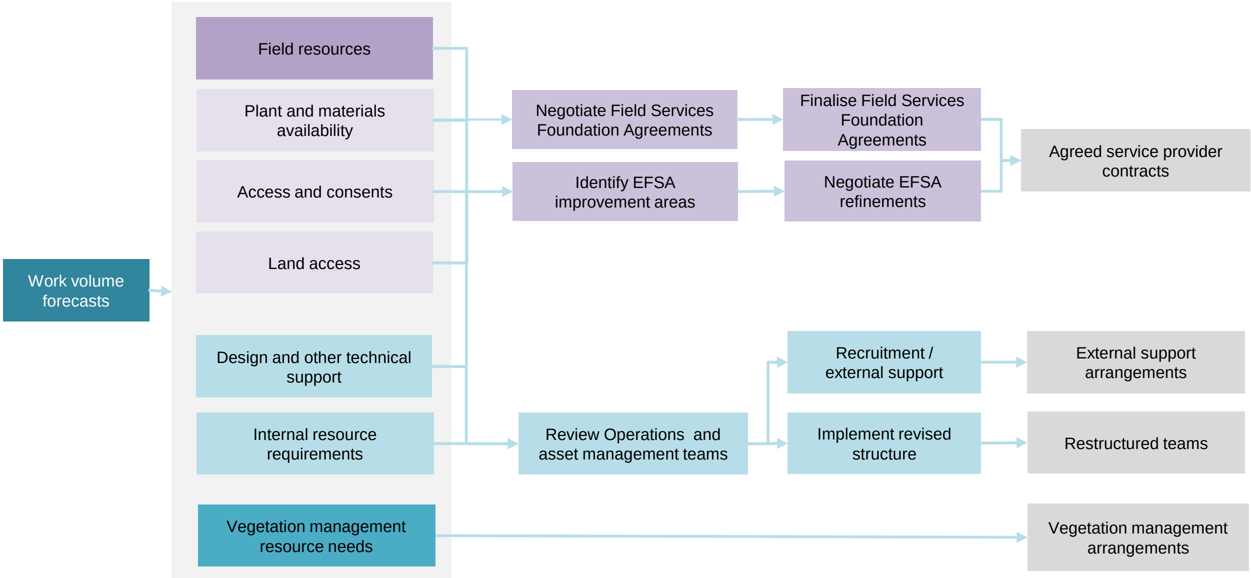
8.3 Deliverability review

We have undertaken a review of our capabilities and service arrangements to assess our ability to deliver the increased levels of network investment during the CPP Period and to ensure we continue to achieve our delivery strategy.

This review included the following activities, as summarised in Figure 8.2:

- modelled the required external field resources, by skill type and location, that will be required to deliver the uplift in work volume
- engaged with our external service providers to assess external resource availability and assessed any gaps in current capability
- secured commitments from our external service providers to deliver the resources and work volumes we require over the CPP Period
- initiated negotiations with additional service providers to secure additional field resource
- engaged with our main contractor to improve service performance and set the platform for assignment of additional work volumes as required
- reviewed plant and materials availability in the New Zealand marketplace in light of the planned increase in network investment
- assessed current capability to support increased requirements for planning and resource consents and land access
- assessed and profiled our internal resource requirements
- reviewed resource availability to support increased levels of vegetation management.

Figure 8.2: Deliverability assessment process



We supported the above initiatives by engaging external specialist advice to assess current approaches against leading practice.

8.3.1 Field resources

Our field resource modelling indicated what resource types we would need during the CPP Period. We discussed this with our external service providers who indicated they are able and willing to meet the increased resource requirements. In September 2016, our service providers confirmed this finding through an exchange of letters. Through subsequent negotiations with our panel of external service providers, we agreed binding delivery commitments and pricing under 'Foundation Agreements' and refinements to the EFSAs. This supports our CPP plans and provides us with cost certainty. The agreements with our panel service providers also incentivise them to actively participate in our tender and customer works markets.

Box 8.1: Field resource modelling

Our field resource modelling process included the following main steps:

- mapped our preliminary annual work programme to each of our six network areas[40]
- confirmed productivity assumptions with service providers and identified productivity values for the main activities
- created a bottom-up forecast of required field resource by skill type, by year, by area
- undertook a top down check using existing field staffing levels and ESI safety statistics
- tested existing service provider depot capacity to accommodate uplift in required resources
- allocated work volumes to potential service providers.

Our panel service providers detailed the strategies, such as training and recruitment, to address any resourcing gaps.

8.3.2 Internal resources

External service provision is only one part of the deliverability challenge. In particular, our external service providers must be supported by a ramp up in our internal resources.

As discussed in Chapters 9 and 15, to deliver our future work programmes we will need to expand our range of internal skills and capabilities. Additional resources will be required in a number of areas, including the following examples:

- managing and effectively analysing greatly increasing volumes of network and asset data, building an information basis for sound asset management and network operational decision making
- building our skills related to innovation, research and development, piloting new solutions and developing these to mature solutions for use on our network
- enhancing our customer-facing capabilities, to help us better understand customer requirements and emerging trends, and how these could effectively be used in our service offerings. We also anticipate that effective customer involvement will be integral to many future network solutions
- future scenario development and analysis – ensuring that we make informed investment decisions that would lead to least-regret outcomes
- enhancing our asset management practices, with the aim of being ISO 55000 compliant by 2020
- optimising our long-term investment plans, balancing technical, customer, regulatory, risk management and shareholder considerations.

As explained in Chapter 15, we have developed a profile for our SONS FTEs to ensure that sufficient resources are in place to deliver the planned work volume without compromising cost efficiency. We have also analysed the relationship between the increase in SONS staffing levels and our proposed investments. Relatively modest increases in SONS FTEs can be used to deliver significant increases in work by combining our internal resources with our external service providers.

We are confident that the required increase in our internal resources is achievable. As a further risk mitigation, any shortfall in our internal FTEs will be addressed by using external specialists and contract staff. Currently we use engineering consultants to fill out our resources to the level required to deliver peaks in our works plan. While our profiled increase in our SONS FTEs is achievable, the availability of external specialists and contract staff provides additional confidence that our expenditure plans are deliverable.

[40] For service operations purposes we divide our network into six areas. For planning purposes, we use 13 areas (which map into the six operations areas).

8.3.3 Plant and materials

Increased investment in the network will drive an increase in the amount of input material that will be needed. We assessed the availability of the following key materials:

- **Conductor and cable:** we have written assurances from one large supplier that they can meet our increased demand. As a risk mitigation measure, supplies can be obtained from an alternative large New Zealand company.
- **Poles:** our main supplier has confirmed in writing that they can comfortably scale to meet our demand, as a fail-safe there are several other viable suppliers.
- **Crossarms:** can be manufactured at relatively short notice with locally sourced materials and are not considered a deliverability risk.
- **Other equipment:** for key equipment types, we assessed availability over the CPP Period and concluded that there are sufficient suppliers serving the New Zealand market.

Given the above analysis, we are confident that there is negligible deliverability risk arising from the availability of plant and materials. Furthermore, there are risk mitigation measures if supply issues arise.

8.3.4 Planning and resource consents

We have a highly experienced in-house Access and Consents Team. Their work includes acquiring property rights and resource consents and managing our planning and consenting, including:

- route and site identification for proposed network projects
- negotiation of property rights
- project management of consenting and environmental aspects for multiple simultaneous projects.

We have been building internal capability in securing consents, land access, and RMA approvals over the last few years. In addition, we work with a number of external specialist advisors and legal professionals to augment our capability. We have also strengthened our relationships with landowners and councils as well as entering into MoUs with several Iwi to streamline the consenting processes.

We are confident that we have sufficient capacity to secure planning and resource consents over the CPP Period.

8.3.5 Vegetation management

During the CPP Period we will increase our vegetation management activities to ensure we comply with relevant regulations and address increasing vegetation related faults. The increase will strike an optimal balance between the cost of managing vegetation and minimising the impact of vegetation on our assets and network performance.

We currently have two primary service providers for vegetation management, one in the eastern network and one in the Western Network. These primary suppliers are augmented by a number of other secondary vegetation management companies. We have limited our relationships to those companies as we believe this approach can better control and achieve required safety, quality and cost outcomes. This approach also ensures adequate competition between providers to maintain competitive tensions allowing us to effectively manage costs.

Our service providers have indicated that our proposed increase in vegetation management can be accommodated. In addition, we will explore whether our vegetation management could use more tree trimming and cutting equipment in conjunction with traditional arborist pruning. This approach will be used to manage resource constraints if they arise.

In summary, our proposed arrangements will ensure required vegetation management volumes can be delivered cost effectively.

8.4 Expected benefits

This chapter has summarised the analysis and measures we have undertaken to ensure that our future expenditure plans can be delivered on time and efficiently. Our approach is focused on delivering the proposed works efficiently and in accordance with our planned timeframes.

Our approach builds on existing relationships with external service providers and our strong track record in delivering our planned works. In addition to ensuring that the proposed work programme is deliverable, we have risk mitigation measures to address any residual delivery risk.

In terms of customer outcomes and benefits, we expect our delivery strategy to achieve:

- continued focus on safe work practices and the health and wellbeing of staff, service providers, and the public
- increased commercial flexibility and competitive pressure from improved contractual arrangements with our service providers
- clear accountability between us and our service providers
- integrated works programming, scheduling and governance
- visible end-to-end planning to improve delivery efficiency
- centralised coordination and management of scheduled maintenance
- improved procurement, safety management and information processes
- increased participation and more competition in the customer-initiated works market.

9 ASSET MANAGEMENT IMPROVEMENTS TO SUPPORT CPP DELIVERY

We have identified a set of asset management improvement initiatives that are required to enable the efficient delivery of our CPP work programme.

Consolidating all of this, is our intent to achieve ISO 55000 certification by 2020. This internationally recognised standard provides an objective reference of where asset management improvements are required, and will help guide us in achieving the maturity levels appropriate for a leading modern distribution utility. Certification will also provide a clear objective measure for our management, Board and external interested parties, by which to assess our performance against industry good practice.

While we have improved many of our processes as we developed our CPP proposal, if we are to deliver our future work programmes we will need to expand our range of internal skills and capabilities.

The initiatives that we are planning are grouped into the following main areas:

- **General improvements:** achieving ISO 55000 certification, and setting up the asset management team and other improvement initiatives to achieve this.
- **Investment optimisation:** developing a framework that will optimise delivery against technical, customer, commercial and regulatory requirements in our investment plans. This will include developing a quantified risk-management system to support investment and operational decisions.
- **Planning for the network of the future:** developing and embedding our network evolution plan; revising our network architecture to align with the needs of the distribution network of the future; developing more sophisticated demand forecasting processes; and evolving our security standards to a probabilistic basis.
- **Information quality initiatives:** data quality improvements to ensure that our asset attribute, health, performance and utilisation data is accurately measured and reported.
- **Streamlining works delivery:** improving our end-to-end Capex delivery process to optimise construction workflows and to maximise contractor utilisation.
- **Expenditure governance:** refining our cost estimation and extending our portfolio budgeting processes.

9.1 Context

Asset management is a critical function for an asset-intensive company like ours:

- as an EDB we have a substantial part of our value locked into the network assets we own and operate. Managing these assets represents a very large part of our activities, and is a direct determinant of the level of service we deliver to our customers
- investing in our assets, whether for maintenance, renewal or network growth, represents the bulk of our expenditure. The cost associated with these activities, and the return we earn, are the largest contributors to the cost of distribution services. Asset management decisions and practices are therefore fundamental to the price that our customers pay
- the assets we manage are inherently dangerous and often in close proximity to the general public. The safety risk posed by these assets to the public and to our workers is directly impacted by asset management decisions. This also applies to their environmental impact.

For us to successfully meet our obligations – that is, providing electricity to our customers in a safe, reliable and cost-effective manner – we must be effective asset managers.

Achieving this is impossible without good practices, processes and information, and a sound asset management governance framework. We align ourselves with current best practice asset management thinking, such as that advocated by the ISO 55000 standard (previously in PAS 55).

9.2 Current capability

We have always been frank in our assessment of our capabilities, strengths as well as shortcomings. While our approach to asset management is appropriate, even leading practice among EDBs operating in the traditional electricity environment, this is no longer the case for a modern utility operating in a rapidly changing environment, or for one facing a major uplift in expenditure and network activities over the coming years. If we are to efficiently deliver the work associated with the CPP proposal, and if we are to keep up with our customers' evolving requirements and expectations, many of our practices have to improve.

In our 2013 assessment of our asset management practices against the Commission's AMMAT[41] we scored an average of 2.0. This indicates good understanding and progress on the implementation of good asset management principles, but fell well short of having these practices effectively embedded - the good practice standard expected from a leading organisation. This result was not acceptable, and accordingly we set an ambitious goal to achieve level 3 by 2018.[42] Progress has been made since 2013, and our latest AMMAT scoring resulted in an average of 2.4, but there is clearly still more scope for improvement.

As we prepared our CPP application, we took a critical look at our asset management practices. As a result, we identified a number of areas where we need to improve if we are to achieve our goal of good practice across all our asset management activities. Where possible, we addressed these shortcomings in advance of the application, but in some instances we require more time, and additional capacity and capability to do so.

9.2.1 ISO 55000 readiness programme

Achieving ISO 55000 certification is by itself not the goal we are pursuing. The benefit we seek is the improved efficiency with which we plan to deliver the proposed works, with the associated cost savings and service improvements to our customers.

The ISO 55000 standard provides a useful framework and effective roadmap to support us to achieve these benefits, as well as an objective, internationally recognised guideline to define asset management maturity levels and good practice asset management. By applying this, we will demonstrate good practice against a broad set of objectively-set requirements which will allow any stakeholder to easily assess our asset management maturity.

We are embarking on a programme to improve our asset management system and to gain ISO 55000 certification by 2020. To achieve this goal, we will continue to develop tools and processes to support robust decision making, supported by access to high quality asset management information. Ensuring that we have the requisite asset management competencies in the business will also be critical.

This will involve refinement and improvement of our asset management system. We are on an asset management improvement 'journey' that will include the improvements discussed in Section 9.3.

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41 This tool is a subset of the PAS 55 asset management standard. For further discussion of our AMMAT assessment see our 2017 AMP.

42 PAS 55 Level 3 indicates that all elements of the reference standard are being applied and integrated – it typically represents good asset management practice. The highest score, Level 4, represents world-leading practice. While we consider this (level 4) an attractive goal, that would be beneficial to our consumers in many respects, it is not realistic to achieve within a short timeframe as it would take an excessive effort and capacity to do so, as well as significant short-term expenditure.

9.2.2 Dealing with increasing asset management complexity

The investment plans we have included in our proposal have already been moderated on the basis that we will identify and deliver our work more efficiently. These moderations assume improved asset management techniques. In particular we intend to:

- enhance our application of asset and network information and analytics to support optimal investment and operational decision making
- shift to probabilistic planning standards and demand forecasting, to enhance network development planning
- expand the use of quantified risk to our network and assets, to help guide portfolio prioritisation and investment decisions
- build out our ability to innovate, research, test and implement new ideas and solutions – sticking with the winners
- streamline our project planning and delivery processes.

It is also noted that the CPP programme will require a substantial uplift in our internal capacity to deliver the increased volumes of Capex and Opex works. This will require more planning and design engineers, project managers, supervisors and network operators. It will also require an expanded field force.

9.3 Planned improvements

In developing our CPP investment plans, we have made many improvements, particularly in our analysis of asset health, investment needs, demand forecasting and cost estimation. The main asset management improvement initiatives we intend to achieve during the CPP Period are discussed below.

These are of course not the only changes we intend to implement as part of the CPP. Further planned improvements and intended programmes are highlighted in our investment strategies and plans – including fleet management, network development, maintenance, vegetation management, network evolution and system operations.

9.3.1 General asset management improvements

Below we set out the general asset management improvements we are targeting.

Asset management team restructuring

To achieve the asset management improvements we are aiming for, and to set ourselves up to be able to effectively meet the needs of a modern distribution utility, we are restructuring our asset management function. This will involve building out our capacity with new skills and focus areas while streamlining our capacity to effectively deliver our ongoing business-as-usual objectives, see Chapter 15.

ISO 55000 certification

One of our core asset management improvement goals is to fully implement the ISO 55000 suite of asset management standards and to achieve certification against these. This will require improvement against a number of areas, to ensure compliance across the broad range of competencies included in the standard. This will support more efficient internal processes and investments, allowing more cost-effective investment and service delivery.

We see ISO 55000 certification both as a useful guideline for areas of improvement and as valuable in the way it provides an objective standard for good industry practice, meaning internal and external stakeholders can easily assess our asset management maturity.

9.3.2 Planning for the network of the future

Network evolution plan

We will develop, consult on and publish a detailed network evolution plan that will set out our plan to evolve to a distribution system integrator. Included in this will be our views on how we see the future use of our network evolving, future demand trends, and intended future solutions (network or non-network).

In recognising that some future solutions need not involve regulated network assets, and that we are not necessarily always best placed to provide the most efficient outcomes to customers, we intend to invite external parties to take part in the evolution of our network (and the evolution plan). This approach will be spelled out in the plan.

Future network architecture

Changes in energy use patterns and in the basic functionality of the distribution network will require us to think differently about what the network should look like in the future. We therefore intend to completely review the architecture of the distribution network. This will require extensive analysis, including detailed scenario development and testing, and will culminate in new network architecture standards and a long-term plan for achieving these.[43]

Demand forecasting updates

Electricity demand trends are becoming increasingly uncertain. Simple approaches that rely on the close correlation between population numbers and electricity demand were traditionally sufficiently accurate to guide investment plans. These relationships are weakening and more sophisticated modelling that also accounts for economic and technology trends, weather influence and changing individual energy consumption patterns is becoming increasingly important. We also intend to expand our use of probabilistic modelling, to support accurate assessment of risk trade-offs and thereby support better optimised investment decision making.

In future, analysis of a wide range of realistic future demand scenarios will be an integral part of our demand forecasting (and network planning).

Revised security standards

Our current network security standards are a mix of deterministic targets which trigger the consideration of projects to address capacity shortfalls, and a more probabilistic approach to assess the load at risk when confirming and prioritising these projects. In future we will move to full probabilistic standards. Doing so will require extensive analysis and modelling, including of the acceptable levels of load at risk for various customer groups or configurations, acceptable exposure duration, reliability of network components, network performance under varying demand patterns, and various other factors.

These new standards will be a core factor in adopting better quantified risk-management principles to optimise decision making.

9.3.3 Investment optimisation

Investment optimisation framework

Distribution network investment plans have in the past focused predominantly on technical network needs and customer growth patterns. We recognise that this has to change materially, and that investment plans will in future need to optimise the balance between technical needs, the long-term interest of customers,

[43] A network architecture change is likely to involve material changes to our planning standards. While these changes can be adopted for new growth projects, and incorporated as part of larger renewal projects, in general it will not be practical or cost-effective to overhaul networks to implement the new architecture. Its introduction will therefore be phased in over a long period.

the commercial interest of shareholders, and meeting the requirements of the regulatory regime in which we operate.

We intend to develop a framework where these (sometimes competing) requirements can be quantitatively assessed so that investment plans can be optimised.

Quantified risk management framework

We will replace our current conventional risk-management processes with a better quantified, more comprehensive assessment framework. This will not only be used to identify and rank risks to the network, but will also form the basis for assessing the benefit from various solutions to mitigate those risks (and according to which solutions can be prioritised). It is also intended to provide management and the Board with an accurate view of the overall risk-outcomes of investment decisions and strategies.

The risk-management framework will support the proposed investment optimisation framework.

Capex-Opex trade-off analysis framework

We will expand and formalise our lifecycle investment analysis tools. This will support objective analysis of Capex/Opex trade-offs, which will help support optimal investment decisions. Not only will the range of factors considered in decision making be expanded, but it will also allow for improved sensitivity analysis around demand scenarios.

Asset criticality framework

We will further expand and embed our existing asset criticality framework. The goal is to include criticality assessments in all asset investment planning decisions – Capex and maintenance. It will also support our risk management initiative.

9.3.4 Information quality initiatives

Data quality improvement

Improving and expanding our asset data – physical attributes, asset condition and health, asset use and performance, is a core future initiative. This will require increased standardisation, expanded inspections and improved information processing capability.

As part of the general improvement of our asset data, we will also improve the inspection and quality auditing processes. This will include expanding our level of auditing in the field, as well as applying diagnostic tools to highlight potential deficiencies. In future we will also increasingly rely on real-time condition and usage data.

Data management improvements

We are planning substantial improvements in how we manage asset data. As part of this we will enhance our data standards and the ICT systems where information is stored and analysed. We intend to work towards ‘one source of truth’ across our business and our service providers, with clear data ownership and responsibility allocations.

Asset decision-making tools

We will develop and implement an asset data quality strategy that will help ensure our asset management and operations staff are provided with comprehensive, accurate and up to date asset and network performance data, and the tools to effectively analyse this in support of investment and operational decision-making. We will also investigate and expand our suite of analytical tools, to continually enhance our understanding of customer trends, network and asset performance.

9.3.5 Streamlined works delivery

End-to-end project delivery process improvement

We will conduct a thorough review of our project delivery process – from conception through to commissioning. The intent is to remove potential bottlenecks associated with limited advance planning and increased work volumes, and to optimise processes to increase delivery efficiency. Project close-out processes will also be improved to ensure effective feedback to the project initiators about practical issues encountered, and final delivery status. This is essential for ongoing planning process improvement.

We will also investigate the manner in which project work-scopes for routine projects are developed, including testing whether the design and scoping function should be outsourced.

Enhance performance tracking against works plan delivery

We will enhance the timeliness of progress and delivery tracking against our work plans, with regular updates on assets installed, maintained or commissioned.

Implement a multi-year works programme

We will investigate and adopt measures to extend the planning and delivery window – providing a longer window for service providers to optimally plan and deliver works. This is one of the areas where potential efficiency gains have been reflected in our CPP forecasts.

9.3.6 Expenditure governance

Budgeting and cost estimation

We will continue to enhance our cost-estimation processes, improving their accuracy. This will rely on increased analysis of actual project costs against estimates, and also working with external parties to continually expand and update our unit rates.

We will also analyse historical outturns, to determine the most efficient level of uncertainty or confidence of outcomes to include in estimates.

We will develop a pricing tool for large projects to help assess tender responses. This will also be used to inform longer-term forecasts for large projects.

Centralised contingency management

We will shift to a centralised contingency model, where contingency amounts are pooled between projects and released in a controlled, prioritised manner.

9.4 Delivering the improvement initiatives

For many of the initiatives above, we have the necessary skills in-house to conduct the necessary analysis, to develop and to implement the proposed improvements. However, with existing resource levels and the ongoing pressure to deliver business-as-usual outcomes as a priority, we have found in the past that our capacity to deliver changes has been constrained. We cannot risk under-resourcing these initiatives as they are a critical part of delivering effectively for our customers, and for positioning ourselves for the future.

In addition, there are a number of activities underpinning the improvement initiatives where we currently lack the necessary internal skills.

To successfully deliver the planned improvement initiatives, we will expand our internal skills and capacity. This requirement is included in the proposed additional expenditure included in our SONS portfolio – which is described in Chapter 15.

Many of the initiatives will involve ongoing refinement of current approaches, which will be most efficiently delivered with in-house resources, ensuring the necessary continuity. However, for some of the work we will use external specialists to support us – especially where initiatives or analysis is one-off in nature.

The diagram below provides a high-level view of our programme and its timings.

Figure 9.1: High level timeline for the improvement initiatives

We have begun to expand this programme into a comprehensive improvement plan that will track a range of initiatives related to the CPP. These will be important KPIs for our business during the CPP Period. We will measure and report our progress against these initiatives, along with our progress against the CPP work programme.

Our proposed expenditure and quality path

This section sets out our planned investments and our proposed quality standards for the CPP period.

CONTENTS

10 OVERVIEW OF OUR PROPOSED EXPENDITURE

When presenting expenditure amounts in this document, we have adopted several conventions, such that amounts are presented:

- in constant value terms using FY16 dollars (unless stated otherwise)
- post cost allocation, i.e. costs relate only to those required to provide electricity distribution services
- after applying our internal cost capitalisation procedure
- net of capital contributions
- by financial year, e.g. FY18 refers to 1 April 2017 to 31 March 2018.

In addition, our proposed expenditure has been reduced to reflect our efficiency allowances.

10.1 Presentation of expenditure

Figure 10.1 sets out our main expenditure categories. These six categories are set out and explained in the indicated chapters.

Figure 10.1: Our electricity business expenditure categories

Capital Expenditure	
Network Capex – Renewals	Chapter 11
Network Capex – Growth and Security	Chapter 12
Other Network Capex	Chapter 13
Non-Network Capex	Chapter 14

Operating Expenditure	
Network Opex	Chapter 15
Non-Network Opex	Chapter 16

Each expenditure category is made up of several expenditure portfolios. These portfolios form the basis of our internal expenditure governance and budget management.

10.1.1 How we have presented our expenditure

We have adopted the following conventions when describing our proposed CPP expenditure.

- **Constant dollars**: all expenditure figures in this document (unless stated otherwise) are denominated in constant value terms using FY16 dollars.
- **Use of financial years**: all expenditure figures relate to our financial years, e.g. FY18 refers to 1 April 2017 to 31 March 2018.
- **Categorisation**: expenditure is presented according to our current internal categories. This includes our historical expenditure which, as a result, may differ from the information we have disclosed as part of our annual information disclosures.[44]
- **Cost allocation**: all applicable expenditure is presented post cost allocation, (based on the cost allocation input methodology) meaning costs relate only to those required to provide our electricity distribution services.

[44] We discuss the relationship between our portfolios and information disclosure categories in the FAMI.

- **Internal cost capitalisation**: all applicable expenditure reflects our current internal cost capitalisation procedure.
- **Consistent basis**: to enable 'like-for-like' comparisons over time we present historical expenditure to reflect current cost allocation approaches and (for Opex only) current internal cost capitalisation procedures.

Box 10.1: Note on expenditure charts

The expenditure charts in this document depict three phases:

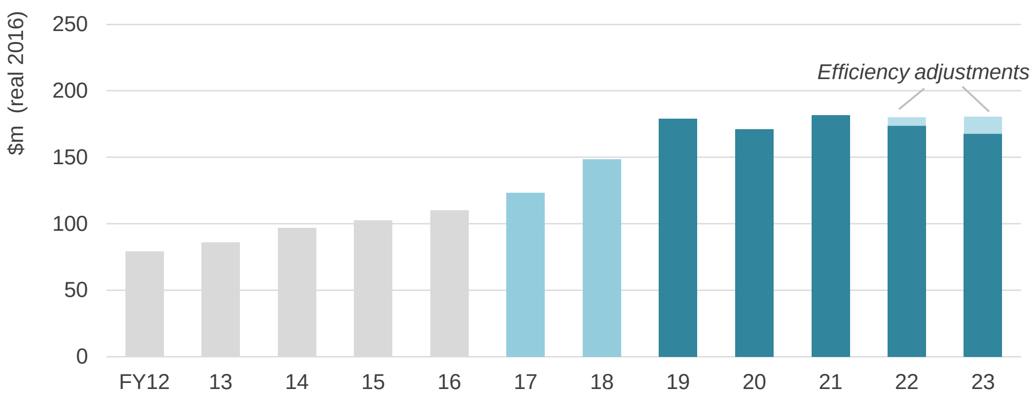
- **Current Period:** expenditure from FY12 to FY16 inclusive (light shade columns) as defined in the CPP IM based on based on actual expenditures.
- **Assessment Period**: expenditure for FY17 and FY18 (medium shade columns) as defined in the CPP IM based on a combination of actual and budgeted expenditure.
- **CPP Period**: expenditure from FY19 and FY23 inclusive (dark shade columns) based on our forecasting approaches.

All figures in these charts are presented in constant value terms using FY16 dollars.

10.2 Total Capex

Figure 10.2 sets out our total proposed Capex for the CPP Period and equivalent historical spend.

Figure 10.2: Total historical and forecast Capex



During the CPP Period we plan to invest $873m in new assets to deliver and support our electricity distribution service. This is a 50% increase above the previous five-year period. This investment profile is driven by:

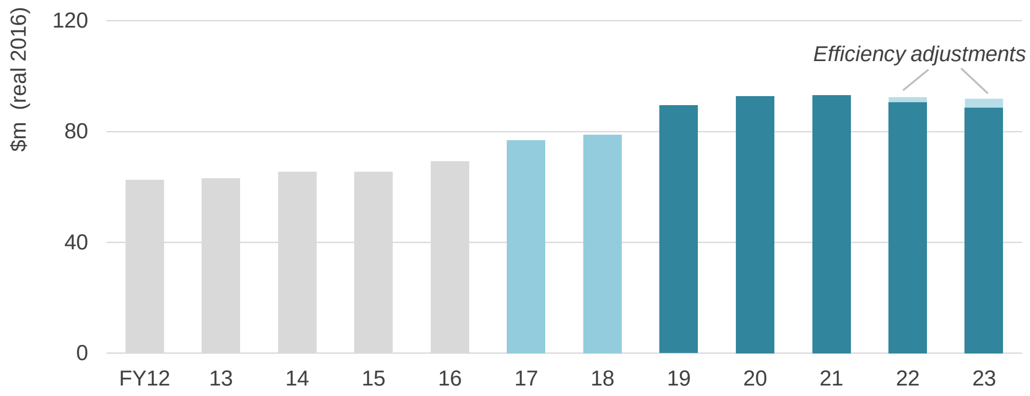
- **Renewals**: we need to increase the volume of assets we replace to manage the health and risk levels on our network. As discussed in Chapter 3, this investment is necessary if we are to continue to provide a safe and reliable service to customers. Chapter 11 sets out and explains these investments by portfolio.
- **Growth and security**: we will increase these investments above historical levels to address the shortfall in substation security and to reduce load at risk, as discussed in Chapter 12. We will undertake several large projects to stabilise security on our subtransmission network. These security-related projects represent the majority of increased investment.
- **Network evolution**: investments will leverage opportunities from emerging technology to cost-effectively increase network and asset utilisation, increase customer choice, and improve operations. These investments will allow us to realise efficiencies over the CPP Period and beyond.

- **Non-network Capex:** will increase as we make two important investments in a replacement ERP system and new facilities to consolidate our New Plymouth offices at one fit-for-purpose site. These investments support our focus on improved operational efficiency.
- **Expected efficiency improvements:** as illustrated in Figure 10.2 we have reduced the level of Capex in FY22 and FY23 to reflect expected efficiency gains. This has led to a reduction of $19.4m. These gains are predicated on our network evolution investments and improving our asset management capability, as discussed in Chapters 9, 13 and 15.

10.3 Total Opex

Figure 10.3 sets out our total proposed Opex for the CPP Period and equivalent historical expenditure.

Figure 10.3: Total Historical and forecast Opex



During the CPP Period we plan to spend $455m on activities that support our electricity distribution service. This is a 28% increase above the previous five-year period. This investment profile is mainly driven by:

- **Maintenance**: activity will increase over the CPP Period as we take action to reduce our defect backlogs and improve our inspection and condition regimes.
- **System operations and network support**: will increase to ensure we have sufficient capacity to deliver our work programmes and enhance our asset management capability to respond to changing customer needs and emerging technology. Improved data quality and analysis capability is essential to underpin the operational improvements that will deliver efficiency gains.
- **Vegetation management**: expenditure will increase to enable us to move from a largely reactive approach to a good practice proactive approach that will enhance safety and ensure full compliance with the Tree Regulations.
- **Expected efficiency improvements:** as illustrated in Figure 10.3 we have reduced the level of Opex in FY22 and FY23 to reflect expected efficiency gains. This has led to a reduction of $5.1m. These gains are predicated on our network evolution investments and increasing our asset management capability, as discussed in Chapters 9, 13 and 15.

10.4 Forecasting approaches

in general, we have developed our CPP forecasts using forecasting approaches that estimate necessary work and activity volumes, which then have associated unit rates applied to them. This so-called 'bottom-up' approach has been used to ensure our forecasts are transparent, and repeatable.

In broad terms, the forecasting methodology for each expenditure category is tailored to address the relevant expenditure drivers. This is achieved using one or more of the following forecasting approaches:

- **Volumetric**: modelling is used for smaller, high-volume works that are reasonably routine and uniform. These are generally related to defect rectification, renewal of bulk assets, reactive works and scheduled maintenance.[45]
- **Customised**: estimates are used for large single projects (generally more than $500k) that require individual tailored investigation. Those above $5m are also supported by independent external cost estimates.
- **Base-step-trend**: forecasting is mainly used for maintenance and SONS Opex. It is also used for non-network Opex and certain trend-based Capex forecasts such as asset relocations.

Our Capex cost estimation process is built around a cost estimation ‘price-book’ that sets out a set of unit rates and component costs. Using this, we can develop robust cost estimates using a centrally managed dataset. These costs have been reviewed and tested by an engineering consultancy.

10.4.1 Volumetric forecasting

Programmes with relatively large volumes of similar works are categorised as volumetric works for estimation purposes. The key determinant of accurate cost estimates for volumetric works is the availability of historical outturn costs from completed equivalent projects. This feedback is used to derive average unit rates to be applied to future work volumes. These unit rates are often combined to form building block costs that include the main components of typical works.

Using this approach our volumetric forecasts are based on P50 estimates, based on the following assumptions:

- scope is reasonably consistent and well defined
- unit rates based on historical outturns capture the impact of past risks
- the aggregate impact of historical risks across portfolios is unlikely to vary materially over time
- to maintain a portfolio effect, a large number of projects will be undertaken[46]
- the volume of historical works assessed is sufficiently large to provide a representative average cost.

For forecasts of investment in non-network assets and systems (e.g. IT hardware) we have used expected volumes and unit rates informed by discussions with vendors and historical cost outcomes.

10.4.2 Customised forecasting

This approach involves developing cost estimates based on defined project scopes, with larger projects supplemented by cost estimates from external engineering consultants. Project scopes are developed through desktop reviews of asset information such as aerial photographs, site layout drawings, underground services drawings, and available cable ducts. These assessments provide reasonably accurate estimates for materials and work quantities.

Activity costs are based on historical costs, service provider rates, quotes, and external reviews. Material costs are determined with reference to supply contracts and historical installation costs. Installation costs are informed by similar previous projects and updated with current prices from service providers.

There are risks associated with estimating projects over a longer period, such as a CPP regulatory period. The costs that are subject to material estimation risk will vary by project type. At a portfolio level,

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45 Bulk assets are smaller assets such as poles, crossarms or distribution transformers. Our network has large volumes of these.

46 The net impact of cost variances will tend to diminish in a portfolio containing a large number of P50 estimates.

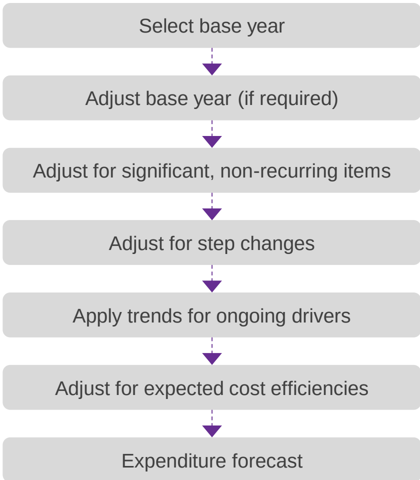
however the overall impact of estimation risk is diminished.[47] We therefore did not include any allowance in the CPP Capex forecast for this.[48]

For investment in large non-network systems or facilities works we have based our forecasts on a combination of tender responses and desktop estimates. These desktop estimates are mainly informed by historical tenders and discussions with vendors.

10.4.3 Base-step-trend forecasts

We have used a 'base-step-trend' approach to forecast expenditure that is recurring, including maintenance, SONS and portions of our non-network Opex. The approach is used by many utilities and economic regulators for forecasting expenditure.[49] Figure 10.4 sets out the typical steps in developing base-step-trend forecasts.

Figure 10.4: Typical steps used in 'base-step-trend' forecasting



The base-step-trend approach starts with selecting a representative base year. The aim is to identify a recent year that is representative of recurring expenditure we expect in future years. If there are significant events (e.g. major storms) an adjustment is made to remove its impact.

Expenditure in the base year is then projected forward. To produce our CPP forecasts we adjusted the resulting series for anticipated significant, non-recurring expenditure, permanent step changes, trends due to ongoing drivers, and expected cost efficiencies.

10.5 Expenditure moderations

When preparing our Final Proposal we moderated our forecasts to allow for efficiency gains resulting from the improvements we intend to make during the CPP Period.

10.5.1 Recognising expected efficiencies

We expect our planned initiatives to deliver cost efficiencies later in the CPP Period – in particular reflecting the improvements from enhanced asset management practices and our new ERP system.

47 Estimation risk relates to over- or under- estimating costs. For a large portfolio, although the risk is not perfectly symmetrical, it is reasonable to assume that the upward and downward variances would balance each other.

48 At an individual project level, the estimation risk is often material. We therefore include a risk-allowance in our project estimates when evaluating or seeking approval for individual projects, or in setting our annual Capex budget.

49 As noted by the Independent Verifier, the base-step-trend approach is an appropriate approach that has been used by energy network businesses regulated by the Australian Energy Regulator. The approach is also conceptually similar to the Commission's approach to forecasting Opex in recent DPPs.

Accordingly, we have allowed for efficiency adjustments in FY22 and FY23, equivalent to a 3.5% reduction in total Opex and 7.2% in total Capex, by FY23.[50]

These reductions recognise improvement opportunities we identified, and were also in response to verifier feedback on likely efficiencies that should flow from the business improvements planned over the CPP Period. These adjustments reflected the following efficiency sources (as applicable):

- **Asset management improvements**: reflecting the various asset management improvements we intend to make, which will also culminate in our ISO 55000 certification. This includes expanded capacity for network analytics and data management; investment optimisation; and condition-based risk management.
- **ERP**: access to an efficient ERP is a pre-requisite for the proposed asset management improvements noted above. It will support and simplify the as-building process leading to some SONS efficiencies.
- **Scale**: reflects the potential cost efficiencies that could be realised by the uplift in work associated with the CPP and delivery efficiencies likely to be realised by working with our service providers to optimise delivery processes.
- **Future network applications:** an important reason for the proposed future network work is to increase network utilisation and defer network augmentation. This factor reflects the potential gains that could be realised late in the period.
- **Commitment term:** as part of our negotiations with service providers to deliver the increase work volumes associated with the CPP, it will be possible to give longer term work commitments. Our delivery partners have indicated that longer commitments, or commitment to a (minimum) six-month in advance rolling basis of work, could result in a lower cost base.

10.5.2 Capex-Opex trade-offs

Our Capex and Opex forecasts recognise the interdependence between capital investments and the costs to maintain and operate our fleets. To effectively manage the lifecycle cost of our assets, we take this interaction into account and reflect it in our expenditure decisions. The approach varies across our portfolios based on the degree of interdependence.

Due to the substantial asset renewal programmes proposed for the CPP Period, in time we expect a reduction in maintenance defects – not only where defected assets are replaced, but also because newer assets are less prone to maintenance defects.

The following Capex-Opex trade-off examples reflect this.

- **Reduced defect expenditure**: based on planned renewals Capex we have reduced our corrective maintenance forecasts to reflect the expected future reduction in defect remediation. We have made a reduction of 5% to reflect this.
- **Lower fault response expenditure**: based on reductions in our defects backlog and increased overhead lines renewals we expect to spend less on reactive maintenance later in the CPP Period. We have made a reduction of 1% to reflect this.

[50] This is measured against a counterfactual of expenditure reflecting our current asset management practices (which themselves already reflect the improvements made in preparing for the CPP). See Section 7.2.2.

11 NETWORK CAPEX – RENEWALS

Renewing our asset fleets is essential to maintaining the overall health and condition of our network. Deteriorating condition increases safety and reliability risks due to the higher likelihood of asset failure.

We are seeing clear deterioration of key indicators such as asset health, defect volumes and fault rates. Failing to address this now will result in unacceptable safety and reliability positions.

Managing safety and reliability to at least current levels is a key requirement of our customers. To achieve this when a large part of our asset population is approaching end of life, will require increased investment.

During the CPP Period our increased renewal investment will focus on:

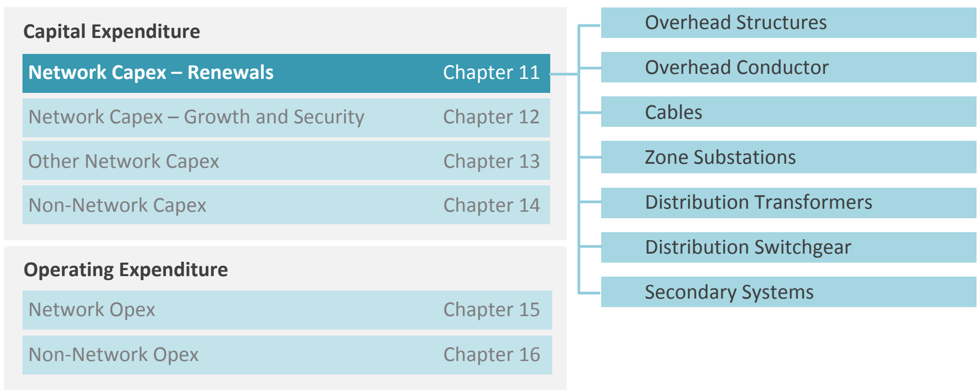
- replacing assets to maintain overall asset health, particularly those with increased likelihood of failure in critical locations
- reducing defect backlogs to steady state levels to manage safety risk and fleet health, particularly for wooden poles
- increasing the volume of distribution conductor renewals to address increasing failures rate and associated public safety risks
- addressing type issues and known asset problems that pose a risk to field staff or the public, for example arc flash risks
- ensuring compliance with electricity market rules and our seismic standards

Expanding our renewals Capex work programme in this way will enable us to maintain network performance and mitigate public and worker safety risk in line with what customers expect from a prudent operator. By addressing issues in a timely manner, we will also avoid the higher future costs of reactive replacement.

11.1 Expenditure category and portfolios

Figure 11.1 illustrates where renewals Capex sits within our overall expenditure and lists its portfolios.

Figure 11.1: Exenditure category map showing renewal Capex portfolios



11.1.1 Our asset fleets

The network Capex – Renewals category includes seven expenditure portfolios that are used for budgeting purposes. These seven portfolios, in turn, include 25 asset fleets.

Our day-to-day asset management is at the fleet level. Fleets are also the basis for medium-term forecasts. Table 11.1 sets out a mapping between our renewals portfolios and our asset fleets.

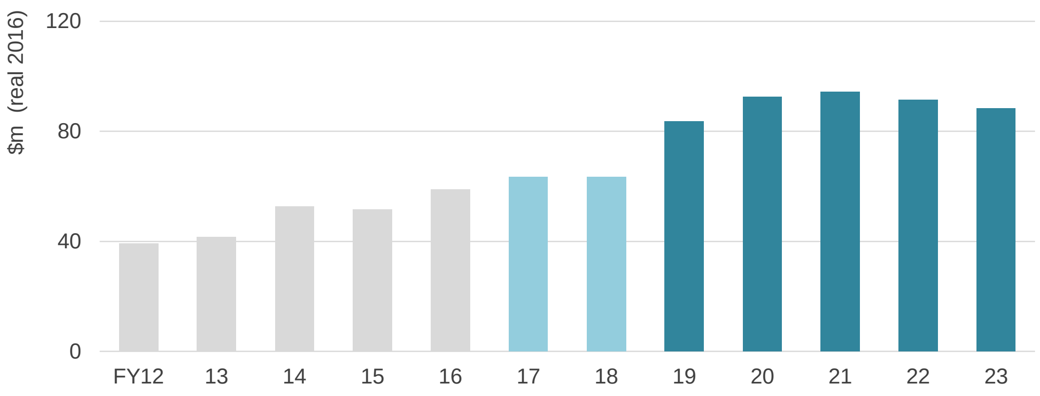
Table 11.1: Portfolio and asset fleet mapping[51]

PORTFOLIO	ASSET FLEETS
Overhead structures	Poles Crossarms
Overhead conductors	Subtransmission overhead conductors Distribution overhead conductors Low voltage overhead conductors
Cables	Subtransmission cables Distribution cables Low voltage cables
Zone substations	Power transformers Indoor switchgear Outdoor switchgear Buildings Load control injection Other zone substation assets
Distribution transformers	Pole mounted distribution transformers Ground mounted distribution transformers Other distribution transformers
Distribution switchgear	Ground mounted switchgear Pole mounted fuses Pole mounted switches Circuit breakers, reclosers and sectionalisers
Secondary systems	SCADA and communications Protection DC supplies Metering

11.2 Overview of renewals Capex

Figure 11.2 sets out our total renewals Capex for the CPP Period together with equivalent historical expenditure. The forecast brings together the individual portfolio forecasts described in this chapter.

Figure 11.2: Historical and forecast renewals Capex



51 These differ in some respects from Information Disclosure categories as they better reflect the way we manage our assets.

Renewals Capex is forecast to increase compared with historical levels. This is primarily driven by the need to proactively manage the health and condition of ageing assets and to manage increasing safety and reliability risks. Network performance is under growing pressure from increased faults and asset failures. The timing reflects the large proportion of assets constructed from the late 1950s to the 1970s, which are now reaching end-of-life.

We have been steadily increasing renewals Capex in recent years (by about 60% between FY12 and FY17) in response to this need, but further increases are now required, particularly in our overhead conductor, overhead structures and zone substations portfolios.

In this chapter, more detail is provided on our larger fleets and portfolios, or those for which we plan to significantly increase expenditure. Further details on all fleets can be found in the 2017 AMP.

11.3 Key drivers and forecasting approaches

Below we discuss the main drivers for our renewals Capex over the CPP Period and how we forecast the associated levels of expenditure. The relative importance of each driver will differ by fleet.

11.3.1 Drivers

During the CPP Period, the main drivers for our proposed renewals Capex are:

- **Safety**: of our staff, service providers and the public. Our staff and service providers work in close vicinity to our assets which exposes them to a number of hazards (such as arc flash), some of which are difficult to mitigate. Many of our assets are in publicly accessible locations, so failure could put the public at risk (as in the case of conductor drops and pole failures). Where asset condition and health is degraded, failure is more likely, which increases these public safety risks. Our asset health is deteriorating and we need to take action to ensure the continued safety of our staff, service providers and the public. We prioritise replacement of assets that present an elevated safety risk and aim to manage health and safety risks to achieve an ALARP (As Low As Reasonably Practicable) level.
- **Asset health**: we use asset health measures to assess the expected remaining life of an asset based on a variety of factors including condition, age and known 'type' issues. The health of a number of fleets is poor, such as wooden poles. Maintaining our asset fleets in good health is a key driver for our renewals investment, as assets in poor health are at increased risk of failure, leading to unacceptable reliability and safety risks. The health of several of our fleets will worsen without intervention. Achieving stable asset health is also a critical precursor to stable network performance and stable reliability.
- **Reliability**: our customers expect us to provide a reliable service. Unplanned outages are disruptive to customers. Focusing on replacement of assets that have poor service reliability (due to faults or forced outages) or which are likely to fail in the near future without intervention, will help reduce such disruptions. Some of our customers currently experience unacceptable interruption levels (see Chapter 3). We will prioritise our renewal investment towards their feeders. Faults, a leading indicator of overall reliability problems, have been steadily increasing over the past ten years (particularly in the western region) reflecting deteriorating asset condition. We also prioritise critical subtransmission assets as more customers would be impacted by a failure of these assets.
- **Criticality**: asset criticality reflects the consequences of asset failure (across multiple dimensions such as safety, reliability and environmental impacts) and when combined with asset health provides a view of asset risk. Our developing criticality framework helps us prioritise investments towards areas of greatest need.
- **Compliance requirements**: we may need to undertake renewals investments to ensure we are able to comply with legislative obligations. One example is the investment needed to support the reserves mechanism in the electricity market.

- **Obsolescence**: renewal is necessary when assets become obsolete, leading to issues or increased risk on our network. Obsolete assets may be incompatible with modern systems and standards, lack necessary functionality (when compared to modern equivalent assets), or are no longer supported by the manufacturer and are therefore difficult and expensive to maintain. We also consider the level of diversity in our fleets as removing 'orphan' models streamlines our approach to maintenance, helping to manage costs and safety. Renewing obsolete assets supports our future readiness objectives and will enable us to deliver our forecast efficiencies.

11.3.2 Forecasting approaches

Our renewals forecasts have been developed using 'bottom-up' approaches that are tailored to the type, volume and cost of the assets to be replaced. More detailed modelling approaches are utilised for large fleets. We explain our general approaches below with further detail provided in the portfolio-specific sections.

Asset health modelling

Asset health reflects the expected remaining life of an asset, and acts as a proxy for probability of failure. Our asset health modelling takes into account multiple condition factors, and what we know about the likely forward degradation profile for the particular asset. For certain fleets we also take into account factors such as the make and model of the asset (and whether it faces any 'type issues'), performance history, defect history, and location.

From our asset health modelling, we forecast the renewal volumes required to maintain a fleet in, or return it to, its desired state of asset health. We also use it to compare investment scenarios, and consider the impact of prioritisation between fleets.

Box 11.1: Asset health indices (AHI)

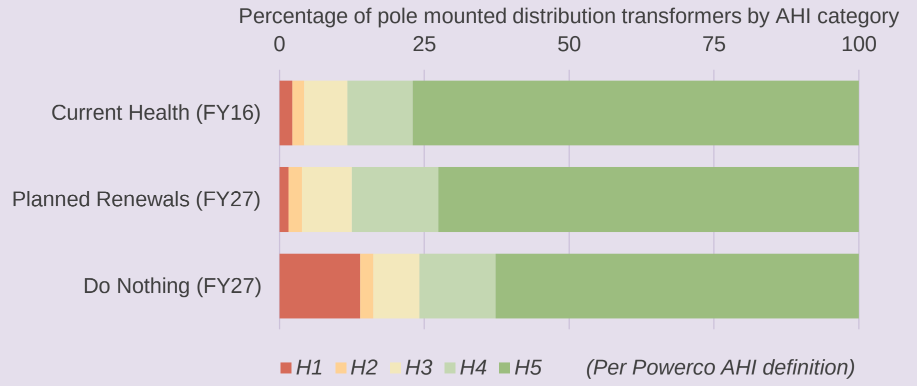
Asset health reflects the expected remaining life of an asset and acts as a proxy for probability of failure. Factors such as age, location, operating duty, observed condition, measured or tested condition and known reliability are combined to assign assets to a health category (H1-H5) as set out below.

Asset health categories

AHI	ASSET DESCRIPTION	REPLACEMENT PERIOD
H1	Asset has reached the end of its useful life	Within one year.
H2	Material failure-risk, short-term replacement	Within three years.
H3	Increasing failure-risk, medium-term replacement	Between 3-10 years
H4	Normal deterioration, regular monitoring	Between 10-20 years
H5	As new condition, insignificant failure risk	Over 20 years

The example below shows current and projected asset health under different intervention options. The 'do nothing' bar estimates the future health of the fleet if no renewals are undertaken, while the 'planned renewals' bar illustrates the impact of our planned level of investment.

We present all our forecast health breakdowns against a 'do nothing' baseline. This isn't presented as a counterfactual investment (which would be the DPP), but as a useful illustration to understand the full potential health degradation over the forecast period. As we will always ensure our assets are safe and provide reasonable service, 'do nothing' is not a viable option.



Survivor curves

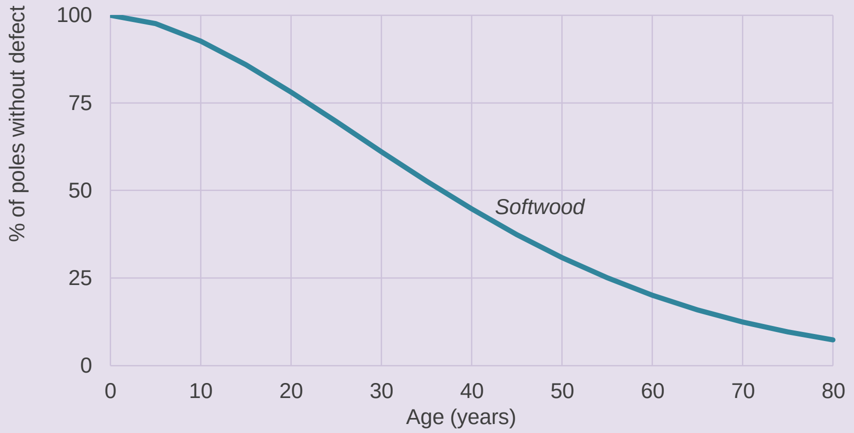
A survivor curve model uses information on previous end-of-life asset replacements to forecast future renewal needs. This is estimated using a probabilistic replacement rate curve that produces a likelihood of replacement for an asset of a given age. The replacement rate curve is applied to the current asset population to predict the future number of replacements.

Survivor curves are a good practice modelling technique when forecasting high-volume renewals because they directly take into account our historical experience of condition degradation and reflect that actual assets will require replacement over a range of expected lives.

Box 11.2: Survivor curves

Survivor curves (see softwood pole example below) are a representation of the 'life' achieved by a population of assets, produced by analysis of historical asset populations and replacement data. They show the probability of an asset 'surviving' to reach a certain life.

This information can be used to produce a replacement forecast by taking a current population and applying the survivor curve to calculate the likely number of assets requiring future replacement per year. Survivor curves are a robust forecasting method as they use historical replacement data from our network, thereby reflecting the particular characteristics of our assets, historical condition degradation, and design standards.



Specified projects

Larger, non-repetitive works (typically zone substation or subtransmission projects) are individually forecast as 'specified projects'. Techniques such as asset condition monitoring identify a renewal need, for which an appropriate option is selected (sometimes with detailed options analysis). The option is then scoped, usually from desktop analysis, so that site specific factors can be taken into account to inform the cost estimate. Project timing is based on the original need, but is often shifted to align with related works and ensure the overall programme is deliverable.

Type issues and compliance programmes

Some of our assets present type issues such as problematic and unreliable components or unacceptable safety and reliability performance risks. This is different from normal wear and tear, and requires early replacement.

In other cases we have programmes to ensure assets comply with our standards, such as where they do not meet our seismic standards, or ensuring all pole mounted transformers have Low voltage (LV) fusing.

We develop programmes of work to replace these assets. These programmes identify the number of impacted assets and determine the appropriate period for addressing the issues, based on risks involved and the cost of mitigating these. These programmes are often directly driven by our asset management strategies.

Age-based

Where we have a large population of assets but do not have sufficient data to develop accurate survivor models or to use condition-based health forecasting, we may use a more simplistic age-based forecast approach for long-term renewal forecasting. This assumes that age is an appropriate proxy for condition or performance degradation. Under this approach, medium-term forecasts are based on assuming assets will be replaced at the end of their expected life or across a statistical range (based on our experience operating the network). This approach is only used for lower-risk asset fleets and where expenditure levels are comparable to historical amounts.

However, it is important to note that actual replacement decisions are typically based on condition assessment via qualified field technicians against our inspection standards. This ensures that our replacement decisions are prudent.

Historical trending

When future renewals expenditure for a particular fleet is expected to be similar to historical levels, we sometimes use historical trends of renewal quantities to forecast investment. This is appropriate for reactive forecasts, such as pole replacements due to vehicle accidents or lightning strikes, where asset condition has little to do with expected expenditure. We also use this approach where we have limited condition information, such as for LV cables. We only use this technique for a small proportion of forecast renewal investment.

11.4 Developing our renewals Capex forecast

Our initial forecasts were subjected to internal challenge and approvals. The objective of this process was to test whether the forecasts were derived in a systematic and rigorous manner, the volumes of assets proposed are prudent and that renewal would be in the long-term interest of customers. Amendments were made to reflect feedback from this process.

11.4.1 Internal challenge and approvals

To ensure the prudency of our proposed renewal investments we undertook a robust, focused internal challenge and approval process. This was in addition to the process used to develop and approve our Preliminary Proposal (discussed in Chapter 4) and the review by the Independent Verifier (discussed in Chapter 6).

- **Engineering approvals**: near term renewals projects and programmes were reviewed and challenged and approved by planning managers, based on their experience of renewal needs gained from our annual planning process.
- **Independent review**: external specialists were engaged to carry out a detailed review of our survivorship and distribution conductor forecast modelling. Recommended improvements to the forecast models were adopted.

- **CPP Governance Group**: a group of general managers was established to provide oversight of our CPP proposal. This group approved expenditure in and across portfolios, and established a set of efficiency targets in consultation with portfolio owners.
- **Executive management team**: forecasts were submitted to the executive management team, including our CEO, and approved for submission to our Board.
- **Board CPP committee**: provided guidance and challenge on our investment plans to support the development of our proposal.
- **Board review**: the renewal plans were submitted to the Powerco Board for final challenge and moderation. They were supported by an independent reviewer, who commented on the reasonableness of the proposed plans.

Further details on our Capex governance approach are provided in Chapter 6 of our 2017 AMP.

11.4.2 Supporting documentation

Below we describe the supporting documentation used to inform our forecasts for the CPP Period.

- **Fleet management plans**: provide detailed information on our asset fleets including their condition and performance, and any associated risks or issues. They set out our approaches to managing these assets throughout their lifecycle, and detail the associated renewal strategies and forecasting approaches that form the basis of our forecasts.
- **Asset management plan**: outlines our long-term asset management strategy for our electricity assets. It explains how we manage our asset fleets including how we plan asset renewal investment across the planning horizon.
- **Policies and standards**: including guidelines on the use of criticality, our design standards, and maintenance specifications.
- **Models**: including those used for survivorship and asset health modelling, and to develop project cost estimates.

This information was reviewed by the Independent Verifier and a representative subset has been included as supporting material to our submission.

11.5 Overhead structures

The overhead structures portfolio includes two fleets, **poles** and **crossarms**.

The remainder of this section sets out our proposed levels of investment in these fleets during the CPP Period and the rationale for the investment.

11.5.1 Poles

Our network includes approximately 265,000 poles. The majority of these are concrete and wooden poles, but we also have a small number of steel poles. They are a key component of our overhead network, which spans close to 22,000 circuit kilometres.

Investment drivers

Below we provide detail on the main drivers for our proposed investment in pole renewals and how they have informed our forecasts.

Asset defects

Through our regular asset inspections, we collect condition and defect information on our pole assets. Serious pole defects, such as wooden pole splits and severe concrete pole spalling cannot be repaired and the assets must be replaced to manage failure risk (and associated safety and reliability risks). Replacement priority is determined based on severity of the defect (red/amber/green).

Defected poles can be a serious safety risk. Pole failure can cause pole-top equipment or conductors to drop, or reduce electrical clearance distances to below safe levels. This can lead to significant public safety hazards, including risk of electrocution either directly or indirectly (by livening houses, fences or other structures). Falling conductor can also cause electrocution to livestock or passes by, as well as potentially start fires and cause environment and property damage.

Defected poles also present a significant safety risk for our field workforce. Climbing poles that are in poor condition can cause them to collapse. Although we tag unsafe poles to prevent these being climbed, a residual risk remains where a defected pole has not being identified or has degraded significantly since the previous inspection.

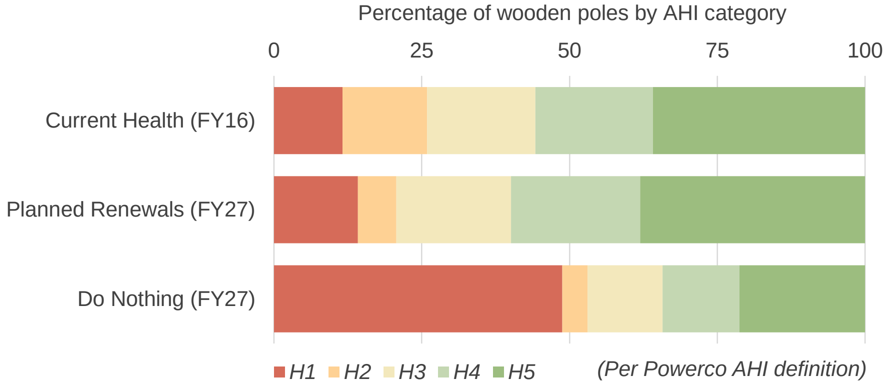
During the past decade we have built up a large backlog of amber pole defects. This backlog is substantially above our target levels. Our inability to replace defected poles within the required period represents a significant operational risk and potential safety risk. Without investment these risks will likely worsen – a situation we cannot accept. An increase in renewal volumes is required to reduce this backlog back to our target level in order to mitigate the associated operational and safety risks.

Asset health

Managing fleet asset health is a key driver for this fleet. Failure to manage fleet health will result in an increasing defect backlog and associated operational and safety risk. We calculate the asset health of our pole fleet based on known condition and defect information, and expected volumes of future replacements (based on our survivorship analysis explained above).

The figure below shows the current and forecast AHI for our population of wooden poles. These poles make up approximately 15% of our total pole population.

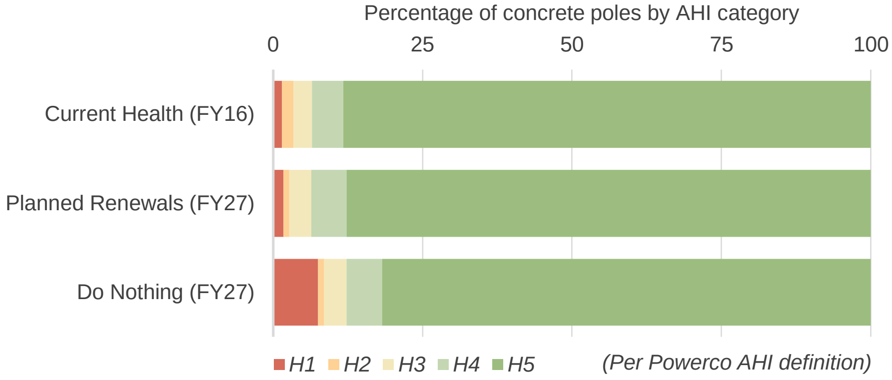
Figure 11.3: Wooden poles – current and projected asset health



The current health of our wooden poles is a concern, with approximately 12% already identified as requiring replacement (H1) within a year. Over our 10-year planning horizon, we will need to replace almost half our remaining wooden pole population to appropriately manage the health of the fleet. Not replacing these wooden poles will likely lead to increasing pole failures and expose our field staff and the public to unacceptable risks.

Our CPP investment plans look to stabilise the health of this fleet before we shift to a steady state replacement level once the defect backlog is reduced to target levels. We will then ‘keep pace’ with expected future defects, maintaining risk at a manageable level. As wooden poles will be replaced with concrete (or in some cases, steel), the steady state investment level will then see us slowly phase out the remaining wooden poles over a couple of decades.

Figure 11.4: Concrete poles – current and projected asset health



The figure above shows the asset health of our concrete pole population. In our experience, concrete poles can achieve service lives far in excess of wooden poles, and therefore the current health of this population is less of a concern. Approximately 7% of the population is expected to require replacement in the coming 10 years. Our CPP investment plans aim to keep the health of our concrete pole population at approximately today's levels.

Reactive

Although we aim to avoid pole failures, a small number occur each year. These are typically due to abnormal structural stress (such as in extreme weather) or unforeseen events (such as vehicle accidents). We replace these reactively. We expect reactive replacements to continue at historical levels during the CPP Period.

Conductor driven works

Poles are often replaced due to the need to replace overhead conductor (as the new conductor may require higher strength poles). When replacing conductor, we consider whether we should also replace the structures, given their condition. Opting to replace them during conductor works will reduce the number of future outages and reduce overall mobilisation and field work costs.

An increase in reconductoring works is driving an increase in expected pole replacements. Refer to Section 11.6 on overhead conductors for more information.

Summary of forecasting approach

Our forecast for pole renewal volumes incorporates both existing defected poles and expected future defected poles (informed by survivor curve models). This includes a programme of work targeting a reduction of the defect backlog to target levels by 2025.

We developed survivor curves for our five primary pole types from historical defect information. Different survivor curves are used to reflect the varying deterioration characteristics of the various pole types. Analysing the rate of defect accumulation rather than defect replacement is more prudent and informative as it ignores historical influences on replacement levels such as budget constraints.

Forecast volumes of reactive replacements are based on historical levels.

The poles we expect to replace as part of reconductoring works are determined from our conductor models (see Section 11.6). We estimate the overlap between poles replaced due to poor health and those replaced via reconductoring programmes, and amend our forecast appropriately. Wooden poles in particular are likely to be end-of-life when their corresponding conductor is replaced because they have similar expected lives.

These forecast volumes of replacement guide our medium-term project planning processes. Over time these are integrated into projects and programmes that can include other fleets to ensure optimal delivery. Our actual replacement works are triggered by known condition, existing defects and reactive replacements.

Unit rates for poles are based on average costs of completed overhead line renewal projects. Since crossarms and poles are always replaced together the cost covers the replacement of both. All new poles are pre-stressed concrete (in line with our pole standards) and the unit rate used reflects this.

The approach is summarised in Table 11.2. Further detail is provided in Chapter 15 of the 2017 AMP.

Table 11.2: Summary of pole renewals approach

Renewal trigger	**Proactive condition-based**: regular overhead line inspections identify poor condition or defected poles that require asset replacement. The severity of the poor condition or defect, combined with the asset's criticality, inform renewal prioritisation. **Reconductoring programmes**: conductor replacement often leads to replacing the associated poles, as the new conductor may be heavier and require poles of increased strength. **Reactive**: following traffic incidents or severe weather.
Forecasting approach	**Survivor curves**: historical information on pole defects is used to derive a probabilistic curve that can be used to forecast likely levels of future defects (and therefore replacement). The output is also reviewed against historical replacements to check for consistency. **Conductor replacement forecast**: poles requiring replacement from reconductoring are forecast in our conductor renewal models (see Section 11.6). **Historical trends:** reactive renewal is forecast using historical trends.
Cost estimation	**Historical average**: unit rates are based on average unit costs from representative historical overhead line replacement works.
Criticality	**Safety**: pole criticality is primarily determined by public safety risk as influenced by the asset's location (e.g. urban/rural).

11.5.2 Crossarms

A crossarm assembly is part of the overall pole structure. Their role is to support and space the insulators that support the overhead conductor. A crossarm assembly is made of one or more crossarms and a range of ancillary components such as insulators, armour rods, binders and jumpers, and arm straps. From this point, we simply use the term crossarm to refer to the whole crossarm assembly.

Investment drivers

Below we provide detail on the main drivers for our proposed investment in crossarm renewals during the CPP Period.

Defects

Similar to poles, through our regular asset inspections, we collect condition and defect information on our crossarms which identify assets requiring replacement (such as through excessive splits or rot). If these crossarms are not replaced or repaired there is a risk of crossarm failure which can lead to conductor drops and significant public safety hazards. These defects are being identified at an increasing rate, and without increased investment a significant backlog will accumulate.

Type issues

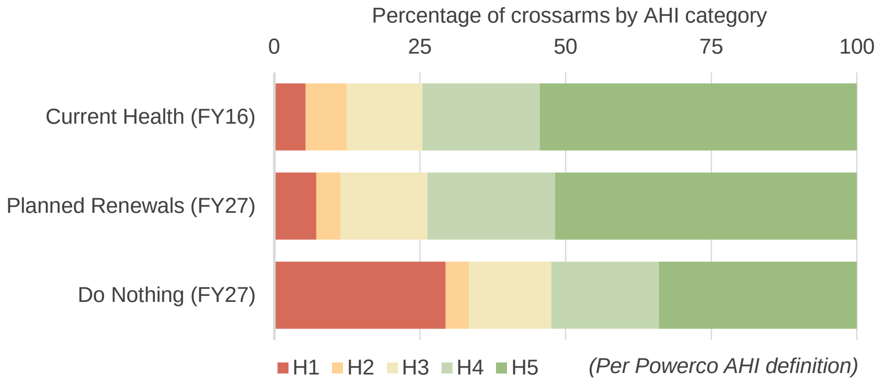
We have identified a safety issue with subtransmission two-piece insulators that are susceptible to premature failure. Insulator failure during maintenance presents significant safety risks to our field personnel. When performing live-line maintenance, in particular, insulator failures can cause flashovers, resulting in burns or possibly electrocution. We have already had a near miss incident where these failed during maintenance.

We will proactively replace these insulators by replacing the complete crossarm assembly. This is the most cost-effective solution over the asset lifecycle. We have also put in place restrictions around live-line work in locations where we have these insulators.

Asset health

We calculate the asset health of our crossarm fleet based on known condition and defect information, information on crossarms with type issues, and expected volumes of future replacements based on our survivorship analysis. Figure 11.5 shows current and forecast AHI for our population of crossarms.

Figure 11.5: Crossarm assets – current and projected asset health

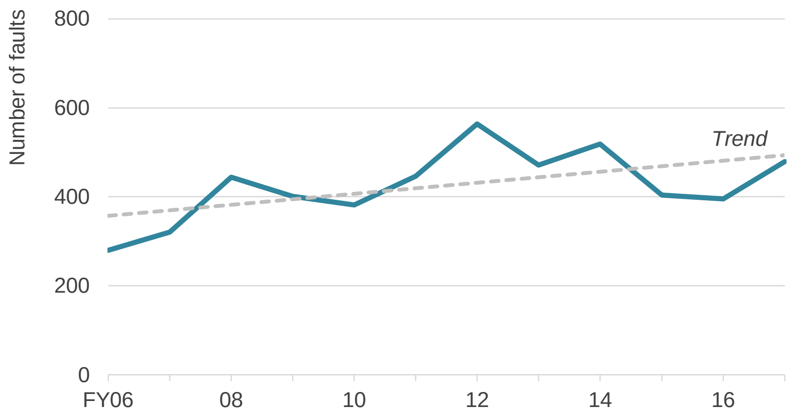


Approximately 5% of the crossarm population requires replacement in the short term (H1). This is primarily due to the existing crossarm defect pool and our replacement programme of subtransmission crossarms with two-piece insulators. Due to the aged nature of the crossarm fleet, a significant proportion is expected to require replacement over the next 10 years as their condition deteriorates (approximately 25% of the fleet). As shown above, our proposed level of investment will keep the health of the fleet stable, ensuring that the associated risks of poor asset health are managed.

Faults

The need to increase crossarm renewal investment is reflected in the increasing number of crossarm and hardware related faults, as shown in Figure 11.6. This trend indicates a historical degradation in the condition of the fleet. Faults primarily relate to the crossarm itself, with binders, jumpers and insulators also contributing. Annual numbers fluctuate with the prevailing weather. Without an increase in investment this trend will continue, compromising safety and network reliability.

Figure 11.6: Crossarm equipment fault history



Conductor driven works

Crossarms are usually replaced during reconductoring works, as either the associated pole is being replaced (as discussed above), or for delivery efficiency reasons (fewer shutdowns, more cost effective as crews are already on-site). An increase in reconductoring works is driving an increase in crossarm replacements. Refer to Section 11.6 on overhead conductors for more information.

Summary of forecasting approach

Our forecast renewal volumes include replacement of defected crossarms (existing defects) and replacements based on our survivor modelling (future defects). This has been integrated into a programme of work with the replacement of subtransmission crossarms with the identified type issue.

We account for the fact that pole replacement includes replacing the crossarm, by deducting crossarms from this forecast as appropriate. For known crossarm defects, we also account for those on defected poles, deducting them from this forecast also.

Crossarms replaced due to reconductoring are determined from our conductor programme (described later in this chapter). We also consider the overlap between crossarms replaced due to poor health and those replaced via reconductoring programmes, and reduce our forecast appropriately.

The forecast replacement volumes guide our medium-term project planning processes. Over time individual replacements are integrated into projects and programmes that can include assets from other fleets, to ensure optimal delivery. Actual replacements are triggered by known condition, existing defects and reactive replacements.

Unit rates for crossarms are based on average costs of completed overhead line renewal projects. We expect to continue to primarily use hardwood crossarms during the CPP Period.

The approach is summarised in Table 11.3. Further detail is provided in Chapter 15 of the 2017 AMP.

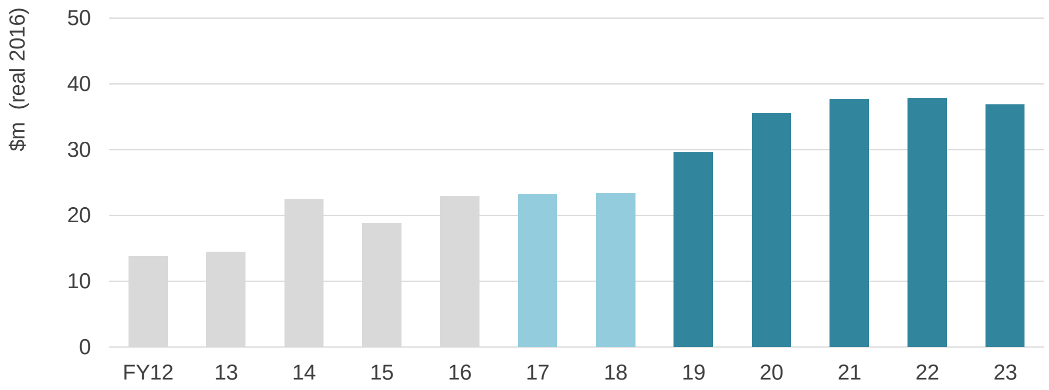
Table 11.3: Summary of croassarm renewals approach

Renewal triggers	**Proactive condition-based**: regular overhead line inspections identify poor condition or defected crossarms that require asset replacement. The severity of the poor condition or defect, combined with the asset's criticality, inform renewal prioritisation. **Reconductoring programmes**: during conductor replacement we often replace the associated crossarms, either because the associated pole is being replaced, or for delivery efficiency reasons. **Type**: subtransmission crossarms with two-piece insulators have a known failure mode and are being replaced to manage the associated safety risks.
Forecasting approach	**Survivor curves**: historical information on crossarm defects is used to derive a probabilistic curve that can be used to forecast likely levels of future defects (and therefore replacement). **Conductor replacement forecast**: crossarms requiring replacement from reconductoring are forecast in our conductor renewal models (see Section 11.6). **Volumetric programme**: for type issue replacements, the forecast is formed from the known number of affected crossarms, based on our asset and GIS information.
Cost estimation	**Historical average**: unit rates are based on average unit costs from representative historical overhead line replacement works.
Criticality	**Safety**: like poles, crossarm criticality is primarily influenced by the asset's location and the associated public safety risk.

11.5.3 Overhead structures renewals Capex

Figure 11.7 shows our forecast capital expenditure on overhead structures during the CPP Period. This represents the combined expenditure for our pole and crossarm fleets.

Figure 11.7: Overhead structure renewal Capex



During the CPP Period we expect to invest $178 m in overhead structure renewals. This accounts for 39% of our total renewals Capex over the period.

Our investment in overhead structures has been increasing, primarily in response to increasing numbers of pole defects. We will gradually increase this investment from FY19 peaking in FY21-22, to ensure there is sufficient time to mobilise additional resources in line with our deliverability planning. The forecast peaks in FY21-22, and reduces in FY23 reflecting the forecast efficiencies discussed in Section 10.5.

This increased investment is essential to manage safety risks associated with potential asset failure as indicated by the poor health of the wooden pole and crossarm fleets. It will also reposition our expenditure to a sustainable long-term renewal rate commensurate with the volume of assets.

The planned renewals Capex for overhead structures will:

- reduce the number of pole defects to steady state levels to manage safety and reliability risks
- continue to replace poles and crossarms that are in poor condition
- increase the volume of proactive crossarm replacements to address failure-related safety risks, as indicated by worsening crossarm asset health and increasing crossarm faults
- address type issues in our crossarm fleet where the probability of failure is high and are potentially unsafe
- ensure overhead structures are sized appropriately when associated conductor is replaced (explained further in Section 11.6 below).

Beyond the CPP Period expenditure is expected to reduce slightly as defect backlogs are returned to steady state levels. However, renewal investment will continue above today's levels to keep up with the increasing number of defected poles and crossarms, and due to the ongoing replacement of overhead conductor.

Box 11.3: Overhead structures justification

We are confident that our approach delivers an efficient and prudent level of investment because:

- **Clear, prudent drivers**: investment will appropriately manage safety risk (related to defected poles and crossarms), which is an overarching asset management objective and core company value. We must invest now, otherwise defect backlogs will grow and the associated safety risk will become untenable. Our planned renewals investments will also stabilise fault numbers, thereby managing unplanned outages and help stabilise our reliability performance. We are maintaining, not improving the health of our concrete pole fleet.
- **Cost effective**: pole and crossarm unit rates are based on market tested historical averages. These averages reflect our efficient integrated replacement of overhead lines.
- **External reviews**: our pole and crossarm survivorship models have been reviewed by industry experts and have been assessed as good practice.
- **Verifier review**: the overhead structures portfolio has been reviewed by the verifier and we have incorporated their feedback, reducing pole and crossarm replacement quantities associated with reconductoring.
- **Review and moderation**: forecasts have been reviewed by executive management and the Board, and the forecasts have moderated to reflect this top down challenge.
- **Efficiency gains**: as we improve our asset management and works delivery processes we expect to be able to gain future efficiencies. We have included an efficiency allowance of 8% by FY23 in our forecast to reflect this.
- **Deliverable**: new service provider agreements are being put in place, ensuring adequate resource (such as linesmen) to deliver the increased renewal investment.

11.6 Overhead conductor

The overhead conductor portfolio includes three fleets:

- **subtransmission conductors**: voltages from 33 kV and above
- **distribution conductors**: primarily 11 kV, but also 6.6 and 22 kV
- **low voltage conductors**: 400/230 V, and including overhead service connections and fuse assemblies.

The remainder of this section sets out our proposed levels of investment in these fleets during the CPP Period, and supporting rationale. We are proposing an increase in investment across all three fleets, to ensure type issues and end-of-life conductors are appropriately managed.

11.6.1 Subtransmission conductor

Subtransmission overhead conductor is used in circuits operating at 33 kV and above, connecting zone substations to grid exit points (GXPs), and interconnecting zone substations.

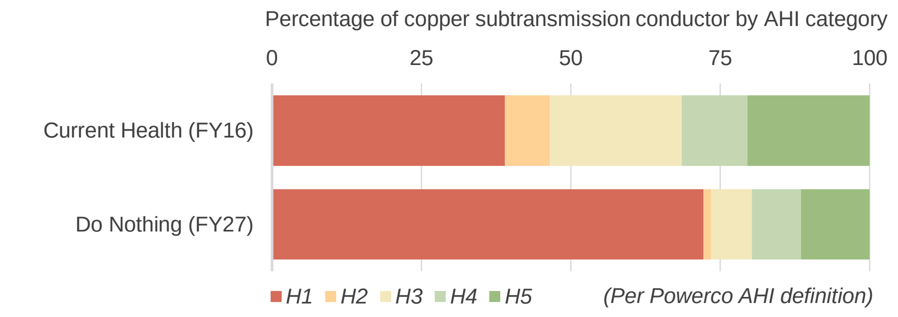
Investment drivers

Below we provide detail on main drivers for our proposed investment in subtransmission conductor renewals and how they have informed our proposed forecasts.

Asset health

The figure below shows the current AHI for our copper and aluminium subtransmission conductor populations. The AHI for this fleet takes into account conductor condition, expected degradation, conductor type, proximity to the coast, and expected remaining life. Managing the health of our subtransmission conductor is important for maintaining the reliability of our network and ensuring customers receive the quality of service they expect.

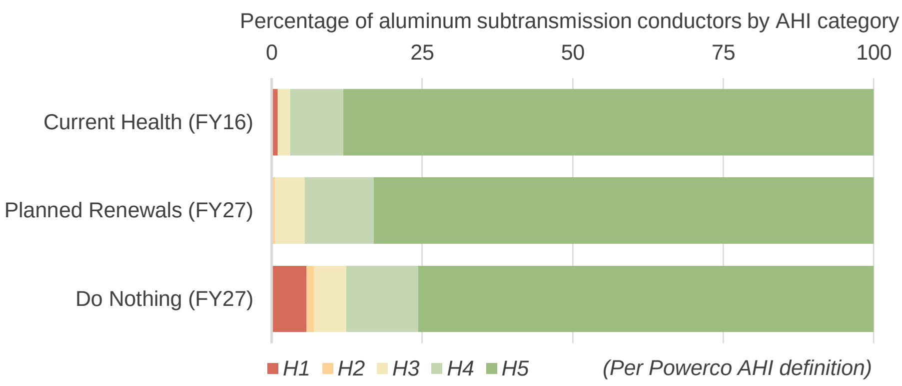
Figure 11.8: Subtranmission Copper conductor – asset health



The chart above illustrates the concerning health of our copper conductor, which makes up 5% of our subtransmission conductor. Most of it will require renewal over the next 10 years, and this will make up the majority of our subtransmission conductor replacement during the CPP Period. Not replacing this conductor will put significant load at risk due to increased likelihood of failure.

Forecast AHI is not shown, as the majority of copper conductor will be replaced (with aluminium conductor) by FY27.

Figure 11.9: Subtranmission Aluminium conductor – current and projected asset health



The health of our aluminium conductor is very good. Most of the subtransmission conductor fleet is made of aluminium. Of our aluminium conductor, only 3% will require renewal over the next 10 years (H1-3). There will be a growing need for aluminium conductor replacement beyond FY27 (H2 and H3 in the planned renewals scenario above).

Type issues

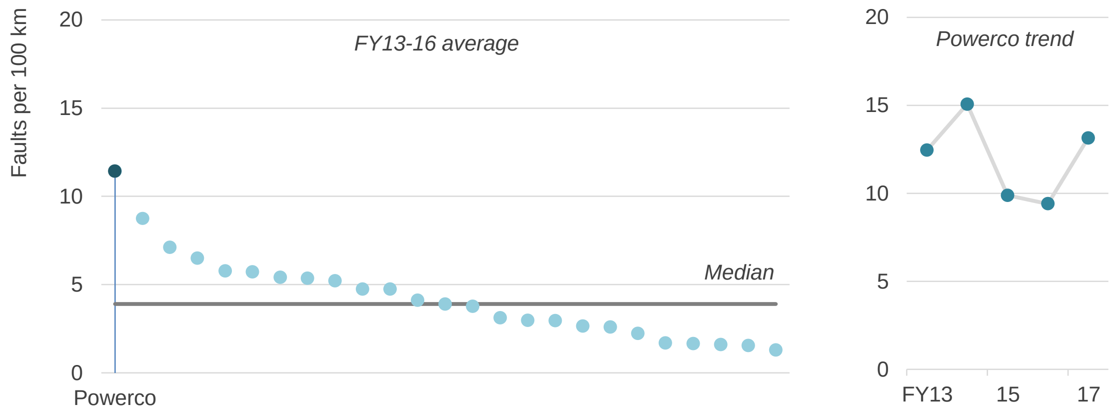
On some subtransmission ACSR conductors, we have found periodic sections of 'grease holidays' throughout the length of failed circuits. These sections were in the late stages of corrosion. Grease holidays reflect a lack of quality control in grease application during conductor manufacture. These sections of conductor exhibit accelerated degradation of the zinc coating (where present) and eventual loss of steel cross-section due to corrosion. This damage compromises the tensile strength of the central steel member, and can lead to eventual failure of the conductor to carry design loads. As such, conductors with this lack of grease have a shorter life expectancy than those that are well-greased.

We have identified some circuits that are affected by this greasing issue where conductor bulging has become evident. Through our overhead line preventive inspection programmes we expect to find further circuits that will require replacement during the CPP Period.

Benchmarking

Figure 11.10 shows our subtransmission overhead fault rate compared to other EDBs.

Figure 11.10: Overhead subtransmission fault rate benchmarking (2013-2016 average) and our trend[52]



Averaged across the last four years, we have the highest fault rate of the group. As can be seen from the trend on the right, this problem has been consistent over the last five years. Fault rates would need to drop by more than 50% to reach the median level. This supports our need to invest to manage reliability, replacing our copper subtransmission conductors which are in poor health and certain ACSR circuits with type issues.

Summary of forecasting approach

The short to medium-term subtransmission overhead conductor forecast is based on the known condition of particular circuits. These works are planned and scoped into projects with desktop cost estimates. Our CPP Period renewals work will focus on our remaining aged copper circuits and ACSR circuits with known greasing issues.

We expect subtransmission overhead conductor replacements to remain fairly constant over the next five to ten years and then to start increasing. A substantial number of aluminium circuits constructed from the mid-1950s onwards will then need to be considered for renewal.

The approach is summarised in Table 11.4. Further detail is provided in Chapter 16 of the 2017 AMP.

Table 11.4: Summary of subtransmission conductor renewals approach

Renewal trigger	**Proactive condition-based**: subtransmission conductor is replaced when the condition is poor and the risk of failure is increased.
Forecasting approach	**Specified projects**: condition and reliability information is used to plan renewal projects, with scopes developed from desktop analysis before more detailed designs and surveys are completed.
Cost estimation	**Desktop estimates**: planned subtransmission projects during the CPP Period are supported by individual cost estimates, based on desktop analysis.
Criticality	**Reliability:** is the primary driver, considering the potential loss of load and the type of load connected, with public safety also considered.

11.6.2 Distribution overhead conductors

Our distribution network conductors operate at voltages of 6.6 kV through to 22 kV. The assets in this fleet connect zone substations to distribution transformers and make up the largest proportion of our overhead conductor portfolio.

52 Our average also includes FY17 data. FY17 information from other EDBs is not yet publically available.

Investment drivers

Below we provide detail on the main drivers for our proposed investment in distribution conductor renewals during the CPP Period.

Safety

Conductor failure exposes the public to the risk of electrocution, and has the potential to start fires causing extensive property damage. We must target replacement of conductor with higher failure risk to reduce the overall public safety risk associated with the fleet.

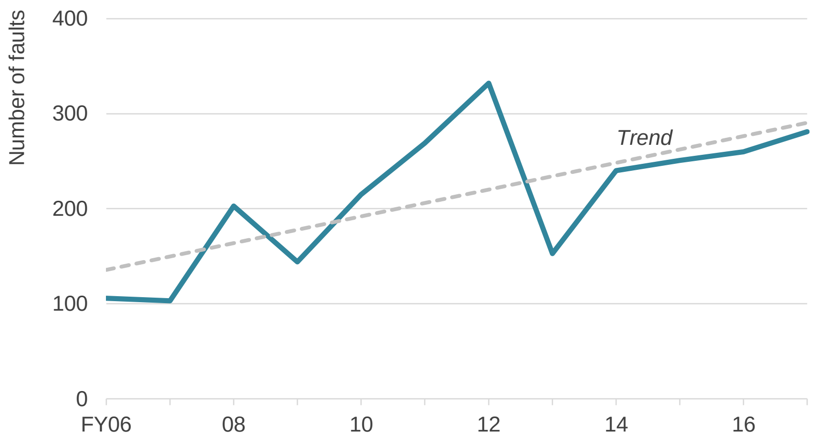
Type issues

There are known issues with some conductor 'types' on our networks. Small diameter distribution conductors (<50 mm^2) are less resilient on average than the larger, heavier types. They have poor strength to weight ratios and a disproportionally high failure rate, regardless of location. The issue is most prevalent with copper and AAC conductors. These poor performing types lead to unacceptable safety risks, particularly in urban areas, and we must act now and replace this conductor.

Fault trends

We are seeing an increasing trend in distribution conductor failures, as reflected in the fault history data in Figure 11.11. Based on the underlying trend, faults have approximately doubled over the past decade.

Figure 11.11: Distribution conductor equipment fault history

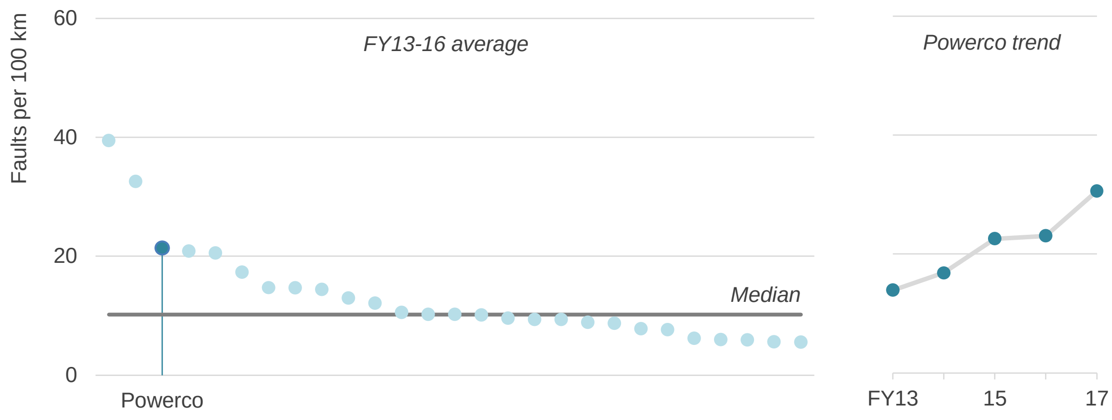


Although we have been increasing our levels of distribution conductor replacement over the past five years, volumes are well below sustainable levels and we are still experiencing an increase in faults. We are seeing the impact of ageing conductors on our networks in our fault rate trends, alongside the poor performing types discussed above. Our analysis indicates that without further increases in conductor replacement, failure rates will continue to rise, corresponding to increased safety risk and reduced reliability for customers. This is a situation we must avoid, and are therefore planning to replace conductor with high failure rates.

Benchmarking

Shown in Figure 11.12 is our overall distribution overhead line performance, compared to other EDBs.

Figure 11.12: Overhead distribution line fault benchmarking (2013-16) and Powerco trend[53]

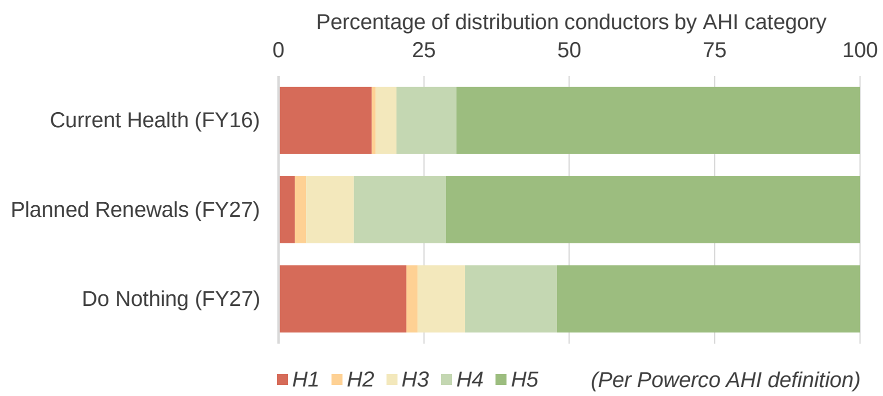


Our performance has us in the poorest quartile. A reduction in distribution line faults of approximately 50% is required to achieve median performance. Of more concern is that during the four-year period of this analysis our distribution overhead line fault rate has increased from 14 faults per 100 km in 2013 to 31 faults per 100 km in 2017. This position is untenable, and as a prudent operator we have to increase our distribution conductor replacement to help arrest the deteriorating performance.

Asset health

Figure 11.13 shows the current overall AHI for our distribution conductor population. The AHI is based on analysis of historical failure data, poor performing types and expected condition degradation.

Figure 11.13: Distribution conductor – current and projected asset health



The health of the fleet indicates the need to replace significant amounts of conductor (16% of the fleet, H1) to improve the health to a more sustainable level, thereby reducing our fault rates and managing public safety risk. This is supported by analysis of our historical failures and benchmarking performance.

Our replacement forecast will improve the health of the fleet by 2027 (as shown by the reduced H1 portion), though not yet to long term sustainable levels. The scale and age profile of our network suggest that investment in conductor renewal will remain a key investment driver beyond the CPP Period.

53 Our average also includes FY17 data. FY17 information from other EDBs is not yet publically available.

Summary of forecasting approach

To forecast distribution conductor renewal requirements, we have modelled expected failure rates for all our distribution conductor spans based on historical information. As our overall failure rates are higher than good practice levels (as evidenced in the fault trends and benchmarking above) we have set ourselves the target of reducing failure rates to an acceptable level by 2030, prioritising improvement in urban conductor performance, before improving rural performance.

Our modelling indicates the need for increased, targeted investment in conductor renewal over the next 10 to 15 years to achieve our target performance. Once we have reduced our failure rates to our target levels, replacement quantities should stabilise to maintain that performance.

Shorter term, we combine information on conductor type, condition, criticality and related assets (such as poles and crossarms) to form overhead line renewal projects.

The approach is summarised in Table 11.5. Further detail is provided in Chapter 16 of the 2017 AMP.

Table 11.5: Summary of distribution conductor approach

Renewal trigger	**Condition and type, considering failure risk**: we will replace conductors where safety risk is the greatest, driven by both the type and condition of conductor.
Forecasting approach	**Failure rate modelling**: using historical failure information we have modelled future failure rates, and have used the model to determine the replacement volumes required to reduce failure rates to an acceptable level.
Cost estimation	**Historical averages**: unit rates are based on average unit costs from representative historical overhead line replacement works.
Criticality	Safety is the primary consideration for distribution conductor criticality, with urban areas prioritised, especially near sensitive locations e.g. schools.

11.6.3 Low voltage overhead conductors

LV conductors operate at 230/400V. Almost half of LV conductors are located within urban areas and a high proportion of network incidents relate to LV conductors.

Investment drivers

Below we provide detail on the main drivers for our proposed investment in LV conductor over the CPP Period.

Safety

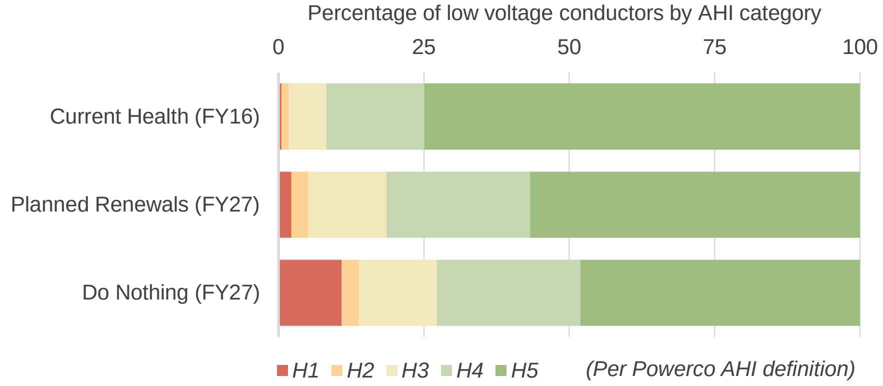
Safety is the primary driver for replacement of LV conductor. Like subtransmission and distribution, LV conductor failures expose the public to the risk of electrocution, and have the potential to start fires. Targeting conductor with higher failure risks is essential to manage the overall safety risk associated with these assets.

The public safety risk of electrocution due to downed LV conductors can be partially mitigated by the use of covered conductor. Our modern standard requires the use of covered conductor but there are rural and suburban overhead LV circuits that still use legacy bare conductor. We identify high-risk LV circuits that have bare conductor, assess the public safety risk due to conductor or binding failure, and prioritise its replacement with covered conductor.

Asset health

Figure 11.14 shows the current overall AHI for our LV conductor population. The overall AHI for this fleet is based on our understanding of LV conductor expected life and age.

Figure 11.14: Low Voltage conductor – current and projected asset health



The health of our LV conductor fleet is good, with approximately three quarters of the fleet (H5) unlikely to require replacement over the next twenty years. However, 8% of the fleet will likely require replacement over the next decade (H1 to H3), and ensuring this occurs requires a large increase in renewal volumes relative to historical levels. As a result of this we are moving from historical reactive replacement of LV conductor, to more proactive condition-based replacement. Not replacing this conductor will lead to a degradation in asset health, and introduce additional safety risks.

Fuse assemblies replacement programme

We currently replace LV service fuse assemblies on a reactive basis when the device fails. We only know the device has failed because our service providers have responded to a customer complaint of no power or flickering power. From a customer perspective, this arrangement is disruptive and not satisfactory because most fuse failures occur when the customer's power demand is high. There are also public safety risks with running these assets to failure.

Replacing LV service fuse assemblies on a planned basis (using asset age and condition) will reduce the number of device failures and customer outages. Planned replacement of these devices is far more cost efficient and less disruptive than reactive replacement. Our strategy for these assets includes a transition to proactive replacement.

Summary of forecasting approach

As we have limited detailed condition and failure information for LV conductors, we use age as a proxy for condition to develop medium-term forecasts. We have chosen to use a replacement distribution based on a Weibull curve to reflect that conductor replacement will occur at different ages depending on the particular condition, environment and criticality of the conductor.

Span length on the LV network is generally shorter than that of the distribution network, which puts less tension on the conductor therefore increasing the threshold at which failure may occur. Because of this, we have chosen a Weibull curve that has a mean replacement age of 70. Although a relatively high age, this suggests a significant increase in low voltage conductor replacement is required during the CPP Period. We will slowly ramp up to the levels indicated by the model by the end of the CPP Period, to allow for refinement of our condition assessment techniques and processes.

Forecast quantities of fuse assembly replacements are based on a long term steady state replacement level using an indicative 45-year age. As we commence the programme, our condition information on these assets will improve and we will be able to refine our forecasting approach.

The overall approach is summarised in Table 11.6. Further detail is provided in Chapter 16 of the 2017 AMP.

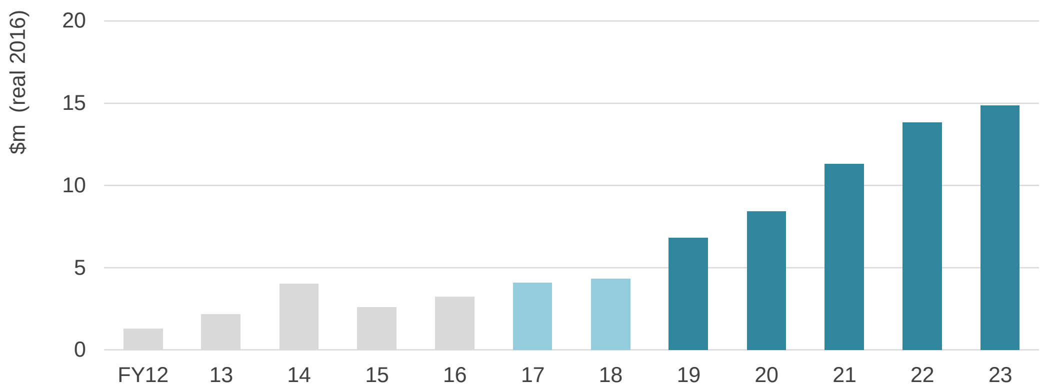
Table 11.6: Summary of LV conductor approach

Renewal trigger	**Proactive condition-based**: like distribution conductor, we replace LV conductor when its condition is poor, while also considering the relative public safety criticality of the circuits. LV fuse assemblies are also replaced when in poor condition.
Forecasting approach	**Age**: we use a mean replacement age of 70 years, using a Weibull distribution, to forecast medium-term LV conductor renewal quantities. An expected age of 45 years is used for the fuse assemblies forecast.
Cost estimation	**Historical average**: our forecasting unit rate is based on recently completed low voltage reconductoring projects.
Criticality	**Location**: urban circuits are more critical, due to their increased public safety risks.

11.6.4 Overhead conductors renewal Capex

Figure 11.15 shows our forecast capital expenditure on overhead conductors for the CPP Period.[54]

Figure 11.15: Overhead conductor renewal forecast expenditure



During the CPP Period we expect to invest $55m in overhead conductor renewals. This accounts for 12% of our total renewals Capex over the period.

Distribution conductor replacement makes up most of the expenditure in this portfolio. Although historical reconductoring levels have been increasing in recent years, performance has continued to deteriorate. We need to increase renewal volumes to sustainable long-term levels otherwise both public safety and reliability for customers will be compromised.

We plan to phase the increase in renewal investment to ensure the programme is deliverable. This also allows more time to refine our condition assessment techniques so that we can effectively locate conductor sections in need of replacement and prioritise replacement.

LV conductor follows a similar expenditure profile to distribution, but at reduced quantities, while subtransmission expenditure is flat during the forecast period. In FY19 we plan to begin our programme of proactive LV fuse assembly replacements.

Our planned renewals Capex for overhead conductors will allow:

- renewal of poor health subtransmission conductor, particularly copper and ACSR conductor with greasing issues, to mitigate safety and reliability risk

[54] Overhead conductor forecasts represent the cost to replace the conductor only, with associated pole and crossarm costs captured in the overhead structures portfolio. Projects are planned, scoped and delivered as overhead line projects.

- significantly increased renewal of distribution conductor to address increasing failures and associated public safety risks
- increased renewal of LV conductors to effectively manage asset health, particularly in urban areas where safety risks are higher
- proactive replacement of LV fuse assemblies reducing overall costs and unplanned outages and improving customer service.

Beyond the CPP Period expenditure is expected to remain at approximately FY23 levels.

Box 11.4: Overhead conductor justification

We are confident that our approach delivers an efficient and prudent level of investment because:

- **Prudent drivers**: investment will help us effectively manage safety risks (from falling conductors). Additionally, we are not satisfied with the deteriorating performance of our overhead lines. Investment will, over time, stabilise our fault performance.
- **External reviews**: our distribution conductor failure analysis model has been reviewed by external specialists and has been assessed as good practice.
- **Verifier review**: the overhead conductors programme has been reviewed by the verifier and their feedback has been incorporated, reducing distribution and low voltage reconductoring volumes where we need to first improve our condition assessment processes.
- **Cost effective**: reconductoring unit rates are based on historical tendered projects
- **Deliverable**: new service provider agreements are being put in place, ensuring adequate resource (such as linesmen) to deliver the increasing reconductoring volumes
- **Review and moderation**: forecasts have been reviewed by executive management and the Board, and the forecasts have moderated to reflect feedback
- **Efficiency gains**: as we improve our asset management and works delivery processes we expect to be able to gain future efficiencies (such as from improved condition assessment techniques and delivery optimisation). We have included an efficiency allowance of 8% by FY23 in our forecast to reflect this.

11.7 Cables portfolio

Our cable portfolio includes three fleets:

- **subtransmission cables**: primarily 33 kV but some at 66 kV
- **distribution cables**: 6.6 to 22 kV, XLPE and PILC
- **low voltage cables**: including low voltage link, pillar and service boxes (LV boxes).

The remainder of this section sets out our proposed levels of investment in these fleets during the CPP Period and the basis for the proposed investments, noting that our planned investments are focused on addressing known issues, and that proposed level of expenditure is broadly in line with historical levels.

11.7.1 Investment drivers and forecasting approach

This section provides an overview of our approach to forecasting cable renewals, overviews of our plans by fleet, and our proposed expenditure during the CPP Period.

Investment drivers

Below we provide detail on main drivers for our proposed investment in cable renewals and how they have informed our forecasts for the CPP Period.

Safety

A key driver for replacement of LV boxes is managing safety risk. Metallic enclosure boxes can be inadvertently livened while other types are prone to overheating due to internal component deterioration and corrosion. These issues are aggravated when LV boxes are physically knocked. LV boxes are easily accessible by the public, so managing this safety risk is critical.

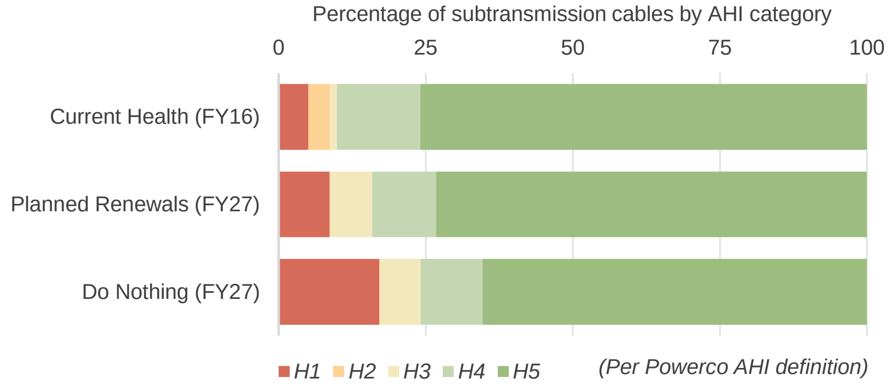
Type issues

Known type issues include some batches of our 11 kV PILC distribution cable whose sheaths have become brittle, allowing water ingress. First generation XLPE cable is also prone to water treeing leading to failure. These cables have high failure rates and we are progressively replacing them to manage network reliability.

Asset health

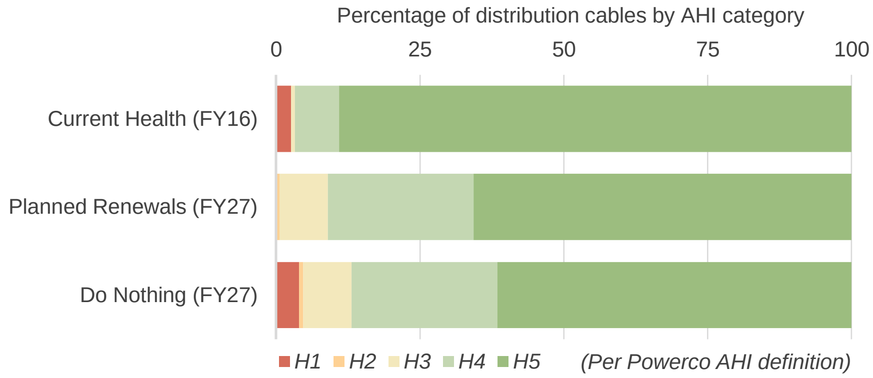
Four of our subtransmission cable circuits in Palmerston North are in poor health. They are pressurised oil-filled cables, and have a history of significant oil leaks (with associated environmental risks). This is reflected in the overall health of the subtransmission cable fleet, shown below. The replacement of these circuits (prior to the CPP Period) will stabilise the health of the fleet and ensure our subtransmission cable circuits remain secure. Towards the end of our 10-year planning horizon early XLPE circuits may start requiring replacement (shown in the H1 planned renewals scenario), but not until after the CPP Period.

Figure 11.16: Subtransmission cable – current and projected asset health



Shown below is the current and projected asset health of the distribution cable fleet. The cable in the H1 category in the "current health" scenario represents the small amount of type issue based replacements (explained above). Renewing this cable, together with some condition-based replacement (at historical levels) will ensure the health of the fleet remains stable to the end of the planning period, and that reliability risk is managed.

Figure 11.17: Distribution cable – current and projected asset health



Reactive

Inevitably, some reactive renewals will be required. Failures often occur as a result of foreign interference (such as a vehicle hitting an LV box, or cable strike from third party excavations), or due to poor condition that has not been recognised. The latter particularly applies to the LV cable fleet for which our condition information is currently inadequate to support a proactive renewal approach, as a result we use a run-to-failure approach.

Summary of forecasting approach

For our subtransmission cables, we carry out regular inspections and collect detailed condition information. We analyse this information to plan individual renewal investments that primarily aim to manage reliability risk. The projects are supported by desktop cost estimates based on the planned scope of works.

Our medium-term distribution renewal forecast is based on cables with known type issues. Beyond this, we use age as a proxy for condition to forecast renewal needs. This is appropriate as other asset information is limited, and the forecast is generally in line with historical levels.

Low voltage cables are managed using a run-to-failure strategy, so we use historical trends to inform our renewal forecasts. We expect to slowly increase the renewals over the CPP Period as condition deteriorates while these assets age.

Unit rates for distribution and low voltage cables are based on a combination of supplier quotes and historical averages. The type of trenching and traffic management required for renewal is taken into account for distribution cable replacement.

The approaches are summarised in Table 11.7. Further detail is provided in Chapter 17 of the 2017 AMP.

Table 11.7: Summary of cables renewals approach

Renewal triggers	**Proactive Condition-based**: subtransmission pressurised oil cables in Palmerston North are in poor condition and require replacement to manage reliability and environmental risks. Distribution cables are also replaced when their condition is poor. **Type**: some distribution cables and LV boxes have known type issues and require replacement to manage reliability (distribution cable) and safety (LV boxes) risks. **Reactive**: third party actions and low voltage cables.
Forecasting approaches	**Identified projects:** subtransmission cable condition information is analysed to form identified renewal projects. **Type:** distribution cable assets with known type issues are prioritised in the renewal forecasts. **Age:** longer term age is used as a proxy for condition-based replacement for distribution cable. **Historical trends:** reactive renewal of LV cable assets is forecast using historical trends.
Cost estimation	**Desktop project estimates:** subtransmission projects with known scopes are estimated based on desktop assessments. **Volumetric**: historical rates and supplier quotes inform average costs for distribution and low voltage cable replacement.
Criticality	**Load**: primarily driven by the load being supplied (both size of load and type), with other factors including level of redundancy and public safety.

11.7.2 Cable fleets overview

Below we summarise our planned investments in each of the cable fleets.

Subtransmission Cables

We have identified the need to replace the oil pressurised cable circuits in the Palmerston North CBD area due to the excessive oil leaks from their joints and concerns about ongoing reliability. Unavailability of these circuits places Palmerston North at an increased risk of loss of supply. Failures of these cables at their joints have already occurred, and their replacement is currently being planned and undertaken prior to the CPP Period.

The rest of the fleet is in good health and no additional replacement is expected during the CPP Period.

Distribution Cables

The health of the distribution cable fleet is generally very good, with over 80% of the fleet not likely to require replacement in the next 20 years. Type issues affect a small proportion of the fleet (approximately 2%) and will require renewal in the short to medium term. A small amount of condition-based replacement is expected during the CPP Period, forecasted on the basis of age but in line with historical amounts. These renewal investments aim to manage the overall reliability of the fleet.

Low Voltage Cables

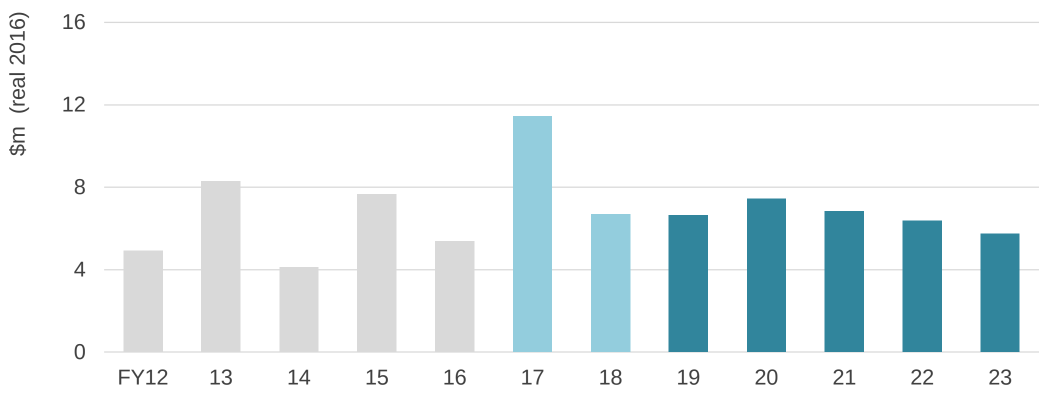
Renewal of LV cable is generally managed using a run-to-failure strategy. We expect renewals to continue in line with historical trends, with a slight increase during the CPP Period to account for ageing of the fleet.

We have identified approximately 5,000 LV boxes with safety-related risks. We have been working to remove these types of LV boxes from our network and we plan to increase the rate of renewal during the CPP Period. This will reduce the associated safety risk.

11.7.3 Cables renewal Capex

Proposed cable renewals Capex during the CPP Period together with equivalent historical spend, is shown in Figure 11.18.

Figure 11.18: Proposed cables renewals Capex



During the CPP Period we expect to invest $33m in cables renewals. This accounts for 7% of our total renewals Capex over the period.

Forecast renewal expenditure is generally in line with historical levels. The increased expenditure in FY17 relates to our subtransmission cable works in Palmerston North. Likewise, historical peaks in FY13 and

FY15 are due to subtransmission works, with distribution and low voltage works generally stable both historically and forecast. Beyond the CPP Period, portfolio expenditure is expected to remain stable.

The planned renewals investments in the cables portfolio will:

- through targeted asset renewal of subtransmission and distribution cable, ensure reliability of the fleets do not degrade
- accommodate increasing reactive replacement of low voltage cable as the fleet ages
- address public safety risks associated with LV boxes, by replacing those that are potentially hazardous.

Box 11.5: Cables portfolio justification

We are confident that our approach delivers an efficient and prudent level of investment because:

- **Prudent drivers**: our expenditure over the CPP Period will address public safety risks, stabilise reliability, and prevent environmental issues associated with oil-filled cables.
- **Historical alignment**: our planned investment level is in line with historical amounts.
- **Review and moderation**: forecasts have been reviewed by executive management, the Board and the verifier, and the forecasts were moderated to reflect feedback.
- **Efficiency gains**: as we improve our asset management and works delivery processes we expect to be able to gain future efficiencies. We have included an efficiency allowance in our forecast to reflect this.

11.8 Zone substations

Zone substations play a critical role in our network. Prudent management of these assets is essential to ensure a safe and reliable service. Zone substations provide bulk supply of electricity for distribution to end users. Supply for many thousands of customers depends on a few key assets within zone substations.

This portfolio includes the following six fleets:

- **power transformers**: the majority being 33/11 kV, with capacities ranging from 1.25 to 24 MVA
- **indoor switchgear**: 11 and 33 kV, including oil, SF_6 and vacuum interrupters
- **outdoor switchgear**: consisting of circuit breakers, switches, fuses and zone substation reclosers
- **buildings**: in zone substations mainly house protection, SCADA, communications and indoor switchgear equipment
- **load control injection**: inject ripple frequencies to control load such as hot water
- **other zone substation assets**: including outdoor bus systems, fencing and security, earthing and lightning protection.

The remainder of this section provides detail on the first three fleets, which comprise the majority of zone substation renewal Capex. This increased expenditure will ensure end-of-life equipment can be appropriately managed, and seismic risks appropriately addressed. For the remaining three fleets a summary is provided.

11.8.1 Power transformers

Zone substation transformers are used to transform power supply from one voltage level to another, generally 33/11kV, but some are 33/6.6kV, 66/11kV or 11/22kV. Capacities range from 1.25 to 24MVA.

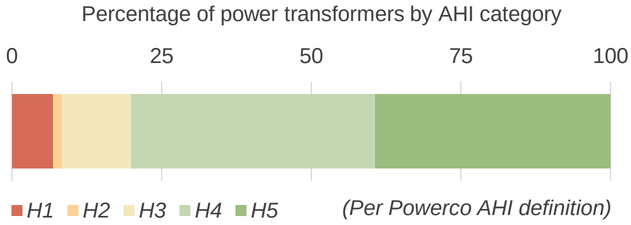
Investment drivers

Below we provide detail on the main drivers for our proposed investment in power transformer renewals and how they have informed our proposed forecasts.

Asset health

We have developed a condition-based asset health model for power transformers. Condition indicators used in the model include dissolved gas analysis, paper insulation degree of polymerisation, external tank condition and known type or design issues. Figure 11.19 shows current transformer health.

Figure 11.19: Power transformer asset health



Fourteen power transformers are currently assessed as needing replacement (H1), making up 7% of the fleet. These units will be replaced as a priority, with their replacement timing set by also considering the transformers' criticality and the timing of any related zone substation works (such as switchboard replacements or growth augmentations). Proactively replacing power transformers in poor health reduces reliability risk (see below).

Reliability

Power transformers are replaced to manage reliability risks. We always aim to replace power transformers prior to failure, to ensure no load is lost (especially at sites of limited backup supply) and to avoid potential collateral damage should a unit fail catastrophically. If a power transformer was to fail, depending on its location on the network, a loss of supply could persist for an unacceptable period as spare units are mobilised. Replacing power transformers in poor health and with high network criticality will mitigate these risks.

We also plan to undertake a programme of firewall installations, mainly to limit damage caused by a transformer fire. They are only used where space is constrained and the distance between transformers and other equipment is insufficient.

Environment

While compliant with local government requirements of the time, some of our existing power transformers have inadequate or no oil bunding, which poses an environmental hazard (soil contamination) in the event of a transformer oil leak. This can be addressed by installing bunding with an associated oil containment and separator system. We intend to retrofit these to all our power transformers that do not already have them during the next ten years. Implementing these measures will also reduce the environmental impact in the event of an explosive transformer failure.

Summary of forecasting approach

We use an asset health model to forecast how many power transformers will require replacement due to poor condition over the CPP Period. Our model takes into consideration both condition factors (such as external appearance and the results of diagnostic tests) and non-condition factors (such as unavailability of spares) to determine an asset health score for each power transformer. This, with the current age of the asset, is used to determine the remaining life and estimated replacement year for each transformer.

Timing of replacement is often adjusted to align with other zone substation works for efficient delivery (typically up to five years forward or backwards). It is also adjusted based on the power transformer's criticality (size and security of load). A desktop cost estimate is developed for each forecast transformer replacement, taking into account the site-specific requirements of the project.

On average, we expect to replace three to four power transformers per year during the CPP Period.

The approach is summarised in Table 11.8. Further detail is provided in Chapter 18 of the 2017 AMP.

Table 11.8: Summary of power transformer renewals approach

Renewal trigger	**Proactive condition-based**: informed by the asset health model, we base our transformer renewal decisions on detailed condition assessments including diagnostic testing.
Forecasting approach	**Asset health and criticality**: our quantitative asset health model using diagnostic inspection results is combined with asset criticality to produce forecast renewal timing for each power transformer.
Cost estimation	**Desktop estimate**: planned power transformer replacement projects are costed individually, based on desktop analysis of site specific requirements.
Criticality	**Security and load**: power transformer criticality is influenced by the site security and substation load. An adjustment to the forecast is made based on the criticality of the asset – for instance, a power transformer with high criticality will have its replacement brought forward.

11.8.2 Indoor switchgear

Indoor switchgear comprises individual switchgear panels assembled into a switchboard. These contain circuit breakers, isolation switches and busbars along with associated insulation and metering. They also contain protection and control devices along with their associated current and voltage transformers.

Investment drivers

Below we provide detail on the main drivers for our proposed investment in indoor switchgear renewals during the CPP Period.

Safety

The primary driver for the replacement of indoor switchgear is managing safety risk, particularly to our field staff. Our assessment of our 11 kV switchboards for severity of arc flash found that approximately one third of these switchboards pose a higher than acceptable risk. Arc flash risks associated with indoor switchgear are driving us to renew older oil switchgear in particular. Although we can mitigate these risks to some extent, such as through remote switching and additional PPE, we are unable to remove the risk of serious harm. We are planning several mitigations to reduce this risk for assets we are retaining, including the installation of arc flash protection and arc blast proof doors. In many cases, especially for older oil switchgear, a lower whole of life cost is achieved by replacing the complete switchboard.

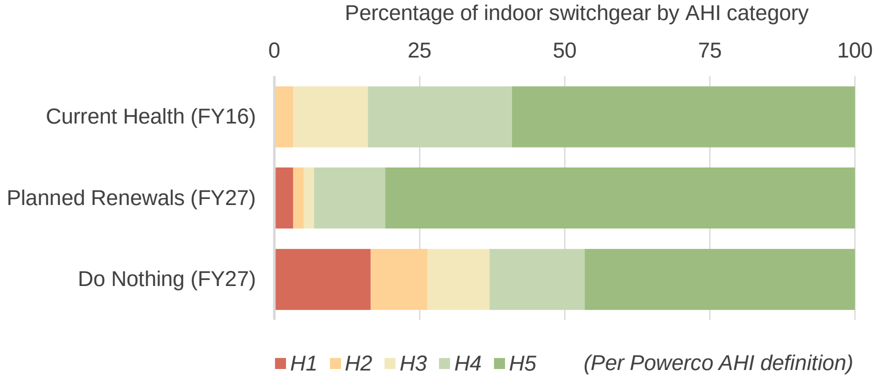
Reliability

Although safety is the primary renewal driver for this fleet, we also consider reliability risks associated with switchgear failure. Switchgear failure typically requires at least the associated bus to be cleared to interrupt the fault, usually disconnecting thousands of customers in the process. Assuming the failure is minor, supply can typically be restored to customers in a few hours, but if a catastrophic failure were to occur, loss of supply could be prolonged. We prioritise switchgear replacement where high reliability risks are present due to equipment unreliability, to ensure customers don't experience extended loss of supply.

Asset health

Figure 11.20 shows current and forecast AHI for the indoor switchgear fleet. We have developed a prototype Condition-Based Risk Management (CBRM) model for the outdoor and indoor switchgear fleets to calculate AHI for these fleets. This model uses asset condition results, type information and asset criticality to calculate fleet risk, and allows us to test our forecasts and prioritisation.

Figure 11.20: Indoor switchgear – current and projected asset health



The overall health of the fleet shows that approximately 16% (H1-H3) of indoor circuit breakers are expected to require replacement over the next 10 years (though actual replacement required is likely to be higher as poor circuit breaker health can trigger replacement of the entire switchboard).

The health of indoor switchgear is forecast to remain generally stable from now through to 2027 under our forecast replacement programme, as we prioritise switchboards with high arc flash risk and poor condition.

Summary of forecasting approach

As we have relatively few indoor switchboards, we can individually assess the condition, safety risks, characteristics and performance of the assets in order to determine renewal requirements. In effect, we have lengthened our usual shorter-term planning horizon to cover the CPP Period and beyond (though with less rigour beyond FY23).

Similar to power transformer replacements, a desktop cost estimate is developed for each switchboard replacement, taking into account the site-specific requirements of the project.

The approach is summarised in Table 11.9. Further detail is provided in Chapter 18 of the 2017 AMP.

Table 11.9: Summary of Indoor switchgear renewals approach

Renewal trigger	**Proactive condition-based with safety risk**: we consider switchboard condition and risk of failure, with a focus on arc flash risk, when identifying switchboard replacements
Forecasting approach	**Identified projects**: we have considered the renewal triggers above to form a long-term forecast of switchboard replacements
Cost estimation	**Desktop estimate**: individual cost estimates are developed for each planned switchboard replacement project, taking into consideration site specific requirements
Criticality	**Safety**: criticality focuses on safety risk to personnel from arc flash, while also considering load at risk

11.8.3 Outdoor switchgear

The zone substation outdoor switchgear fleet comprises several asset types including outdoor circuit breakers, air break switches, load break switches, fuses, and zone substation reclosers. Outdoor switchgear is primarily used to control, protect and isolate electrical circuits in the same manner as indoor switchgear.

Investment drivers

Below we provide detail on the main drivers for our proposed investment in outdoor switchgear renewals and how they have informed our forecasts.

Safety

As with indoor switchboards, we carefully manage the condition of outdoor switchgear due to the potential for explosive failure. Older oil switchgear in particular has the potential to fail catastrophically, especially when it is being operated, with significant safety risk for our field staff. Catastrophic failure also has the potential to cause collateral damage to nearby zone substation equipment, and cause environmental damage from spilt oil. We must replace these outdoor switchgear types with known unreliability (especially oil switchgear), to manage these risks.

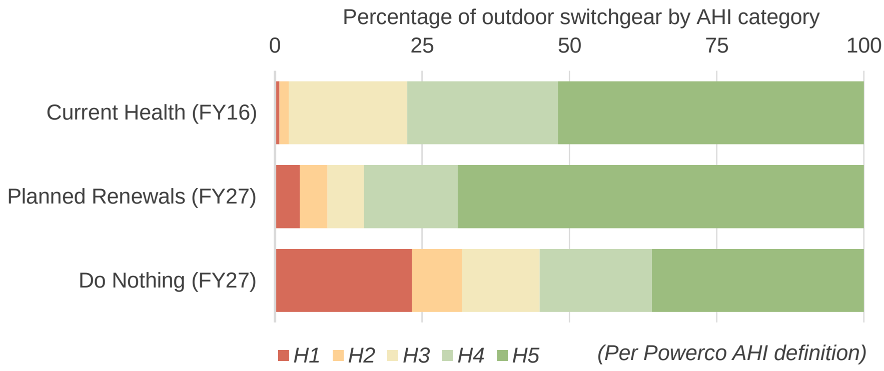
Reliability

Reliability of our zone substations is a strong driver for the outdoor switchgear fleet, especially for our programme of outdoor to indoor conversions[55]. Some of our older zone substation sites were designed with outdoor 33 kV switchgear, and often with no bus coupling circuit breaker putting significant load at risk if a fault was to occur. Outdoor switchgear is generally more susceptible to faults than indoor switchgear (for example, indoor switchgear is protected from bird strikes and debris, and is less susceptible to corrosion). For zone substations with significant load and outdoor switchgear that requires replacement, we consider the benefits of replacing the outdoor switchgear with a modern indoor 33 kV switchboard. This decision also takes into consideration the safety of the outdoor structure when performing maintenance, and the location of the zone substation and its visual impact on the community.

Asset health

Figure 11.21 shows the AHI for our population of outdoor switchgear. Like indoor switchgear, we use our prototype CBRM to calculate outdoor switchgear asset health, based on asset condition results, type information and asset records.

Figure 11.21: Outdoor switchgear – current and projected asset health



The overall health of the outdoor switchgear fleet is poor, with approximately 22% (H1 to H3) requiring replacement over the next 10 years. A significant increase in renewal investment is required to stabilise the health of this fleet. We can maintain stable asset health through to 2027 by increasing renewal investment in line with our forecast. Without this investment however, the health of the fleet will significantly degrade, increasing the reliability and safety risk of the fleet.

Summary of forecasting approach

We use an age-based approach for our medium-term forecasts. Age is a robust proxy for asset condition in outdoor circuit breakers, as older assets are generally less reliable than newer assets, and have been more exposed to corrosion, and wear and tear from operating. Using age as a proxy for condition also accounts for older switchgear designs generally having fewer safety features compared to modern

55 Outdoor to indoor conversions are discussed under outdoor switchgear as these assets drive the programme, however the expenditure is classified under Indoor Switchgear as this what gets installed.

equivalent assets. We use a conservative replacement age of 45 years, higher than industry benchmarks, and which, in our experience, correlates well with observed, useful life on our network.

The approach is summarised in Table 11.10. Further detail is provided in Chapter 18 of the 2017 AMP.

Table 11.10: Summary of outdoor switchgear renewals approach

Renewal trigger	**Proactive condition-based**: we consider the overall condition of outdoor switchgear, and the related safety and reliability risks, when planning replacement
Forecasting approach	**Age**: age as a proxy for condition is used to produce the longer term forecast
Cost estimation	**Historical averages**: outdoor switchgear renewal costs are based on historical works
Criticality	**Reliability**: potential reliability impacts, based on the number of connected customers, form the basis of outdoor switchgear criticality

11.8.4 Remaining Zone Substation fleets

This section provides an overview of our approach to renewal Capex forecasting for the remaining Zone Substation fleets and overviews of our plans by fleet. The fleets are: buildings; load control injection assets; and other zone substation assets.

Investment drivers

Below we provide detail on main drivers for our proposed renewals investment in the remaining Zone Substation fleets during the CPP Period.

Safety

A number of our zone substation buildings do not meet our seismic requirements or comply with modern standards, raising concerns around the safety of staff working in them. We plan to bring all our zone substation buildings up to a NZSEE[56] grade of B or better.

We are also planning a programme of zone substation fencing and security renewals, to ensure our sites are secure and prevent public access. Replacement of switchyard metalling is also required for some sites, to ensure compliance with our earthing guidelines and to manage safety risks.

Resilience

The seismic strengthening of our zone substation buildings (discussed above) also has a reliability driver. As a lifeline utility, we must be able to maintain (or quickly restore) electricity in the event of a major earthquake, requiring our assets to be able withstand these events. We are also reviewing the seismic compliance of our outdoor busbars, ensuring connections between equipment are flexible and won't break during a seismic event.

Obsolescence

A significant proportion of our load control injection assets have become obsolete, as they do not share the communication protocols of our newer assets, and spares are no longer available. We plan to decommission or replace these assets.

Summary of forecasting approach

The renewal forecast of these fleets is based on planned projects and programmes of work. The timing of building seismic reinforcements is determined for each site individually, based on the relative criticality of the site and its current level of seismic compliance. Project timing is also adjusted to align with other zone

[56] New Zealand Society of Earthquake Engineering

substation works (particularly indoor switchgear renewal). Programme and project costs are based on previously completed works.

The approach is summarised in Table 11.11. Further detail is provided in Chapter 18 of the 2017 AMP.

Table 11.11: Summary of forecasting approach

Renewal triggers	**Seismic risk**: seismic reinforcement of zone substation buildings is based on achieving an NZSEE standard of B or greater **Obsolescence**: some of our load control plant is no longer compatible with modern standards, and ongoing serviceability is a concern **Safety and reliability risk**: programmes of zone substation fencing and security, switchyard metalling, flexible busbar connections and lightning protection will mitigate known safety and reliability risks
Forecasting approach	**Various**: based on the triggers above, projects and programmes of work have been planned for the forecast period.
Cost estimation	**Historical averages**: based on previously completed works. Building refurbishments are based on recent strengthening works by building types (e.g. wooden frame, masonry) and level of seismic compliance. Rates were prepared by external specialists.
Criticality	Zone substation criticality is primarily determined by the number and type of connected customers.

Individual fleets

Below we summarise our planned investments in the remaining zone substation fleets.

Buildings

Zone substation buildings mainly house protection, SCADA, communications and indoor switchgear equipment. We have 158 buildings at our zone substations. These are constructed of various materials including concrete, timber and masonry.

We have performed desktop assessments of the seismic ratings of our zone substation buildings. Approximately 35% of buildings require seismic strengthening. As a lifeline utility, we need to ensure we can restore supply after a significant seismic event. The need to stay ‘current’ regarding seismic requirements has been further highlighted by recent earthquakes in Kaikoura and ongoing seismic activity in Christchurch. New Zealand is a seismically active country and ensuring equipment reflects required industry and legislative requirements is a key focus for us.

We have commenced addressing these requirements, and we will continue to do so over the CPP Period.

Load control injection

We currently operate a fleet of 36 load control injection plants. Ten of these are CycloControl based, mainly supplying the Stratford and Huirangi networks, which use an obsolete signalling method, suffer more faults than other systems, and the assets can no longer be supported. These plants have been superseded by two recently installed ripple injection plants that will take over the entire area’s load control. We will decommission these plants once ripple receiver relay owners transition their devices to work with the updated modern formats. We are also planning on replacing seven other legacy load control injection plants by the end of the CPP Period, completing our modernisation programme commenced 5 to 10 years ago.

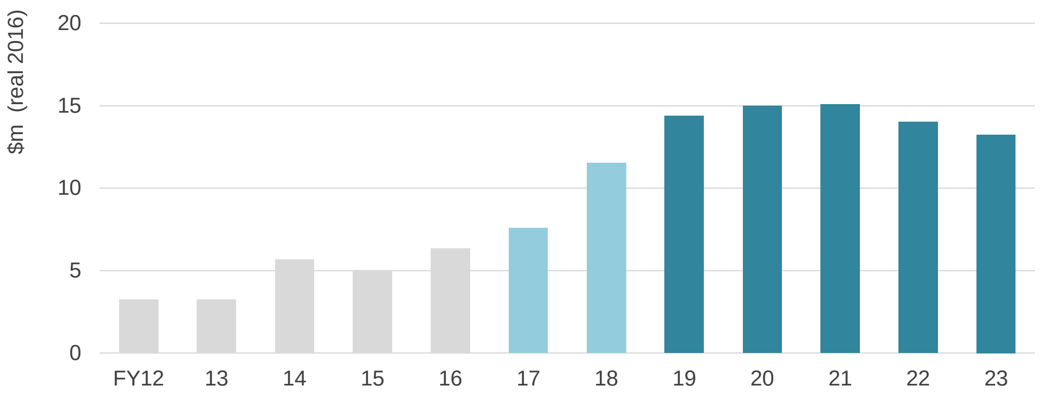
Other zone substation assets

This fleet includes renewal programmes targeting areas of safety and reliability risk. Fencing and security works will be undertaken to ensure our sites are secure and prevent public access. Switchyard metalling will be replaced where no longer compliant with our earthing standards. Seismic compliance of busbar connections will be reviewed, with flexible connections installed in place of older rigid connections. Lighting protection systems will also be reviewed, and surge arrestors and other forms of lightning protection installed where necessary.

11.8.5 Zone Substations renewals Capex

Proposed zone substations renewals Capex during the CPP Period, with equivalent historical spend, is shown in Figure 11.22.

Figure 11.22: Zone substation renewal forecast expenditure



During the CPP Period we expect to invest $72m in zone substation renewals, which is approximately 16% of our total forecast renewals expenditure.

We plan to increase zone substation renewal expenditure relative to historical levels[57]. This is primarily driven by increases in power transformer and indoor switchgear renewal. This need is reflected in the increasing renewal expenditure from FY15-FY18.

Improving the asset health of our zone substations has become a key focus for us in recent years as large numbers of assets constructed in the 1960s and 1970s are now in poor health, and renewal cannot be further deferred. The forecast reduces late in the CPP Period due to our efficiency targets (see Section 10.5).

Power transformer renewal is a key area of focus for us during the CPP Period. Few have been renewed since their original installation, with the exception of some replacement as part of growth augmentations. We have had an overhaul and rotation to maximise the useful life of these assets but scope for this is now reducing. Renewal is required at this point, and our asset health modelling indicates that we will need to replace three to four units per year during the CPP Period, in order to avoid loss of supply to customers. Replacement at this level will continue beyond the CPP Period.

The planned increase in switchboard renewals is primarily driven by the need to better manage arc flash risk. Older oil switchgear in particular often has high arc flash levels, which can't be effectively mitigated

[57] Note that the historical expenditure shown above excludes some asset replacements that occurred through growth augmentations, so the level is somewhat suppressed.

other than by replacement. We don't compromise the safety of our staff, so must act to effectively mitigate these risks. We expect to replace four switchboards per year during the CPP Period.

The planned renewals Capex for zone substations will:

- replace power transformers that are in poor health and present high reliability risks
- mitigate arc flash risk, primarily by renewing indoor switchboards, but also by undertaking retrofits where practical
- replace poor condition outdoor switchgear, and where reliability risks are greater we may convert to an indoor switchboard
- ensure seismic compliance of our zone substation buildings, so we can maintain supply after a major earthquake and improve safety for our workers
- bring our load control injection fleet up to modern standards so that the significant value of load control can continue to be realised.

Beyond the CPP Period expenditure is expected to stabilise, as the worst arc flash risks will have been mitigated and power transformer health improves. However, ongoing renewal will be required to maintain performance.

Box 11.6: Zone substations justification

We are confident that our approach delivers an efficient and prudent level of investment because:

- **Prudent drivers**: increasing investment is primarily to manage unacceptable safety risk to staff due to arc flash, and reliability risk from transformers in poor health.
- **Modelling aligned to good practice**: our power transformer AHI model is based on the EEA's guide to asset health modelling.
- **Verifier review**: the zone substations programme has been reviewed by the verifier and we have incorporated their feedback
- **Review and moderation**: forecasts have been reviewed by executive management and the Board, and the forecasts have moderated to reflect feedback
- **Efficiency gains**: as we improve our asset management and works delivery processes we expect to be able to gain future efficiencies (such as from improved delivery techniques). We have included an efficiency allowance of 8% by FY23 in our forecast to reflect this.

11.9 Distribution transformers

Distribution transformers convert distribution level voltages energy to LV, generally from 11 kV (but in some cases 6.6 kV or 22 kV) down to 400/230V. Their effective performance is essential for maintaining a safe and reliable network.

The portfolio includes three fleets:

- **pole mounted distribution transformers**: majority ranging from 15 to 100 kVA
- **ground mounted distribution transformers**: majority ranging from 100 to 500 kVA
- **other distribution transformers**: including voltage regulators, capacitors, conversion and single wire earth return (SWER) transformers.

The remainder of this section sets out our proposed levels of investment in these fleets during the CPP Period and supporting rationale. Proposed investment is in line with historical levels.

11.9.1 Investment drivers and forecasting approach

This section provides an overview of our approach to forecasting distribution transformer renewals, overviews of our plans by fleet, and our proposed expenditure during the CPP Period.

Investment drivers

Below we provide detail on main drivers for our proposed investment in distribution transformer renewals and how they have informed our proposed forecasts.

Safety

Following a major change to the national seismic standards in 2002, some of our larger pole mounted transformers are no longer seismically compliant. While we are not obliged to bring these assets up to modern seismic standards, they present a clear safety risk (as well as potentially causing outages). We intend to proactively reduce this risk by converting large pole mounted units to ground mounted equivalents in urban areas, or upgrading the associated poles to meet seismic codes. This will also reduce the need for personnel to work at heights, which is another key safety risk.

Renewals will be prioritised based on risk, as determined from structural assessments of individual sites. We intend to complete our programme of seismic upgrades by 2028.

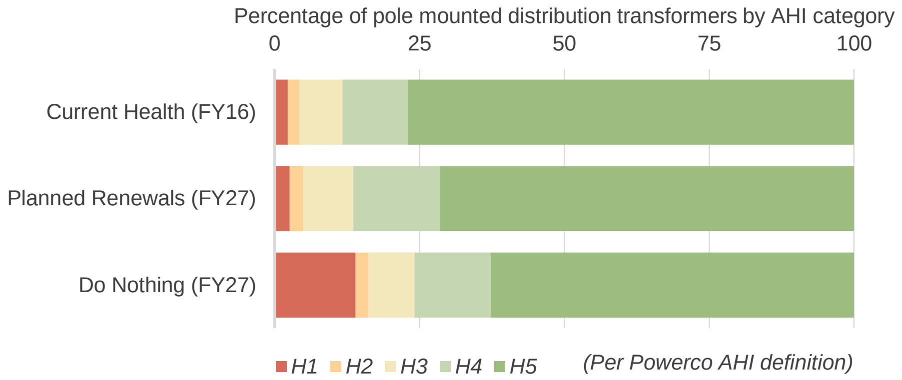
Some of our older distribution transformers do not have low voltage fuses to protect against downstream faults and enable fast clearing of conductor faults. In this case, a fault cannot be cleared until it is manually isolated (or the High Voltage (HV) fuse blows), posing a significant safety risk to both our service providers and, in particular, the public. In 2013 we initiated a programme to install LV fuses on 6,700 existing pole mounted distribution transformers, predominantly in the Taranaki, Valley and Wairarapa areas. This programme will be completed by 2023.

Ground mounted distribution transformers are made secure from the public by the use of padlocks. We have several legacy padlocking systems that have been inherited from prior integrations of previously independent networks. As a result, our current padlocks are non-standardised and the access register (of who has keys to network locks) has fallen out of date. We need to replace our locks and keys, standardising on a single system (also to be used within distribution switchgear and zone substation portfolios), to ensure access to our assets is appropriately controlled and to ensure that we meet our obligations under the Electricity Act and the Health and Safety Act.

Asset health

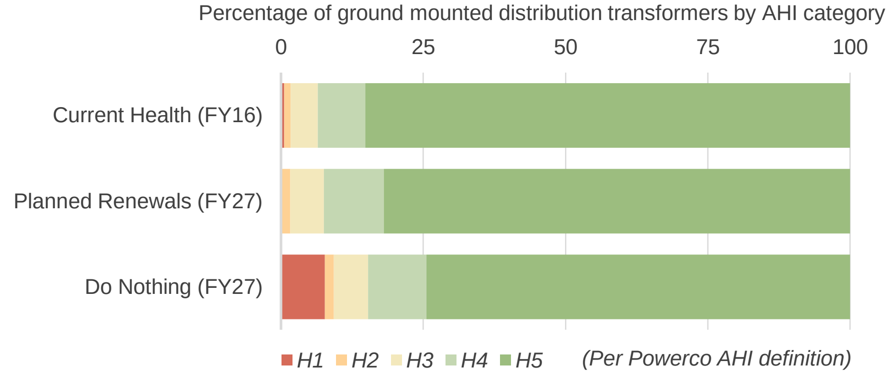
Figures 11.23 and 11.24 show AHI for our pole mounted and ground mounted distribution transformer fleets. The overall AHI is based on historical survivorship and defect analysis.

Figure 11.23: Pole mounted distribution transformers – current and projected asset health



The overall health of the pole mounted transformer fleet is generally good, with few assets currently requiring replacement. However, AHI modelling indicates that we should expect to replace 12% of the fleet (H1-H3) over the next 10 years. The level of investment proposed for the CPP Period will replace transformers in poor condition in order to maintain a stable asset health position.

Figure 11.24: Ground mounted distribution transformers – current and projected asset health



Like the pole mounted fleet, the overall health of our ground mounted transformers is generally good, with few assets requiring replacement in the short term. However, our AHI modelling indicates we should expect to replace 6% of the fleet (H1-H3) over the next 10 years in order to maintain this stable asset health position. We have planned for this level of replacement during the CPP Period.

Foreign interference

On occasion, we need to replace distribution transformers reactively due to foreign interference, such as from vehicle impacts or extreme weather. We try to locate assets away from road edges, and where possible not locate transformers or poles carrying transformers on busy intersections or road corners. We expect these replacements to continue at historical levels during the CPP Period.

Summary of forecasting approach

For condition-based replacements of pole and ground mounted transformers, we developed survivor curves based on historical replacement information. This approach ensures that our forecasts reflect the particular characteristics of our network and the service life we have historically achieved from distribution transformer assets.

The use of separate curves for pole and ground mounted transformers reflects the different degradation characteristics and failure modes of each, and therefore different survivor characteristics. Ground mounted distribution transformers tend to have longer lives than pole mounted units. This is consistent with the additional condition assessment and maintenance applied to ground mount units, and the fact they are typically protected by an enclosure thereby limiting corrosion.

LV fusing, seismic conversions of pole mounted distribution transformers and lock and key replacement programmes are forecast as programmes of work, based on the scope and expected costs of each.

We forecast replacement needs for the ‘other distribution transformers’ fleet based on age. This approach is appropriate as the forecast materiality is low, and is in line with historical levels.

Our approach is summarised in Table 11.12. Further detail is provided in Chapter 19 of the 2017 AMP.

Table 11.12: Summary of distribution transformer renewals approach

Renewal triggers	**Proactive condition-based**: ground mounted and larger pole mounted distribution transformers are replaced based on condition, assessed via our preventive inspections **Reactive**: smaller, less critical pole mounted distribution transformers are sometimes run to failure, as the impact to customers is low and costs of obtaining better condition information are high.
Forecasting approach	**Survivor curves**: historical replacement information on pole and ground mounted transformers was used to develop survivor curves for forecasting. **Volumetric programmes**: LV fusing, seismic conversions of pole mounted distribution transformers and locks and keys programmes are forecast as specifically scoped programmes.

Cost estimation	**Historical averages**: distribution transformer unit rates are based on historical averages from our network.
Criticality	**Safety and reliability**: distribution transformer criticality is based on the number of customers connected (reliability) and its location (public safety).

11.9.2 Distribution transformers fleets

Below we summarise our planned investments in each of the distribution transformers fleets.

Pole mounted distribution transformers

The health of the fleet is generally stable, and we plan to continue replacement on based on condition (with some smaller less critical units running to failure) to maintain this health profile. The forecast is based on our survivorship modelling.

Some larger units (≥200 kVA) are no longer seismically compliant, and we are proactively converting these to ground mounted units or strengthening the pole structures to reduce the associated safety and reliability risks.

Some of our older distribution transformers do not have low voltage fuses to protect against downstream faults and enable conductor faults to be cleared more quickly. In this case the fault cannot be cleared until it is manually isolated, posing a significant public safety risk in the interim. During the CPP Period we plan to complete our programme of LV fusing that was commenced in 2013.

Ground-mounted distribution transformers

Ground mounted distribution transformers are usually located in suburban areas and CBDs with underground networks. Ground mounted transformers are generally more expensive and serve larger and more critical loads compared with pole mounted transformers.

Ground mounted distribution transformer health is stable, and our CPP forecasts aim to maintain this profile. Replacement is based on condition, identified through our preventive inspection programmes. The detailed forecast is based on our survivorship modelling.

We are planning a padlock replacement programme (which includes the locks on our ground mounted distribution transformers), to standardise our locks and keys across the network, ensuring the access to our assets is appropriately controlled and safety risks are managed.

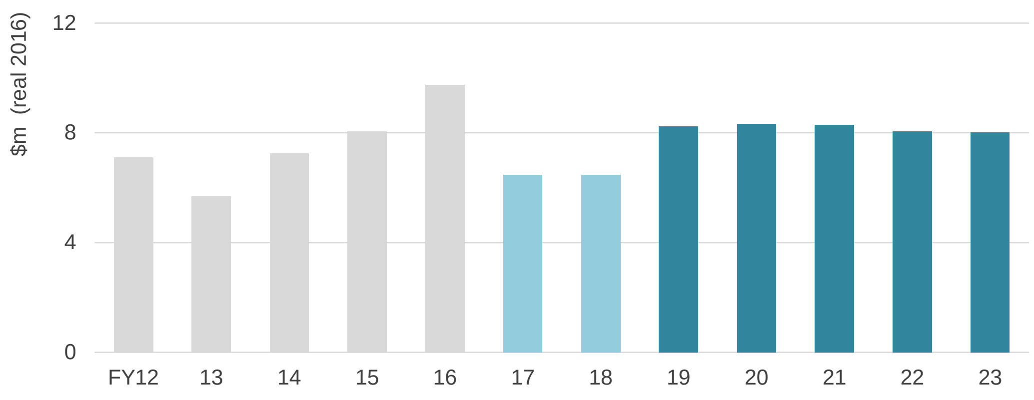
Other distribution transformers assets

Other types of distribution transformers include conversion and SWER isolation transformers, capacitors and voltage regulators. The population of this sub-fleet is a small part of the distribution transformer portfolio and is quite varied. The condition of the fleet is relatively good with no known type issues. A small number of renewals are forecast for the fleet, in line with historical levels.

11.9.3 Distribution transformers renewals Capex

Proposed distribution transformers renewals Capex during the CPP Period, with equivalent historical spend, is shown in Figure 11.25.

Figure 11.25: Proposed distribution transformers renewal Capex



During the CPP Period we expect to invest $41 m on distribution transformers renewals. This accounts for 9% of our total renewals Capex over the period.

Our proposed level of investment is generally in line with historical levels, and is stable during the CPP Period. The step change in FY19 is due to the commencement of proactive seismic conversions of pole mounted transformers and the locks and keys programme.

We expect expenditure to remain at about these levels beyond the CPP Period. The ageing pole and ground mounted transformer fleets will require increasing levels of renewals as more assets reach their expected lives, but will be offset by the completion of the locks and keys and LV fusing programmes. We have also included efficiency targets in the forecast from FY22.

Planned renewals Capex for distribution transformers will:

- reduce safety risks related to some large pole mounted transformers that do not comply with seismic standards
- continue our distribution transformer replacement programmes to maintain the health of the fleet by focusing on poor condition and defected units
- manage public safety risks by completing our LV fusing of pole mounted transformers and installing new padlocks on ground mounted units.

Box 11.7: Distribution transformers justification

We are confident that our approach delivers an efficient and prudent level of investment because:

- **Prudent drivers**: our programmes (LV fusing, seismic reinforcements and locks and keys) are all focused on mitigating known public safety risks.
- **External reviews**: our distribution transformer survivorship models have been reviewed by industry experts and have been assessed as good practice.
- **Cost effective**: distribution transformer unit rates are based on market tested historical averages
- **Historical alignment**: our distribution transformers forecast is in line with historical amounts
- **Review and moderation**: forecasts have been reviewed by executive management and the Board, and the forecasts have moderated to reflect feedback
- **Efficiency gains**: as we improve our asset management and works delivery processes we expect to be able to gain future efficiencies. We have included an efficiency allowance of 8% by FY23 in our forecast to reflect this.

11.10 Distribution switchgear

The distribution switchgear portfolio contains a large number of diverse assets with a wide range of types and manufacturers. The portfolio includes four fleets:

- **ground mounted switchgear**: ring main units and individual ground mounted switches
- **pole mounted fuses**: drop out fuses used for protection and isolation
- **pole mounted switches**: comprises air break switches (ABSs), vacuum insulated isolators and SF_6 gas insulated isolators
- **circuit breakers, reclosers and sectionalisers**: used in automation schemes.

The remainder of this section sets out our proposed levels of investment in these fleets during the CPP Period and supporting rationale. Our proposed expenditure is in line with historical levels.

11.10.1 Investment drivers and forecasting approach

This section provides an overview of our approach to forecasting distribution switchgear renewals, overviews of our plans by fleet, and our proposed expenditure during the CPP Period.

Investment drivers

Below we provide details on the main drivers for our proposed investment in distribution switchgear renewals and how they have informed our proposed forecasts.

Safety

As with ground mounted distribution transformers, our distribution switchgear is made secure in public spaces using padlocks. As explained previously, replacement of locks and keys, standardising on a single system across all our assets, is necessary to ensure that access to our assets is appropriately controlled to meet our obligations under the Electricity Act and the Health and Safety Act.

Oil switchgear (relevant to ground mounted switchgear and circuit breaker, recloser and sectionaliser assets) has the potential to fail catastrophically, imposing safety risks on our service providers and potentially the public especially when the switchgear is unreliable. The potential for explosive failure causing fatalities was highlighted recently in Australia in an incident that occurred during maintenance of bulk oil switchgear. Where we know this oil switchgear to be potentially unreliable (either due to type issues or poor condition) we prioritise its replacement to mitigate these safety risks.

We are planning on moving to vacuum and SF_6 based pole mounted switches in place of ABSs, in part to reduce the safety risks associated with operating ABSs, but also for decreased maintenance costs and improved reliability.

Type issues

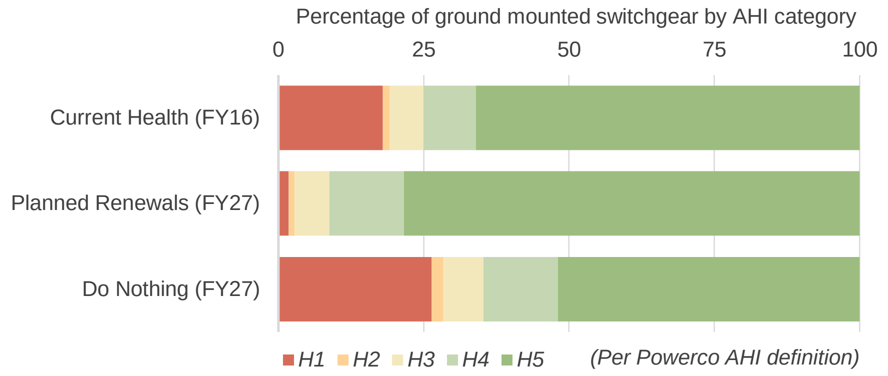
We have a type issue with cast resin switchgear, primarily in the fog-prone area of Taranaki and in the Thames Valley and Waikato areas. When installed in cubicles without heating or co-location with a transformer, surface condensation has resulted in degradation of the asset, causing unreliability. Failure to replace these units will result in worsening reliability. Based on our condition assessment data, we plan to replace the affected cast resin switchgear during the CPP Period.

Certain types of distribution oil switchgear and circuit breakers are unreliable. Design issues, obsolescence or poor reliability increase network and safety risks (including catastrophic failure), and these types of switchgear also tend to be more difficult and expensive to maintain. We have prioritised the renewal of these assets.

Asset health

Figure 11.26 shows AHI for our population of ground mounted switchgear. The AHI is based on asset age and known type issues.

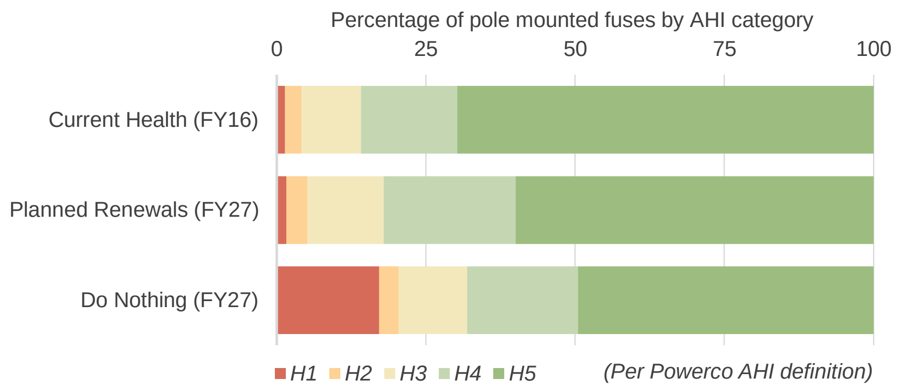
Figure 11.26: Ground mounted switchgear – current and projected asset health



Approximately 20% of the fleet (H1) is in poor health and requires renewal. Over the CPP Period, the overall health of the ground mounted switchgear fleet will improve due to the replacement programmes described above for cast resin and oil-filled switchgear.

Figure 11.27 shows AHI for our population of pole mounted fuses. The AHI for this fleet is based on survivorship analysis.

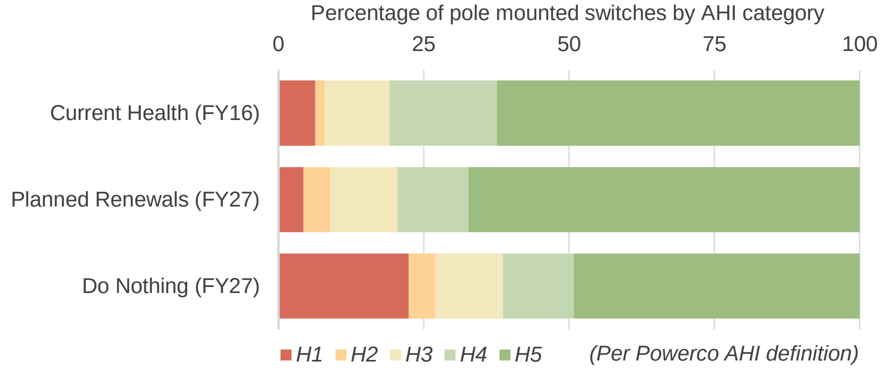
Figure 11.27: Pole mounted fuses – current and projected asset health



The health of the fleet is stable, with the AHI data indicating that 10-15% of the fleet is likely to require renewal over the next 10 years (H1-H3). Our planned works during the CPP Period and beyond will maintain this health profile.

Figure 11.28 shows AHI for our population of pole mounted switches. The AHI is calculated using our knowledge of specific assets with reliability or safety issues, and asset age.

Figure 11.28: Pole mounted switches – current and projected asset health

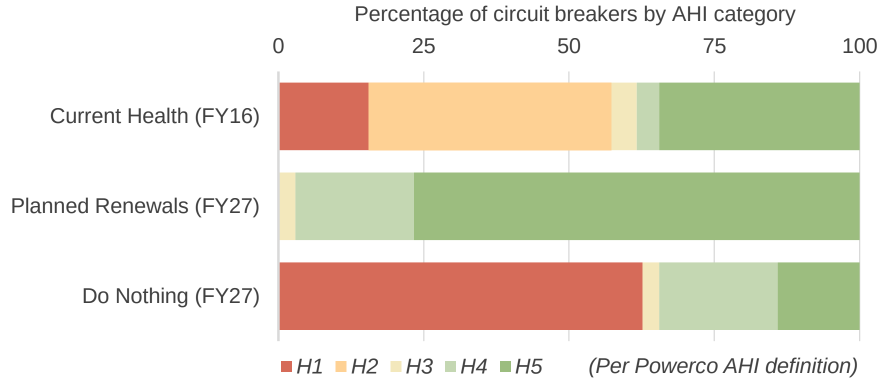


AHI analysis indicates that around 20% of our fleet will require renewal in the next 10 years (H1-H3). Around 7% of pole mounted switches have already exceeded their expected life and likely require replacement (H1).

Our proposed work programme looks to manage the health of the fleet over the planning period. Renewal expenditure levels will remain constant over the CPP Period, and broadly consistent with historical levels. Our plans also include a transition to vacuum and SF_6 based switches in place of ABSs, which for a similar capital cost offer improved reliability and safety and reduced maintenance costs.

Figure 11.29 shows AHI for our population of circuit breakers. The AHI is based on asset age and known type issues.

Figure 11.29: Circuit breakers – current and projected asset health



The health of our distribution circuit breakers is poor, with over 50% of the fleet expected to require replacement over the next 10 years. We have concerns regarding the ongoing safe and reliable operation of a number of oil-filled circuit breaker models (based on ours and other EDB's experience operating this switchgear). There are also a large number of aged circuit breakers at our Kinleith site, where arc flash levels are high, and replacement of these is needed. Our CPP plans include significant investment in this area to improve our circuit breaker asset health and manage the associated safety and reliability risks.

The health of recloser and sectionaliser assets is very good with very little replacement expected in the next 10 years. No forecast AHI is shown due to the small amount of forecast renewals.

Summary of forecasting approach

Where fleets contain assets with known type issues with safety risks (e.g. ground mounted switchgear and circuit breakers), our forecasts prioritise their replacement. Medium-term forecasts are typically based on age as a proxy for condition degradation. This is a prudent approach as it is generally accepted that older types of switchgear present higher failure risk than newer types of switchgear as insulation degrades, mechanical components wear and enclosures corrode over time. Using age as a proxy for condition also takes into account that older designs of switchgear generally have fewer safety features and lower reliability, when compared to modern equivalent assets. The evolution in design of switchgear over time has incorporated many safety and reliability improvements.

The exception to this is our pole mounted fuse fleet, where we have sufficient historical replacement information to derive a survivor curve, incorporating our historical experience in operating and replacing these assets. As we inspect and replace further fuses we will use this data to refine the survivor curve.

The approach is summarised in Table 11.13. Further detail is provided in Chapter 20 of the 2017 AMP.

Table 11.13: Summary of distribution switchgear renewals approach

Renewal trigger	**Condition and type based, with safety risk**: assets having type or condition issues where probability of failure is high, are prioritised with a focus on those posing safety risks.
Forecasting approaches	**Type issues**: asset types with a known history of unreliability are forecast for renewal in the short to medium term **Age**: age is used as a proxy for condition for longer term renewal forecasting of distribution switchgear **Survivor curve**: for pole mounted fuses **Volumetric programmes**: the locks and keys programme is forecast based on its scope and expected costs.
Cost estimation	**Historical averages**: unit rates for distribution switchgear are based on historical averages of completed replacement works.
Criticality	**Safety and reliability**: criticality is determined by number of connected customers, and public safety risks.

11.10.2 Distribution switchgear fleets

Below we summarise our planned investments in each of the distribution transformers fleets.

Ground mounted switchgear

Ground mounted switchgear provides distribution network isolation, protection and switching facilities. This fleet includes ring main units, switches, fuse switches, links and associated enclosures. In general, ground mounted switchgear is associated with our underground network, though some support overhead sections.

Because of recent safety incidents occurring in other distributors' networks we have imposed operational restrictions on certain oil-filled switchgear models that have a potentially explosive failure mode. This reduces risks to personnel working on and around this equipment as an interim measure until their scheduled replacement. As most of the affected assets are close to, or have exceeded their expected life, we plan to replace them as a priority.

Some cast resin switchgear types are not performing well in certain environmental conditions (such as high humidity) which can result in premature failure or false trips. We plan to replace the cast resin switchgear located in such environments with alternative types of switchgear.

This fleet is part of the locks and keys programme, replacing padlocks with a standardised system to ensure access to our equipment is appropriately controlled.

Pole mounted fuses

Pole mounted fuses provide protection and isolation ability on the network. Their main role is to isolate and protect distribution transformers. They are also used on distribution feeders to provide cost-effective fault isolation for spur lines or cables at the tee-off from the main feeder.

The health of this fleet is good, and we plan to continue replacements in line with historical rates to maintain this stable health profile. The forecast is supported by survivorship analysis, based on our historical replacement information.

Pole mounted switches

The pole mounted switch fleet comprises ABSs, vacuum insulated isolators and SF_6 gas insulated isolators.

The overall fleet health is stable, with forecast replacement in line with historical amounts. Over time we plan to install more vacuum and SF_6 based switches in place of traditional ABSs, as they have safety and reliability benefits and reduced maintenance costs.

This fleet is part of the locks and keys programme, replacing padlocks with a standardised system to ensure access to our equipment is appropriately controlled.

Circuit breakers, reclosers and sectionalisers

Circuit breakers, reclosers and sectionalisers are used when distribution switchgear needs to fulfil a protection function such as the isolation of network faults.

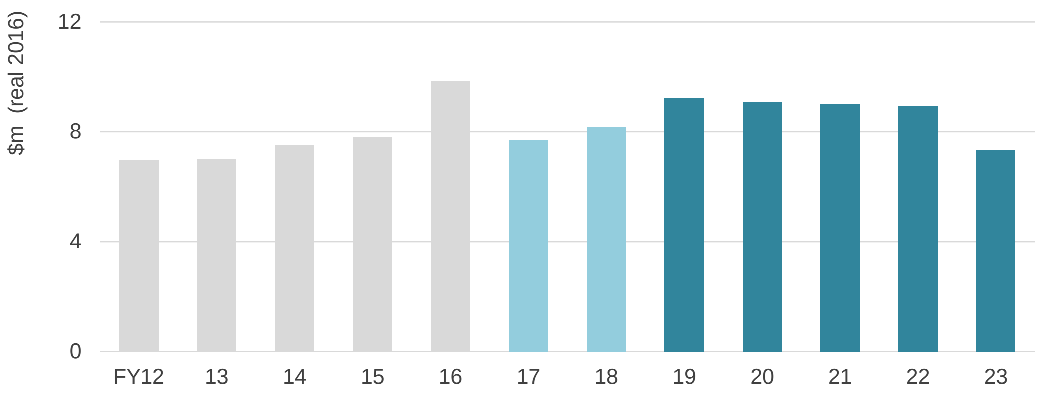
The health of the circuit breaker population is poor. A number of oil-filled circuit breaker models have type issues, with safety and reliability concerns. There are also considerable aged circuit breakers at a major customer site, where arc flash levels are high, and require replacement. We also plan to replace the majority of our oil-filled circuit breakers to reduce safety risk.

In contrast, our recloser and sectionaliser populations are young, and in good condition. Correspondingly, we expect very few renewals during the CPP Period.

11.10.3 Distribution switchgear Capex

Figure 11.30 shows our forecast Capex during the CPP Period. Proposed distribution switchgear renewals Capex during the CPP Period, with equivalent historical spend, is shown below.

Figure 11.30: Distribution switchgear renewal forecast expenditure



During the CPP Period we expect to invest $44m on distribution switchgear renewals. This accounts for 10% of our total renewals Capex over the period.

Our planned investment is generally in line with historical levels. Expenditure during FY19-FY22 is higher due to planned circuit breaker replacements at Kinleith, and the installation of new padlocks on equipment.

Beyond the CPP Period, renewal expenditure is expected to reduce slightly, as the health of the ground mounted switchgear and circuit breaker fleets stabilises. Condition-based renewals will be ongoing however, and remain at approximately historical levels for pole mounted fuses and switches.

The planned renewals Capex for distribution switchgear will:

- reduce the safety risks related to unreliable oil ground mounted switchgear and circuit breakers
- maintain stable asset health for pole mounted fuses and switches.

Box 11.8: Distribution switchgear justification

We are confident that our approach delivers an efficient and prudent level of investment because:

- **Prudent drivers**: investment in ground mounted switchgear and circuit breaker renewal primarily aims to manage service provider and public safety.
- **Historical alignment**: our distribution switchgear forecast is in line with historical amounts, corresponding with maintaining overall fleet health.
- **Cost effective**: distribution switchgear unit rates are based on market tested historical averages.
- **External reviews**: our pole mounted fuse survivorship model has been reviewed by industry experts and has been assessed as good practice.
- **Review and moderation**: forecasts have been reviewed by executive management and the Board, and the forecasts have moderated to reflect feedback
- **Efficiency gains**: as we improve our asset management and works delivery processes we expect to be able to gain future efficiencies. We have included an efficiency allowance of 8% by FY23 in our forecast to reflect this.

11.11 Secondary systems

Secondary systems are crucial for enabling the safe and reliable operation of our electricity network. The portfolio includes four asset fleets:

- **SCADA and communications**: including SCADA base stations, radios, RTUs and communication assets
- **protection**: mainly composed of numerical, static and electromechanical relays
- **DC supplies**: provide backup power to zone substations and communication sites
- **metering**: includes GXP check meters, HV metering units and ripple receiver relays.

This section provides an overview of our approach to forecasting secondary systems renewals, overviews of our plans by fleet, and our proposed expenditure during the CPP Period. We propose a slight increase in investment to ensure compliance with extended reserves requirements.

11.11.1 Investment drivers and forecasting approach

This section provides an overview of our approach to forecasting secondary systems renewals, overviews of our plans by fleet, and our proposed expenditure during the CPP Period.

Investment drivers

Below we provide details on the main drivers for our proposed investment in secondary systems renewals and how they have informed our proposed work programmes.

Obsolescence

Our SCADA and communications network has had significant investment in recent years to improve standardisation across the fleet and amalgamate disparate networks from previous network owners. Some remaining replacements are needed to complete the standardisation to the DNP3 protocol, including SCADA base station radios and SCADA remote radios. A small number of legacy RTUs which do not provide the functionality required for our network are also planned for replacement.

Modern numerical protection relays provide more than just protection functionality and are highly configurable, with sophisticated data capture, self-monitoring and analysis inbuilt. Legacy electromechanical and static relays only provide basic protection functions, and are now at an age where we have concerns about their ongoing reliability. In addition, these relays have higher maintenance costs and few available spares. Primarily due to obsolescence and risk of mal-operation (potentially causing safety and reliability risks) we plan to replace older electromechanical and static relays during the CPP Period.

DC systems have been installed using many different supply voltages, as a result of different load requirements and historical network amalgamation. Planned renewals will reduce the diversity within the fleet as systems with non-standard voltages are replaced with modern equivalents. Modern capacity requirements are also driving us to replace some of our DC systems.

Our fleet of GXP check meters has undergone a programme of modernisation over the past decade. Only a small number of legacy meters remain, which will be replaced in the short term.

Compliance

The Electricity Authority is currently implementing new requirements for extended reserves (to be applied from 2019). The new requirements include tripping based on the rate of frequency decay, which requires a more sophisticated relay unit. A very high percentage of our existing load shedding relays are decades old and incapable of meeting the new specifications. To meet our obligations we need to replace and re-programme existing under-frequency relays at approximately 100 zone substations.

Load control capability

A current ripple receiver relay owner in the Tauranga region is considering withdrawing ongoing maintenance and support of their relays (circa 35,000 assets), potentially jeopardising our ability to control load in the area. As a result, we are planning on taking ownership of these relays, to ensure the ongoing viability of load control in the region.

Some of the ripple relays are old and obsolete and some are no longer operating, with replacement required for reliable operation. There is an opportunity to work with a metering provider in the area who is completing a smart meter rollout, to coordinate replacement of the ripple relays at the same time thereby minimising costs. To take advantage of this, we are planning on a replacement programme of the ripple relays, coordinated with the smart meter rollout.

In addition to this core ripple relay renewal requirement, we consider it prudent to install a ‘smart’ ripple relay that can communicate via a communications network to provide near real-time network data at an ICP level and that could also be remotely programmed with respect to load control groupings.[58] There are also additional benefits to the consumer as this enhanced capability can enable them to participate in new market offerings such as peer to peer energy sharing. This aligns to our strategy of becoming a ‘Distribution System Integrator’.

Summary of forecasting approach

Obsolescence driven investments with small asset populations are forecast by identifying the particular assets that require replacement, and planning and prioritising these into an overall programme. This applies to our replacement of SCADA base stations, radios and RTUs, along with GXP check meters.

[58] The associated communications network is classified as Network Evolution expenditure, and is discussed in Section 13.7. Renewal of the relays is included in this portfolio.

Type and age are used as proxies for obsolescence for protection and DC supplies forecasting. Older assets (such as electromechanical and static relays) don't have the features and functionality of modern assets, and can't provide the service now expected of them. Age is also a good proxy for condition, particularly for older electromechanical relays which, being mechanical devices, are subject to wear.

Replacement needs driven by the extended reserves programme are forecast as individual projects, supported by detailed cost estimates. Ripple relay replacement in Tauranga has been forecast based on desktop analysis.

The approach is summarised in Table 11.14. Further detail is provided in Chapter 21 of the 2017 AMP.

Table 11.14: Summary of secondary systems renewals approach

Renewal triggers	**Obsolescence**: obsolescence is the primary driver for secondary systems renewal, as modern assets provide functionality far beyond legacy devices, allowing us to better operate the network. **Compliance**: changes to the extended reserves programme require us to replace our load shedding relays to provide require functional. **Load control capability**: we need to renew ripple receiver relays to ensure the ongoing viability of load control in the Tauranga area.
Forecasting approaches	**Age**: age is used as a proxy for obsolescence for protection and DC system fleets, as older assets no longer provide required functionality. **Identified assets / projects**: SCADA and GXP metering forecasts are based on the volumes requiring replacement, and the extended reserves projects are forecast on their planned scope.
Cost estimation	**Historical averages**: asset forecasts use historical average costs for forecasting **Desktop estimates**: the Extended Reserves and Tauranga ripple relay replacement programmes are based on desktop cost estimates.
Criticality	Protection and SCADA assets are highly critical as they enable the safe and reliable operation of the network

11.11.2 Secondary system fleets overview

Below we summarise our planned investments in each of the cable fleets.

SCADA and communications

The SCADA system provides visibility and remote control of our network, enabled by a communications system made up of carriers such as radio, microwave and fibre optic cable. RTUs interface with the network equipment such as transformer control units and circuit breaker control systems.

Our SCADA and communications network has undergone significant investment in recent years, in order to improve standardisation across the fleet and amalgamate disparate networks from previous mergers. Some remaining renewal investment is needed to complete the standardisation to the DNP3 protocol, requiring the replacement of SCADA base station radios and SCADA remote radios. We also have a small number of legacy RTUs which do not provide the functionality required for our network, which are planned for replacement.

DC supplies

Our DC supply systems provide a reliable and efficient DC power supply to vital elements within our network (e.g. circuit breaker controls, protection equipment, SCADA, and communications). DC supplies are located at each substation and communications site on the network.

DC systems have been installed using many different supply voltages, as a result of different load requirements and network amalgamation. Planned renewals will reduce the diversity within the fleet as systems with non-standard voltages are replaced with modern equivalents. Modern capacity requirements are also driving us to replace some of our DC systems.

Protection

Protection assets ensure the safe and appropriate operation of the network. They detect and isolate network faults that could otherwise harm the public and our service providers or damage network assets.

Protection relays have evolved over time and can be broken down into three main technologies – electromechanical, static and numerical devices. Modern numerical protection relays provide more than protection functionality and are highly configurable, with sophisticated data capture, self-monitoring and analysis inbuilt. Legacy electromechanical and static relays only provide basic protection functions, and are now at an age where we have concerns about their ongoing reliability. In addition, these relays have higher maintenance costs and few available spares. Primarily for obsolescence reasons, we will replace older electromechanical and static relay during the CPP Period.

The Electricity Authority is currently implementing new requirements for extended reserves (to be applied from 2019). The new requirements include tripping on the rate of frequency decay, which needs a more sophisticated relay unit. A very high percentage of our existing load shedding relays are old and incapable of meeting the new specifications. To comply we need to replace and re-programme under-frequency relays at approximately 100 substations.

Metering

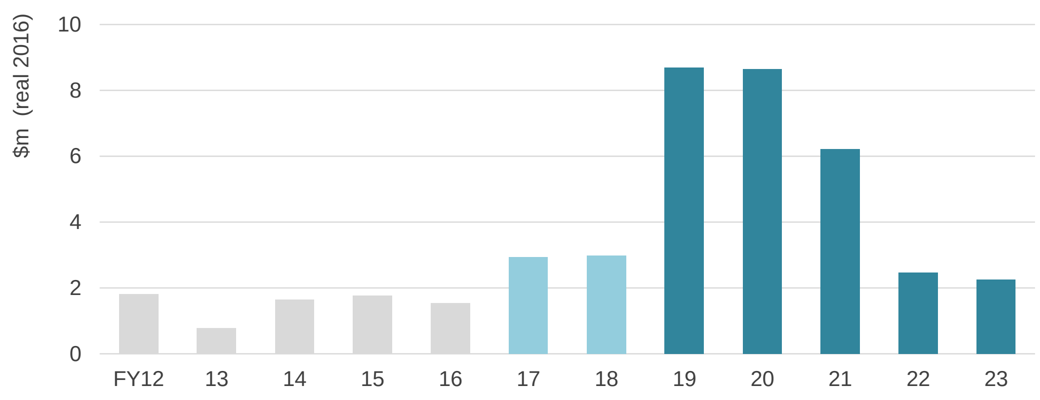
The metering fleet includes three sub-types – Grid Exit Point (GXP) and HV metering, and ripple receiver relays. Our fleet of GXP check meters has undergone a programme of modernisation over the past decade with only a small number of legacy meters still to be replaced.

Our programme to secure the long-term viability of load control in the Tauranga area will renew the ripple receiver relay fleet with a modern 'smart' ripple relay. These relays will be able to communicate via a communications network to provide near real-time data at an ICP level and also be remotely programmed for load control groupings. There are additional benefits to the consumer as this enhanced capability may enable them to participate in new market offerings such as peer to peer energy sharing.

11.11.3 Secondary systems renewal Capex

Proposed secondary systems renewal Capex during the CPP Period, with equivalent historical spend, is shown in Figure 11.31.

Figure 11.31: Proposed secondary systems renewal Capex



During the CPP Period we expect to invest $28m in secondary systems renewals. This accounts for 6% of our total renewals Capex over the period.

The significantly higher forecast expenditure in FY19-21 is driven by the Extended Reserves and Tauranga load control programmes. Other expenditure is in line with historical levels.

Beyond the CPP Period renewal expenditure for this portfolio is expected to remain at FY23 levels, as protection relays (making up the majority of the portfolio expenditure) continue to be replaced due to obsolescence.

The planned renewals Capex for secondary systems will:

- ensure our secondary systems assets provide the functionality required for the ongoing safe and reliable operation of our network
- allow us to comply with the new extended reserves programme, requiring the replacement of our load shedding relays
- secure our ability to control load from ripple injection in the Tauranga area, while also improving visibility of our network and providing future additional benefits to our customers.

Box 11.9: Secondary systems justification

We are confident that our approach delivers an efficient and prudent level of investment because:

- **Compliance**: replacement of our load shedding relays is required to ensure compliance with new extended reserves requirements.
- **Prudent drivers**: obsolescence based renewal of SCADA and protection assets enables continued safe and reliable operation of our network
- **Future readiness**: taking the opportunity posed by the need to replace relays, investing in 'smart' ripple relays in the Tauranga area aligns to our strategy of becoming a 'Distribution System Integrator'
- **Verifier review**: the secondary systems programme has been reviewed by the Verifier and feedback incorporated
- **Review and moderation**: forecasts have been reviewed by executive management and the Board, and the forecasts have moderated to reflect feedback
- **Efficiency gains**: as we improve our asset management processes we expect to be able to gain efficiencies. We have included an efficiency allowance of 4.5% by FY23 in our forecast to reflect this.

12 NETWORK CAPEX – GROWTH AND SECURITY

Growth and security investments address growing electricity demand, allow new customers to be connected to our network, and provide appropriate security of supply. These investments are essential to support development and economic growth in the regions we serve.

While we are seeing sustained demand growth across our network, the rates vary. We expect this growth to continue particularly in regions where population and economic activity are expanding, such as Tauranga and Palmerston North.

During the CPP Period our increased investment in growth and security Capex will focus on:

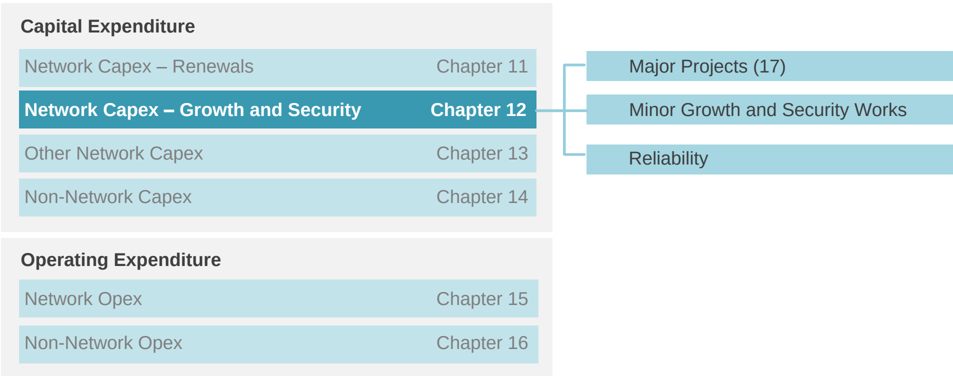
- restoring security of supply, which has deteriorated in recent years, to acceptable levels
- major projects to provide additional capacity, supporting demand growth and managing load at risk
- continuing our programme of automation as a cost-effective way to reduce the impact of outages

Failure to invest will curtail our ability to ensure a reliable, secure service to customers, resulting in unacceptably high risk of outages following asset failures, and in some cases could result in limits to new connections or meeting future demand.

12.1 Expenditure category and portfolios

Figure 12.1 illustrates where growth and security Capex sits within our overall expenditure and lists its portfolios.

Figure 12.1: Exenditure category map showing growth and security Capex portfolios



The network Capex – growth and security category includes the following expenditure portfolios.[59]

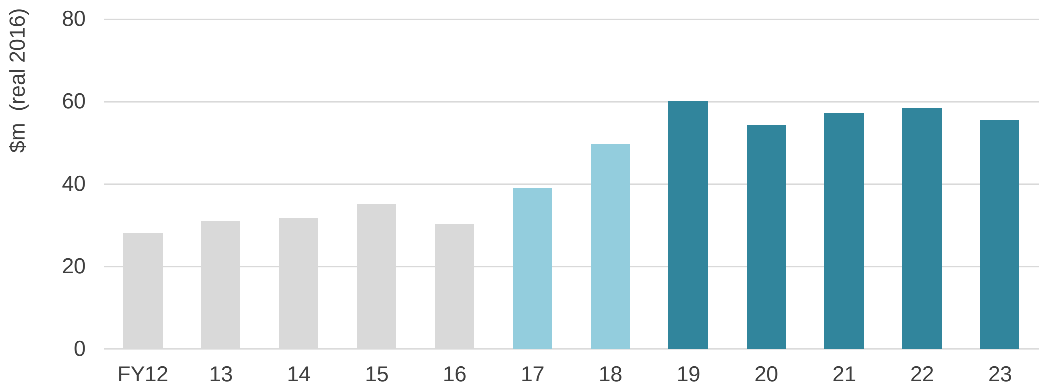
- **Major projects**: are growth and security projects with total investment above $5m. There are 17 projects that incur expenditure during the CPP Period. A selection of these projects is discussed in Section 12.5.
- **Minor growth and security works**: includes minor projects (between $1m and $5m) and routine projects (works below $1m) that address growth and security constraints. It also includes supporting investments in field communications. This portfolio is discussed in Section 12.6.
- **Reliability**: includes our investments in network automation. This portfolio is discussed in Section 12.7.

[59] These portfolios expand on those specified by Information Disclosure as they better reflect the way we plan these investments.

12.2 Overview of growth and security Capex

Figure 12.2 sets out our total growth and security Capex for the CPP Period together with equivalent historical expenditure.

Figure 12.2: Proposed growth and security Capex



During the CPP Period we expect to invest $286m in growth and security projects. This accounts for 35% of total network Capex over the CPP Period.

We plan to increase growth and security Capex above historical levels. This is primarily driven by the need to address key security shortfalls on our networks and therefore reduce the load at risk, discussed below in Section 12.3 and in Chapter 3. During the CPP Period we will undertake several major projects to stabilise network security on (mainly) the subtransmission network. These security-related projects represent the majority of increased investment. In addition, expenditure on minor and routine growth projects, to maintain appropriate security at distribution level, will continue at largely historical levels.

Over the CPP Period our investment in automation (reliability portfolio) will increase as we continue to roll out these devices to stabilise our reliability performance. This will increasingly focus on our Western Network as we approach saturation of these devices in the eastern network. These projects are an essential part of mitigating the impact of increasing asset failures on overall network reliability as they provide an effective way of limiting the number of customers effected in the event of an asset failure, particularly in rural and remote rural areas (see further discussion in Section 17).

12.3 Key drivers and forecasting approaches

Below we discuss the main drivers for our growth and security Capex over the CPP Period and how we forecast the associated levels of expenditure.

12.3.1 Key drivers

Drivers for our growth and security investments include the need for ensuring appropriate security of supply, updating existing network architecture, expanding capacity where assets are in danger of overload, and creating additional capacity for new developments or increased activity to meet predicted future demand. During the CPP Period, the investments in this category will be mainly driven by:

- addressing situations where we are currently materially non-compliant with our security standards (resulting in excessive load being potentially lost following an event). We are currently not meeting the standard at more than half of our substations, and failure of an important asset could result in unacceptably high load loss to our customers, with associated major economic losses
- increasing demand on parts of our network, which require investment to ensure loads can continue to be reliably supplied, and excessive future network security exposures are avoided.

– our use of automation devices to stabilise reliability performance.

Below we discuss how demand growth and our security standards are driving our planned investments during the CPP Period.

Section 12.7 explains how the need to stabilise our reliability performance drives investments in network automation.

Security

From a system planning perspective, our primary objective is to ensure sufficient network capacity to meet customers' demand. On top of that, we must get the balance right between the cost of building security enhancements such as redundancy into the network, and the risk of customer outages (and the resulting impact). Our security standards provide guidance on the level of redundancy that we aim to provide to different parts of the network, for different types of load.

These standards help us identify areas where network capacity or security may be inadequate, particularly following the loss of a subtransmission or zone substation network element, and therefore where investment may be required. They also specify the acceptable threshold of demand interruptions in the event of asset failures and the tolerable duration before supply is restored. Both of these have a fundamental bearing on network reliability and quality of service delivered to customers.

Box 12.1: Overview of our security standards and security investment approach

Our security standards are aligned with the internationally recognised P2/6 framework (from the UK), adapted for New Zealand[60]. The standards specify what redundancy our substations should have and the acceptable duration of outages. They include both the size and type of load, to reflect the consequence of an outage. For example, the greater number of customers affected by outages in urban areas and resulting higher load at risk, result in higher standards there than in rural locations.

Our security standards have been independently assessed, and found to be "middle of the road" for New Zealand EDBs.

These security standards represent the practical 'starting point' for our investment analysis. In Powerco we are prepared to judiciously accept more risk than some of our peer companies, where this helps us avoid potentially uneconomic investment. This means that we may decide not to progress with security investments that are identified as necessary under our internal security standards, where other options exist to manage the implications of asset failure within acceptable bounds, or where the risk of lost load does not support the costs associated with investment to address the risk.

We describe our approach as a 'two step' approach to security investment.

As a first step, we use our security standards to trigger an investment review. This review includes further analysis of the economic cost of supply loss, as well as a full options analysis of potential supply solutions, or other means to mitigate the downside of an asset-related failure while avoiding major investment.

For example the outcomes we may deem as an acceptable substitute for investment include:

– we may accept the need to reconfigure our network (over a number of hours) in an urban environment, or

– we may accept the need to repair a line (over a day) in a rural environment where we can be reasonably assured we can access damaged equipment.

The second step involves ranking the required reinforcement projects (where alternative risk mitigation options are not feasible) according to their impact on avoiding load at risk. The final selection of projects to include in the work programme is based on this consideration – generally treating those with higher load at risk as priority. The actual volume of prioritised projects included into an annual works plan is limited by the availability of capital.

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60 The Electricity Engineers Association of New Zealand published guidelines on security standards ("Guide for Security of Supply", 2013), which we have largely adopted.

While this two step approach deliberately targets a lean investment profile by accepting some risk, the approach, combined with the capital rationing on our networks in recent years, has meant that the extent to which we are unable to meet the security standards has escalated significantly. That, in combination with historical load growth, has led to a situation where the demand at risk for many areas is now much higher than the level we consider acceptable. Our CPP investment proposals seek to address these issues.

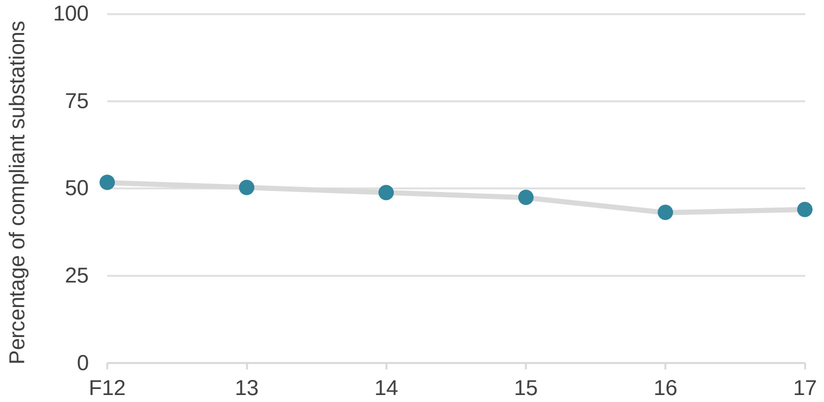
This increasing exposure to security risks can be seen by considering the level of compliance achieved with our security standards network over time. This is illustrated in Figure 12.3. In a less financially constrained investment scenario, still using our balanced two step investment approach, we would have expected this trend to remain broadly stable, and also that the extent to which our standards are breached to be less severe.

Performance against security standards

Currently, at most of our zone substations, we do not achieve the security required by our security standards. While a significant degree of under-performance against standard is implicit to our two step application of these, the degree to which they are now breached is excessive. The decline in compliance is therefore of significant concern, and we recognise that the risk of loss of supply to many of our customers is beyond acceptable limits. Given that our security standards are aligned with those of most EDBs, the degree to which we breach these would also suggest that many of our customers face a significantly higher risk of loss of supply than they would on other networks.

Figure 12.3 below shows how our security performance has deteriorated over time.

Figure 12.3: Historical performance against our secuirty standard (% of compliant substations)

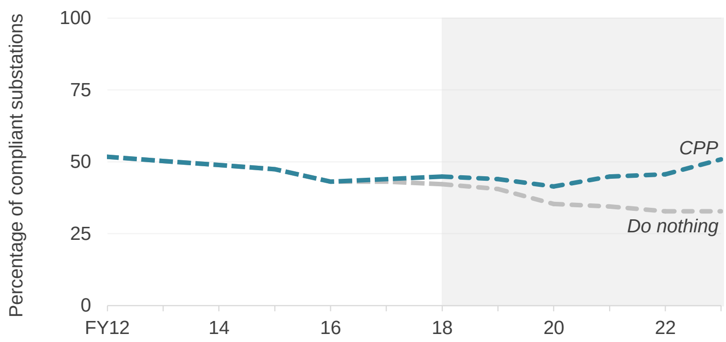


We have continued to invest in a way that addressed the most significant load exposure, but the available level of funding has not been adequate to keep up with needs, even for a company prepared to accept a higher, calculated risk exposure than many others.

One of our drivers for increased investment is to support our customers by facilitating economic growth – which requires a balance between providing adequate security of supply and the cost to achieve this. Currently the balance leans towards lower cost, with too much load at risk. We therefore plan to increase network development Capex to reduce the number of substations where we now have excessive load at risk. This investment, which represents the largest part of our planned growth and security investment over the CPP Period, is important in supporting regional economic growth.

The process to restore overall network security to an acceptable level will be gradual. We are not targeting full compliance with our security standards – as such an outcome would step beyond our balanced risk approach, and is not in the best interests of our customers. Instead, as indicated in Figure 12.4, we intend to restore compliance levels to what we had in FY12 (which is slightly over 50%).

Figure 12.4: Forecast performance against our secuirty standard (% of compliant substations)



Probabilistic security standards

While our basic security standard is deterministic in nature, the way in which apply these and the subsequent evaluation of according to load at risk, introduces probabilistic elements. In the longer term we plan to move to full probabilistic security standards, that will allow us to better model the implications of the fluctuating future demand, variable generation sources and related risks.

This is anticipated to bring a more refined, risk-based view to required redundancy and would, all else being equal, lead to lower investment levels than that indicated by our current standards. However, we note that the way in which the current standard is applied may mean that the savings are not as material as anticipated. Adopting probabilistic security standards is one of the planned capability improvements discussed in Chapter 9.

Demand growth

New subdivisions and developments due to population growth, or increasing economic activity are the main factors leading to growth in electricity demand. To ensure our network can safely and reliably facilitate these growth factors we need to invest in more capacity or seek ways to reduce the impact of increased demand.

To identify these investment needs we conduct detailed demand forecasting on our network and compare the outcomes with available network capacity. We also analyse the potential impact of different future demand growth rates, under a number of future scenarios. Each year as part of our planning process we update our demand forecasts and undertake systematic contingency analysis to identify potential investment needs. Due to the long lead time for large projects, such as with new subtransmission circuits, we need to forecast expected demand on the network and plan these investments several years in advance.

Box 12.2: How we forecast network demand

Our demand forecasting approach has been designed to be straightforward and robust. Growth rates are primarily driven by population forecasts provided by Statistics New Zealand. We assume stable ratios between population and demand growth in residential and small commercial customers, as we have consistently observed on our network. For larger commercials and industrials, we reflect committed step change developments over the relevant period.

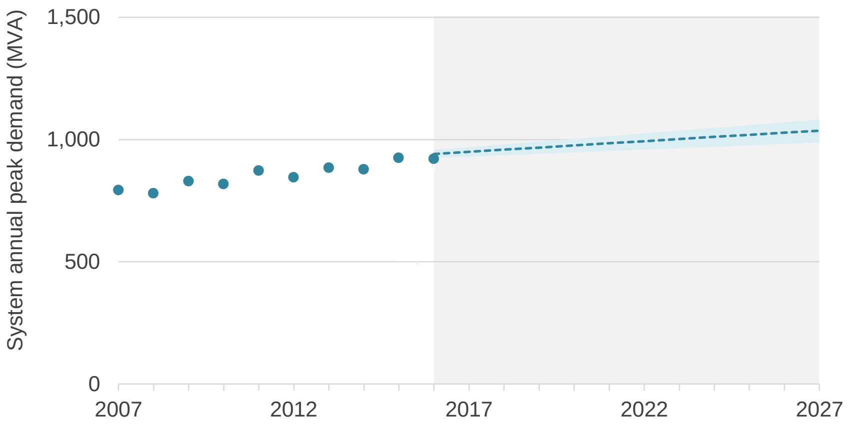
Our forecasts of demand growth rates are developed at feeder level, and these then determine zone substation and GXP growth rates, which are used in evaluating potential minor and major projects. We also test larger development investments against a higher and lower growth scenario.

Our forecasts use a prudent estimate of current peak demand (the ‘P90’ of trended historical annual peaks) with the population based forecast growth rate then applied to this, with known customer developments added as appropriate.

For a more detailed description of our approach, refer to Chapter 7 of the AMP.

The results of our latest forecasting round are shown in Figure 12.5.

Figure 12.5: Total network demand – historical and forecast



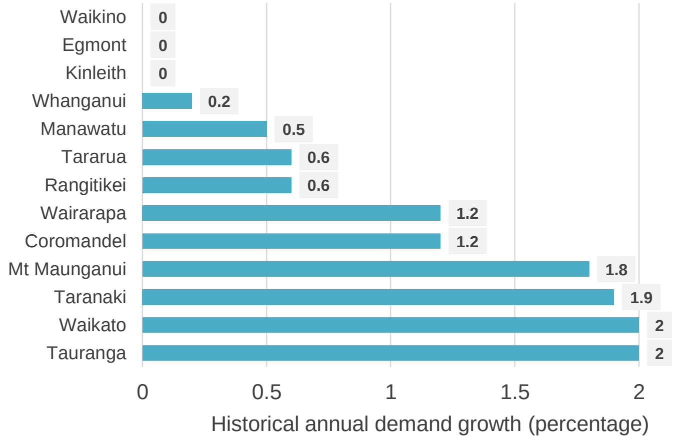
In contrast to national demand or that seen in some other areas of the country, our network demand has exhibited relatively consistent growth, even in the past decade following the global economic slowdown in 2007. Growth has come from sustained residential activity, in particular around Tauranga, plus step changes in load brought about by primary industry and commercial activity in several locations, particularly the Waikato, New Plymouth and Palmerston North.

Our forecast network demand suggests continuing growth, reflecting population forecasts that support sustained residential development. Recent new connection rates suggest residential growth may actually be considerably higher than forecast rates in the short term.

Future commercial developments are by nature difficult to forecast in a long-term context. The slightly more subdued forecast network demand growth, when compared to historical growth, reflects these intrinsic assumptions in the methodology.

Notwithstanding the general trend above, our customer base is diverse with varying growth by sector and regions. Figure 12.6 shows historical growth by planning area over the last 10 years.

Figure 12.6: Demand growth across our planning regions



Historical growth has been driven by horticultural, commercial and residential activity in the Bay of Plenty and dairy farming, plus associated primary industries in the Waikato. Tourism and new holiday homes continue to drive increased demand in coastal areas such as Coromandel. Taranaki has seen strong demand growth from the oil and gas industry and its dairy industry, but this is expected to be slightly more subdued in the next 5 years. Population centres such as New Plymouth and Palmerston North continue to expand due to net inward migration and increased commercial activity, though more slowly than Tauranga and Mount Maunganui. Smaller cities are more static, with towns and the general rural demographic showing signs of a stable or slight reduction in peak demand. Localised areas around Manawatu and Rangitikei may see increased irrigation developments.

During the CPP Period we will invest in increased capacity to meet expected demand in Tauranga and Mt Maunganui. In addition, a series of investments in the Coromandel and Waikato regions will increase subtransmission capacity so that we can maintain secure and reliable supply and reduce the risk of widespread and lengthy outages.

12.3.2 Forecasting approach

Below we provide a brief explanation of how we forecast the need for growth and security investments. Further detail on our approach is provided in Chapter 7 of our 2017 AMP.

Growth and security projects are assessed and managed using three categories, based on the likely scale and complexity of the project, as summarised in Table 12.1.

Table 12.1: Growth and security project types

	TYPICAL COST	TYPICAL PROJECTS	TYPICAL LEAD TIME
Major	Over $5m	Subtransmission or GXP works	2 to 10 years
Minor	Between $1m and $5m	Zone substation works or small subtransmission projects	Within 5 years
Routine	Repetitive projects below $1m	Distribution level capacity and voltage upgrades, distribution backfeed reinforcements to support automation. Smaller zone substation upgrades, and LV and distribution transformer upgrades	Within 2 years

Our forecasting approaches have been developed to be commensurate with these project types.

Needs identification

We use our security standards in conjunction with our demand forecasts to identify possible limitations (known as 'constraints' or 'needs') in our network capacity to supply loads following a network event. Where current or expected demand grows above required capacity we consider network upgrade options.

Constraints merely provide a trigger for further analysis. Reinforcement projects or other interventions are assessed according to relative need and their likely cost. Projects without clear economic benefit do not proceed to the next stage of consideration.

Given the varying conditions and load density on our network, and to ensure sufficient granularity we divide it into 13 planning areas. This area planning approach allows us to better consider appropriate network architecture, specific customer needs, and local development plans. We also coordinate potential network reinforcement projects with planned renewal investment, thereby ensuring an integrated approach to investment, and minimising disruption to customers.

Options analysis

Once a project need is identified, consideration of potential solutions is undertaken. The number and type of solutions (or options) that are considered will vary depending on the type and size of the need and the complexity of the solutions. We use a systematic and objective process to consider viable options.

We have developed a tool and guidelines for undertaking options analyses so that the assumptions and approach remains consistent, traceable and documented. This process varies based on the expenditure type, but generally includes technical studies, economic assessments and risk analysis. Some needs are recurring (e.g. power transformer capacity constraints) and we have specific strategies on how these are to be addressed.

We develop high-level cost estimates to inform our choice of solution. Option cost analysis for these projects is usually dominated by three components – Capex, lifecycle operations, and to a lesser extent the relative reliability benefits. Reliability reflects the cost of unserved energy to customers in the event that supply cannot be maintained. [61] Our estimation tool also provides built-in rates and helps estimate the cost of different options.

Non-network alternatives, such as demand management, localised generation or energy storage are increasingly included as alternative options to address security standard breaches.

The options analysis process may also include external consultation with affected stakeholders (for example, where routes for new lines have to be found).

Based on this analysis, the most cost efficient, long-term solution is identified.

Portfolio prioritisation

Implicit to our planning approach is that identification of a project need does not mean it will be automatically included in our works plan. Breaching the security standard is rather seen as a trigger that identifies the need for further analysis.

Prior to approving a project, we undertake a detailed comparative analysis, ranking projects across various factors, including:

- the demand at risk (or the risk-reduction that a project would provide) as an indicator of the economic costs to customers of a supply outage
- project cost (following options analysis to select the best investment solution)
- the criticality of other factors requiring attention (such as voltage constraints)
- the need to support new developments or load growth at existing customers.

Based on this analysis, we prioritise projects within our work plan. In recent years this process has also been influenced by capital rationing and the investment needs of other portfolios (e.g. renewals). This has resulted in an increase in the number of instances where our security standards are not met, as witnessed by the historical decline in compliant substations.

Major and minor projects – cost estimates

We use a customised (or tailored) approach to develop major and minor project cost estimates. These are based on solution scopes, with larger projects supplemented with cost estimates from external consultants. The project scopes are determined from desktop reviews of asset information such as aerial photographs, site layout drawings, underground services drawings, and available cable ducts. These provide a good basis for reasonably accurate estimates for materials and work quantities: for example, building extensions, cabling, and firewalls. For more complex projects, on-site investigations and geotechnical sampling may also be used to better inform the cost estimates.

Activity costs are based on historical costs, service provider rates, quotes, and external reviews. Material costs are determined with reference to supply contracts and historical installation costs. Building block unit rates are informed by historical projects and updated with current prices from suppliers. These project estimates have been used to develop our CPP forecasts.

Routine Projects

These often-repetitive projects have short lead times and are often built in direct response to increased growth and customer or network activity. These needs are generally related to distribution feeders, that have exceeded guidelines or planning parameters related to voltage profile, thermal capacity, and number of connections. It is generally not practical to identify individual projects more than one to two years before implementation.

For the CPP Period we have used a base-step-trend approach to forecast routine expenditure as the underlying drivers and associated type and volume of work tend to be consistent year to year. Rather than a project specific expenditure forecast, we estimate an overall forecast based on the recently

[61] Reliability, or the cost of outages to customers, is a more important consideration when prioritising projects as part of the larger portfolio.

observed level of expenditure, trended for expected ICP growth. This assumes overall demand growth is relatively constant and consistent with recent past experience, which is evident for our network as a whole and especially for the key growth areas.

The estimated expenditure is sense-checked for any observable trends in the underlying drivers, including:

- planned automation works, which often necessitate increased backfeed capacity in the supporting distribution feeders
- increased expectations of reliable supply, especially in rural areas or to address worst performing feeders
- increased localised demand associated with dairying or irrigation
- voltage compliance and increasing need to manage voltage with higher uptake of distributed generation and resources.

More detail on this approach is included in Chapter 11 of our 2017 AMP.

12.4 Developing our growth and security Capex forecast

Our growth and security Capex forecast for the CPP Period has been developed using a 'bottom-up' approach. Individual projects and programmes have been developed in response to the drivers in the previous section. Our challenge and approvals process has then been used to ensure that we have selected high-priority projects, that forecasts have been derived in a systematic and rigorous manner, and have undergone appropriate scrutiny.

12.4.1 Internal challenge and approvals

To ensure our forecasts were prudent we undertook a robust, focused internal challenge and approval process. This was in addition to the approach used to develop and approve our Preliminary Proposal (discussed in Chapter 4) and the review by the Independent Verifier (discussed in Chapter 6).

- **Engineering approvals**: the proposed set of preferred projects were reviewed, challenged and approved by planning managers and the asset manager.
- **Specialist advice**: an external specialist assisted us in reviewing our planned solutions and provided advice on the project documentation.
- **Cost estimates**: our larger projects had their estimates reviewed by an external engineering firm.
- **CPP Governance Group**: a group of general managers was established to provide oversight of our CPP proposal. This group included general managers responsible for the majority of expenditure. This group approved expenditure in and across portfolios.
- **Executive management team**: the CEO and full executive performed a further challenge round on the CPP Proposal.
- **Board review**: the expenditure forecasts were submitted to the Powerco Board for review and approval. An independent expert was appointed to also review the proposed activities and expenditure forecast, and report his findings to the Board.

Further details on our Capex governance approach are provided in Chapter 6 of our 2017 AMP.

12.4.2 Supporting documentation

We have used several supporting documents to inform our growth and security investments for the CPP Period.

- **Network Development Plan**: summarises the outcomes of our area planning studies and sets out detail on our planned growth and security works.

- **Asset Management Plan**: summarises how we manage the development of our network and ensure we provide sufficient supply security to customers. It explains how we identify network constraints and includes our 10-year growth and security forecasts in Chapter 11. It sets out how we plan to provide a secure and reliable service to our customers.
- **Project overview documents**: were developed for our major Capex projects. These summarise the needs case, options considered and approved solutions. Similar less detailed versions were prepared for our Minor Projects.
- **Policies and standards**: used to inform our growth and security forecasts, including our security standards.
- **Models**: used to develop our growth and security forecasts include those used to derive our demand forecasts and to develop our cost estimates.

This information was reviewed by the Independent Verifier and a representative subset has been included as supporting material to our submission.

12.5 Major projects portfolio

The major projects portfolio includes large projects as explained in Table 12.1. Below we provide an overview of the key major projects planned for the CPP Period.

12.5.1 Summary of investments

The following project descriptions summarise the drivers and proposed solutions for five large major projects during the CPP Period. Further details on these (and other) projects are included in Chapter 11 of the AMP.

Palmerston North CBD Reinforcement

Need: the subtransmission network supplying the Palmerston North CBD has several existing constraints. A combination of historical load growth and the de-rating of unreliable oil-filled cables mean that a large part of the CBD would not be supplied in the event of a subtransmission fault on any of a number of key components. Cable and transformer capacity at several substations is below the level needed to provide sufficient backup. Firm capacity at one of the two GXPs feeding the CBD (Bunnythorpe) is exceeded at peak load times. As further growth in the area is being experienced (and forecast), the load at risk is increasing even further.

Solution: we are reinforcing the subtransmission network into the Palmerston North CBD via the installation of 33kV underground cable interties to enhance existing cable links, and by building a new zone substation (Ferguson) to reduce load on the existing substations. New subtransmission circuits will be installed into the CBD to transfer some of the load onto Linton GXP.[62]

We considered a range of non-network solutions and various network configuration alternatives, including improving the capacity and subtransmission from Bunnythorpe GXP. The alternative options were more expensive or did not sufficiently address the existing constraints. Non-Network options (such as large-scale battery storage, on-site generation or demand management) were deemed to be impractical given the size of load at risk, and/or too expensive to implement.

We expect to complete the project in 2023.

62 Replacement of faulty oil-filled cables is not included in this project as it is covered under the renewal portfolio.

Putaruru GXP

Need: security of supply to Transpower's Hinuera GXP is constrained by a single transmission circuit and supply transformers loaded beyond firm capacity. Consequently, our entire downstream network is at risk from a fault on Transpower's equipment. The subtransmission network to Putaruru is also constrained due to a single circuit supplying the Putaruru substation from Hinuera.

Solution: a new 110/33kV GXP is to be established at Putaruru to provide an alternate supply to the area and increase capacity, restoring security of supply levels. It will be located at the existing Putaruru substation and be supplied via a single 110kV cable circuit from Arapuni hydro station.

We worked closely with Transpower in considering various supply, voltage, connection and route options including 33kV from Arapuni to Putaruru, 110kV from Arapuni to Hinuera, 110kV from the existing Kinleith to Arapuni lines as well as overhead line and underground cable options for each configuration option. These alternative options are more expensive to construct and in many cases are likely to have a protracted delivery due to property and consenting issues. Non-network options were considered but not considered viable for the amount of load at risk.

We expect to complete the project in 2022.

Omokoroa / Aongatete / Katikati / Kauri Point Reinforcement

Need: subtransmission supplying the Omokoroa, Aongatete, Katikati and Kauri Point substations are on the point of breaching our security of supply standards due to capacity constraints on the existing circuits. Under fault conditions, the capacity of the circuits is exceeded and subtransmission voltages drop below acceptable levels at Kauri Pt and Katikati substations. Given that this is an area with major residential and commercial development which is adding considerable additional demand, the existing constraints are worsening rapidly.

Solution: The preferred solution is to build a third circuit between Greerton and Omokoroa substations. This will be done by creating a new 33kV underground circuit between Greerton and Bethlehem and reconfiguring the existing Greerton-Bethlehem circuit to create a third circuit between Greerton and Omokoroa. To minimise costs we intend using road reserve where practical.

We also considered extending the 110kV network from either Tauranga or Waikino and creating a new GXP at Omokoroa, as well as an alternative 33kV configuration with two new circuits from Tauranga. These alternatives were deemed to be too expensive, and could also lead to many consenting and property issues that would delay completion and add risk.

We expect to complete the project in 2022.

Whangamata Reinforcement

Need: Whangamata is supplied via a single 33 kV subtransmission line which has historically had frequent faults. An outage on this line causes a total loss of supply at Whangamata until the fault is fixed. During high load periods, the line is thermally constrained and low subtransmission voltage occurs at Whangamata. Maintenance is challenging due to a lack of sufficient alternative supply. As a result, especially at peak demand Whangamata represents a serious breach of our security standards.

Solution: we will adopt a two-stage solution based on a new 33 kV line from Waikino GXP to Whangamata in the longer term, and an a interim local energy storage/generation solution. Due to long lead times and consenting issues involved in securing a line route, construction is not expected to start before 2024. In the interim, we will install a feeder-based energy storage solution supported by standby diesel generators to provide backup supply to commercial loads in the Whangamata town centre. This also offers an opportunity to trial the use of energy storage and local generation in an automated, self-restoring network which, if proved successful, can be replicated at other towns on the network with single supplies only. We have been in close consultation with the local community on our proposal.

We also considered other subtransmission routes and connection points, as well as options to upgrade the 11kV interconnections where practical. All other options are more expensive to construct, or would not be able to make up for the capacity shortfall during outages on the existing supply line.

We expect to complete the first stage of the project in 2020.

Pyes Pa substation

Need: the distribution network supplying the Pyes Pa area, south of Tauranga, has insufficient backup capacity to support the load if normal supply fails. This exposes customers to unacceptable risk of low voltages and long outages. Sustained load growth has and will continue to exacerbate these issues.

Solution: the preferred solution is to build a new 33/11kV zone substation at Pyes Pa which will be supplied from Kaitimako GXP via Tauranga GXP. The new substation will in addition to addressing the back-up risk in the region address many other existing network issues (including transmission constraints into Tauranga), and will have the required capacity to support future growing demand.

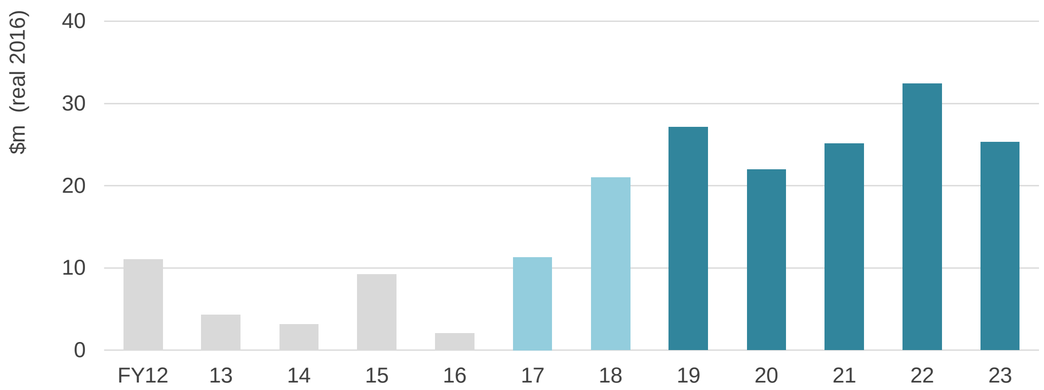
We also considered reinforcing the existing 11kV circuits from Tauranga by adding new 11kV feeders. This option is more expensive and would not address the existing transmission constraints into Tauranga GXP.

We expect to complete the project in 2019.

12.5.2 Proposed expenditure

Our proposed investments in major growth projects during the CPP Period, with equivalent historical spend, is shown in Figure 12.7.

Figure 12.7: Proposed major projects Capex



Major network reinforcement expenditure is by its very nature lumpy, as it reflects network needs as these arise, which is inconsistent between years. However, in recent years we have also been deferring large investments as far as possible. This has been for a number of reasons, including:

- regulatory revenue settings based on historical trends cannot accurately reflect future needs. Under the DPP, incurring major (lumpy) additional growth expenditure leads to overspending regulatory allowances, a disincentive to investment
- we increased expenditure on minor works from FY13, to provide temporary relief to network constraints, increasing utilisation from existing bulk and subtransmission supply points. This is a cost-effective solution in the short term (but not sustainable in the longer term if load growth continues)
- following the global financial crisis and growing industry awareness of changing customer demand trends, it was considered prudent to defer major reinforcements as far as possible, obtaining more certainty on future demand before doing so
- for some projects we experienced major delays in obtaining line routes and consents.

As a result of the low investment in major projects, and sustained demand growth over the period, we now face the need to materially increase expenditure on network reinforcement, particularly on the subtransmission and bulk supply networks.

Over the CPP Period, we are planning 17 major growth projects. These are predominantly directed at:

- addressing major existing shortfalls in backup capacity, leading to excessive load at risk. For example the reinforcements planned for Palmerston North CBD, Putaruru, Whangamata, Feilding-Sanson-Bulls and several projects in the Coromandel
- addressing growing shortfalls in backup capacity in high growth areas. For example the reinforcements planned for Omokoroa and Pyes Pa.

More details on each of the 17 projects are provided in our AMP, individual Project Overview Documents and the Network Development Plan.

Box 12.3: Major growth project justification

We are confident that our approach delivers an efficient and prudent level of investment because:

- **Prudent security standards**: we have compared our security standards with those applied by others and confirmed that these are 'middle of the road' for New Zealand EDBs, representing good industry practice.
- **Prudent use of our security standards**: we do not mechanistically apply our security standards and begin reinforcement work, but rather treat them as a trigger to initiate further detailed investigation. An integral part of the development of our reinforcement programme is to assess the benefit of projects. The benefits and technical factors are used to develop a comparative ranking used to prioritise works. This approach recognises that in some cases the cost of meeting the standard may not be justified by the benefits, and so maintaining a residual exposure to unserved energy may be the most economic option from customers' perspective.
- **Security position**: the need for major network reinforcement is clear when considering the large proportion of substations where our security standard is breached. While we are not able to conduct a direct comparison of this with other EDBs, considering that our standards are similar and that, anecdotally, they broadly apply their standards, the situation we face is abnormal.
- **Reliability**: in addition, our overall network reliability performance is materially worse than the New Zealand average (normalised to take account of network density), as shown in Chapter 3. The extent of demand placed at risk through insufficient backup capacity contributes to this, with single events causing outages where good practice would avoid this.
- **Efficiency moderation**: as part of the CPP we are proposing to enhance our asset management practices, including expanding our analytical capability around risk quantification, probabilistic security standards, project prioritisation and lifecycle cost analysis. This will result in improved investment decision making. We have therefore made an efficiency allowance of a 2.5% cost-reduction in major project expenditure towards the end of the CPP Period.
- **Innovative solutions**: we are planning a substantial research and development programme to support our network evolution strategy. This is in a large part directed at identifying, testing and integrating improved network solutions that will allow project deferment, or more cost-effective solutions. We expect to see the benefits of this programme arising towards the end of the CPP Period (and continue to increase thereafter), and have therefore allowed for a further 2% reduction in major project costs by then.

12.6 Minor growth and security portfolio

The minor growth and security works portfolio includes minor and routine projects as explained in Table 12.1 and investments that expand our communications capability.

12.6.1 Summary of investments

Below we describe the three types of investment in this portfolio and provide some examples of projects during the CPP Period.

Minor projects

Investments with a value in the $1-5 million range are managed as Minor Projects. Drivers for these investments are generally identified constraints on zone substation transformers or on subtransmission circuits or distribution feeders. Typical examples include upgraded zone substations, larger transformers and some subtransmission or larger distribution circuit upgrades (of lesser value and risk than major projects).

Examples of Minor projects during the CPP Period are summarised below. Further detail on these and the other Minor projects is included in Chapter 11 of our 2017 AMP.

– **Sanson substation supply transformers**: is a typical supply transformer capacity upgrade project. The substation supplies the Sanson, Rongotea and Himatangi townships and the Ohakea Air Base. It has two transformers and demand has exceeded the firm capacity of the zone substation. There is only limited backfeed capability from the 11kV network, leading to potential for extended loss of supply following a transformer fault. The preferred solution is to replace the existing transformers with two larger units with sufficient capacity to continue to meet the demand if one transformer is out of service.
– **Tower Road to Browne Street tie**: is a typical subtransmission enhancement project, necessary to restore appropriate security of supply. These substations are each supplied via a single 33 kV line from Hinuera. Both are experiencing load growth as the Matamata town grows. These substations support each other via 11kV interconnections but there is insufficient backup capacity to supply the full demand for either substation. Due to these constraints both substations do not meet our required security levels leading to a risk of a major outage following a subtransmission event. The proposed solution is to construct a 33 kV underground cable circuit between Tower Road and Browne Street substations to create a 33 kV ring between Hinuera GXP, Tower Road and Browne Street substations.
– **Lake Road substation second supply transformer**: is a typical example of a project initiated to provide appropriate levels of security. The substation supplies farms and other rural loads in the Hinuera area. The substation has one supply transformer and the backup supply from adjacent substations is very limited. An outage of this transformer will result in a loss of supply to a significant number of customers. The solution proposed is to upgrade to a two transformer substation, where each transformer has sufficient capacity to meet demand independently, thereby providing adequate redundancy.

Routine projects

Routine projects Capex includes lower cost, usually repetitive projects, mostly at distribution levels. They include small power transformer upgrades and the provision of new backfeed capabilities.

Routine projects are generally driven by incremental urban growth (e.g. in-fill housing), significant rural land conversion (e.g. forestry to dairy) or industrial / commercial developments. The need for the investment is normally identified from distribution feeder analysis, backfeed studies or as a reactive response to power quality issues.

These projects have short lead times and are responsive to changing growth rates and customer or network activity. Therefore, they are more likely to arise, or change in scope at short notice. It is impractical to try to identify individual projects more than one to two years before implementation. There are generally few alternative solutions, and the solutions mostly follow established practice.

While it is not practical to identify specific projects in the routine class, there are trends and patterns that dominate each planning area, which determines routine growth spend at a portfolio level.

Where several distribution level issues become apparent for a particular location, a larger investment may be the most effective approach, typically leading to a Minor project.

Communications

Our communications investments support the safety of our field crews. They rely on reliable, real time communications and visibility of network state, particularly under unplanned outage conditions.

Electricity networks increasingly require multi-layered communications systems and architectures to support capabilities such as increased network control and automation, workforce and dispatch management, field data mobility, and support for future technologies. Our network evolution strategy will be supported by these assets.

Sufficient communications capability is also needed to support improved protection and asset monitoring which requires expanded data handling capabilities and bandwidth. Efficient operations and planning depends on the collation and timely availability of data. This supports the wider efficiencies we expect to make across the CPP Period.

Our investment include the following projects:

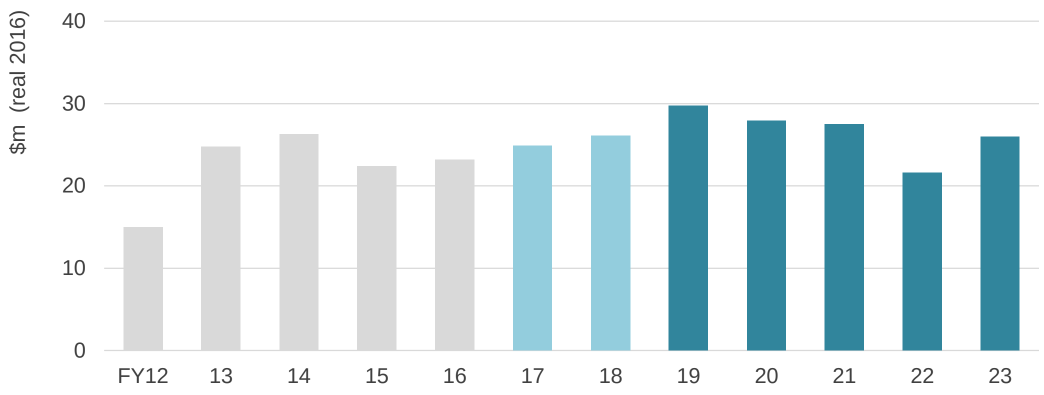
– voice mobile project, a priority due to its reduction of safety risks
– trunk network upgrade vital to the reliability of a range of devices, particularly SCADA
– field-work mobile platform needed to facilitate improved information management, particularly condition data from inspections.

Beyond these, a number of smaller upgrade programmes will take place over the period. We will also need to consider new communication technologies that facilitate new network management capabilities.

12.6.2 Proposed expenditure

Our proposed investments in minor growth and security Capex during the CPP Period, with equivalent historical spend, is shown in Figure 12.8.

Figure 12.8: Proposed minor growth and security works Capex



Our forecast minor growth and security Capex over the CPP Period is largely in line with historical investment levels. During FY19 and FY20 we plan some catch-up on deferred cable work (distribution and subtransmission), distribution line upgrades, and additional transformer capacity. There is also a material uplift in forecast expenditure on SCADA, communications and monitoring early in the CPP Period.

Historically we have needed to prioritise between minor and major projects, and as discussed above we have deferred several large major in recent years. This resulted in more minor projects, particularly in FY13 and FY14. This 'balancing' of investment between major and minor projects will continue, with the low minor project investment in FY22 offsetting increased major project expenditure in that year.

Routine expenditure has been relatively consistent historically, and we expect this trend to continue in line with forecast growth in demand.

Box 12.4: Minor growth and security justification

We are confident that our approach delivers an efficient and prudent level of investment because:

– **Prudent security standards**: we have compared our security standards with that applied by others and confirmed that these are 'middle of the road' for New Zealand EDBs, representing good industry practice.
– **Meeting immediate needs**: traditionally we have managed minor and routine projects to meet the immediate needs arising from increased demand, voltage regulation issues or new customer developments – this has served our customers well, avoiding unnecessary investment while keeping costs down, and we intend to continue with this approach.
– **Innovative solutions**: we are planning a substantial research and development programme to support our network evolution strategy. This is in part directed at identifying, testing and integrating improved network solutions that will allow project deferment, or more cost-effective solutions. We expect to see the benefits of this programme arising towards the end of the CPP Period (and continue thereafter), and have therefore allowed for a 2% reduction in these costs by then.
– **Efficiency moderation**: as part of the CPP we are proposing to enhance our asset management practices, including expanding our analytical capability around risk quantification, probabilistic security standards, project prioritisation and lifecycle cost analysis. This will result in improved investment decision making and we have therefore made an efficiency allowance of 2.5% cost-reduction in minor growth and security to be achieved by the end of the CPP Period.

12.7 Reliability

The reliability portfolio includes our investments in network automation devices. We use these devices to help manage the reliability performance of our network, as discussed in Chapters 3 and 17. This has helped to ensure that network SAIDI remained relatively stable in recent years, while SAIFI has actually improved (during a period when fault rates have risen steadily).

More specifically, network automation refers to the systems and devices that are used to undertake the real-time monitoring and control of distribution switchgear installed on the network, including automatic fault restoration.

Our use of automation is constrained by the need to maintain the safety of field workers and the general public. Automatic reclosing of circuits that have been subject to a fault can present safety risks. To manage this we use a risk-based assessment to understand the safety implications of reclosing schemes. We avoid automatically reclosing circuits when there is a possibility of danger to workers or the public.

We have adopted a strategy of centralised operator control in conjunction with improved fault and network state visibility. Specifically, we aim to:

– maintain control room oversight of automated switching in situations with potential safety risk
– (with current technology) prioritise sectionalisation and isolation capability over fully automated loop automation schemes
– ensure protection systems remain effective by limiting the number of reclosers on circuits.

Investment drivers

Reliability investments support our objective to maintain overall network reliability at an acceptable level, while minimising the associated costs. This reflects our understanding of our customers' preferences. The main drivers for undertaking these investments are set out below.

– **Reduced impact of outages and reliability risks:** by reducing the severity (extent and duration) of outages. This is particularly effective on heavily loaded or older circuits where the impact on customers may otherwise be unacceptable. Automation devices also provide improved visibility of fault location and network state which allows us to respond faster to events on the network.

- **Increased network control**: automation increases the level of central oversight and control we have on our network. This increases our operational flexibility and improves the real-time control of our assets.
- **Reduced costs**: automation devices are a cost-effective way to address reliability performance.
- **Investment deferral**: we can use automation to defer other more expensive investments.

Summary of forecasting approach

The automation programme is forecast 'bottom-up' from the number of devices we plan to install and unit rates based on historical averages. We have undertaken representative economic analysis to understand the relative costs and benefits between automation approaches, based on feeder lengths, customer impacts and device lifecycle costs. This has informed our automation strategy that outlines what devices on what type of feeders we plan to install, which is the basis for the forecast.

In the short term, we select suitable feeders using a tool that assess the specific benefits associated with additional switching devices, enabling us to set an appropriate density of switching devices.

Our approach is summarised in Table 12.2. Further detail is provided in Chapter 12 of our 2017 AMP.

Table 12.2: Summary of reliability forecasting approach

Investment triggers	**Reliability issues**: in areas and/or particular feeders with poor reliability performance are prioritised for inclusion in our automation programmes. **Feeder attributes:** our tool assesses the suitability of individual feeders.
Forecasting approaches	**Volumetric programme**: the automation programme is forecast based on defined device volumes that reflect estimates of suitable device density on feeders in particular network areas where automation is beneficial.
Cost estimation	**Building blocks**: our unit rates for automation assets are based on historical averages that include the cost of material and install.
Criticality	**Reliability**: location of automation assets is driven by reliability considerations which reflect the failure-consequences of our assets, as considered under our criticality framework. **Safety**: in urban areas, we limit the amount and type of automation to minimise safety risks from circuit reclosing.

12.7.1 Summary of investments

The reliability portfolio includes our investments in automation solutions that allow us to manage our reliability performance by providing remote or automated operation of distribution switchgear.

Our network automation programme involves deploying new remote controlled or automated distribution switchgear, protection and monitoring devices to allow us to reduce the impact of asset failures or other incidents causing outages. These assets include:

- three-phase main line reclosers and sectionalisers with SCADA control and visibility
- line fault indicators to give indication of fault locations
- single phase sectionalisers or reclosers to protect spur lines
- fuse-savers.

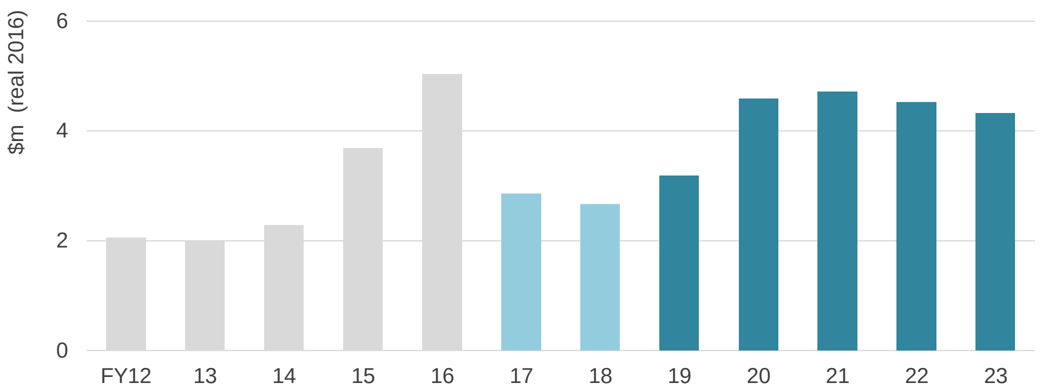
These investments include required device-specific extensions to the communications network, but not the extension of the backbone communications network.

Automation is an important investment option, as it allow reliability issues to be managed cost-effectively and reasonably quickly. This helps us stabilise reliability outcomes on our networks while we work to address and stabilise emerging asset health and network security issues It is important to note that automation can limit the severity of outages, but does not reduce faults, and cannot provide a permanent solution when fault rates continue to increase, as we're seeing on our network. Underlying asset issues therefore still have to be addressed.

12.7.2 Proposed expenditure

Our proposed investments in the reliability portfolio during the CPP Period, with equivalent historical spend, is shown in Figure 12.9.

Figure 12.9: Proposed reliability Capex



In the lead up to the CPP Period we have decided to prioritise Capex on renewals and the major and minor growth projects discussed earlier in this chapter. In FY19 and we will begin to increase our level of investments as we target further areas of our western network that meet our assessment criteria.

Our reliability investment in recent years have been weighted more to the eastern part of our network and, in many cases, we have now reached saturation.[63] However, there is still scope for improvements in the western part of the network, and on some eastern feeders – which is the basis of our expenditure forecast. By the end of the CPP Period we anticipate that the large majority of feeders where automation is cost-effective and would have material benefit, will have been covered.

Towards the end of the period we have applied efficiency adjustments to reflect expected benefits from improved processes.

Box 12.5: Reliability justification

- **Confirmed benefits**: our historical investments have led to direct benefits in terms of feeder outage performance. While we have seen substantial increases in asset failures, we have managed to avoid the impact of this flowing through to deteriorating network reliability (SAIDI and SAIFI).
- **Better customer outcomes**: the reduced impact and duration of outages benefits our customers who will experience less disruption.
- **Prudent**: our approach to automation investments is an effective medium-term approach to addressing reliability and SAIDI/SAIFI performance deferring larger expenditure on other solutions. It also provides better visibility of network operating conditions and allows us to identify fault locations more quickly.

63 There is a practical limitation on the number of automation devices that can be installed on a feeder, dictated by the need to coordinate devices and allow protection system to still function appropriately.

- **Moderation**: following feedback from the Independent Verifier we reassessed the benefits of further investment in areas of the eastern network and removed areas with lower marginal benefits from our forecast.
- **Efficiency**: as with the rest of our growth and security portfolios, as we improve our asset management processes we expect efficiency savings. Our efficiency allowance for this reduces forecast expenditure by 2.5% by FY23.

13 OTHER NETWORK CAPEX

Other network Capex includes the remainder of our network related Capex. It includes works driven by customer requests and our investments to future-proof our network and service offerings.

Consumer connection investments over the CPP Period will be broadly in line with current levels.

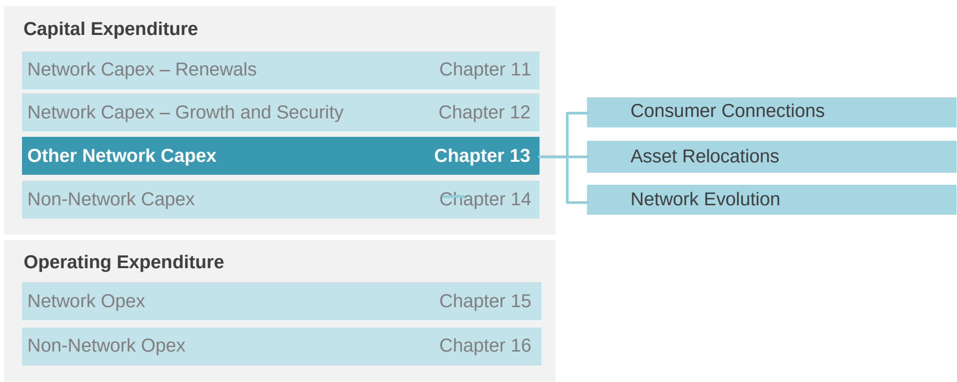
Asset relocation investments over the CPP Period will be broadly in line with current levels.

In 2018, we will begin to invest significantly in technology and systems that will ensure our network can absorb future change and meet changing customer expectations. These network evolution investments will continue over the CPP Period.

13.1 Expenditure category and portfolios

The following diagram illustrates where other network Capex sits within our overall expenditure and lists its portfolios.

Figure 13.1: Expenditure category map showing other network Capex portfolios



The other network Capex category includes the following expenditure portfolios.[64]

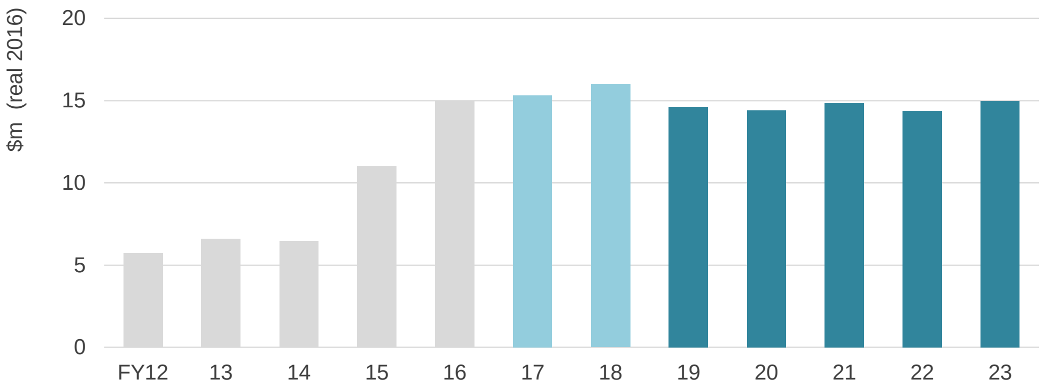
- **consumer connections**: discussed in Section 13.5
- **asset relocations**: discussed in Section 13.6
- **network evolution**: discussed in Section 13.7.

13.2 Overview of other network Capex

Our total proposed other network Capex during the CPP Period, with equivalent historical spend, is shown in Figure 13.2.

64 The network evolution portfolio is reported within System Growth expenditure for Information Disclosure.

Figure 13.2: Proposed other network Capex (net of contributions)



During the CPP Period we expect to invest $73m in other network Capex. This accounts for 9% of our total network Capex spend over the period.

The main driver for increasing investment since 2015 is the increasing number of new connections to our network.

During the CPP Period we plan to increase our investment in technology and systems to support our network evolution strategy. This strategy will enable us to meet evolving customer requirements and also to maximise the benefits from expected innovative technologies.

13.3 Key drivers and forecasting approaches

Below we discuss the main drivers for our other network Capex over the CPP Period and how we forecasted the associated levels of expenditure.

13.3.1 Key drivers

Our investments in other network Capex are driven by the following:

- **Economic growth**: in our regions leads to increased connection numbers and larger connections as businesses expand. A key driver in recent years is residential growth in the Tauranga area.
- **Third party requests**: for our assets to be moved or undergrounded drives our asset relocation investments.
- **Future opportunities**: our expectation of the future benefits of innovative technologies has led us to begin trialling and installing new systems and solutions.
- **Changing customer needs**: a further driver for our network evolution investments is the changing requirements of our customers, which includes better information on their electricity supply and the ability to connect generation and energy storage solutions.

13.3.2 Forecasting approaches

We primarily forecast consumer connection and asset relocation investments using a trending approach. This is based on our expectation that future new connections and third party requests will largely be in line with historical activity and correlate well to indicators such as expected ICP growth. Where we have confirmation of large projects we reflect this in our forecast.

Our network evolution forecast has been developed using a ‘bottom-up’ approach based on the projects and trials we expect to undertake during the CPP Period. We explain these approaches below when discussing our proposed Capex for the CPP Period.

13.4 Developing our other network Capex forecast

Our challenge and approvals process for other network Capex has been used to ensure that forecasts have been derived in a systematic and rigorous manner, and have undergone appropriate scrutiny. Below we describe this process and list key supporting documents.

13.4.1 Internal challenge and approvals

To ensure our forecasts are prudent we undertook a robust, dedicated internal challenge and approval process. This was in addition to the approach used to develop and approve our Preliminary Proposal (discussed in Chapter 4) and the review by the Independent Verifier (discussed in Chapter 6).

- **Commercial team**: our commercial team developed forecasts based on previous works, forecast ICP growth, and known significant works.
- **Engineering strategy**: our asset management team proposed a set of research and development projects that was reviewed and challenged by the Electricity Asset Manager.
- **CPP governance group**: a group of general managers was established to provide oversight of our CPP proposal.
- **Executive management team**: this group of general managers led by the CEO performed a further challenge round on the CPP Proposal.
- **Board review**: the expenditure forecasts were submitted to the Powerco Board for review and approval.

Further details on our Capex governance approach are provided in Chapter 6 of the 2017 AMP.

13.4.2 Supporting documentation

We have used several supporting documents to inform our other network Capex forecast for the CPP Period.

- **Asset management plan**: our 2017 AMP provides further information on our approach to customer initiated works and sets out our proposed network evolution investments.
- **Policies and standards**: including our capital contributions policy.
- **Models**: used to trend historical customer works.

This information was reviewed by the Independent Verifier and a representative subset has been included as supporting material to our submission.

13.5 Consumer connections

Every year thousands of homes and businesses connect to our network. These new connections require investment in infrastructure. Residential connections range from a single new house to subdivisions with dozens of residential plots. The business connections include a range of infrastructure, from small connections such as water pumps to large connections such as factories.

The portfolio also includes works for customers, typically commercial, who want to upgrade the capacity of their existing electricity supply.

We generally require capital contributions from the connecting customer. Where a customer connection request impacts assets owned by us, we contribute towards the cost of constructing those assets. This is because they often lead to expanded capacity that benefits customers in general. We generally require contributions for extensions or reinforcements that solely benefit individual customers and connections that require new assets to be built. In most cases the requesting customer pays the majority of the cost.[65]

13.5.1 Expenditure drivers

We expect to continue making significant investments to enable customers to connect to our network over the CPP Period. A large portion of this cost will be directly recovered from the connecting customers.

This expenditure is largely driven by growth in population (residential) and the overall economy (commercial/industrial). Specifically, investment levels tend to be driven by:

- **New residential developments**: these in turn are influenced by population growth, land supply and Government policy which impacts connection requests and large subdivision developments
- **Growth in commercial activity:** impacts new premises and increasing load requirements as businesses seek to expand their operations.

The level of investment that we make also depends on the level of contributions by the connecting party.

13.5.2 Forecasting approach

These investments are externally driven with short lead times so our ability to accurately forecast medium-term requirements is limited. As such, our forecast is based on trending historical activity. We use FY16 expenditure (gross) as a baseline as we believe it to be a strong indication of future activity. We then use forecast ICP growth to modify the base, before applying capital contribution assumptions and future efficiency targets to form a final forecast.

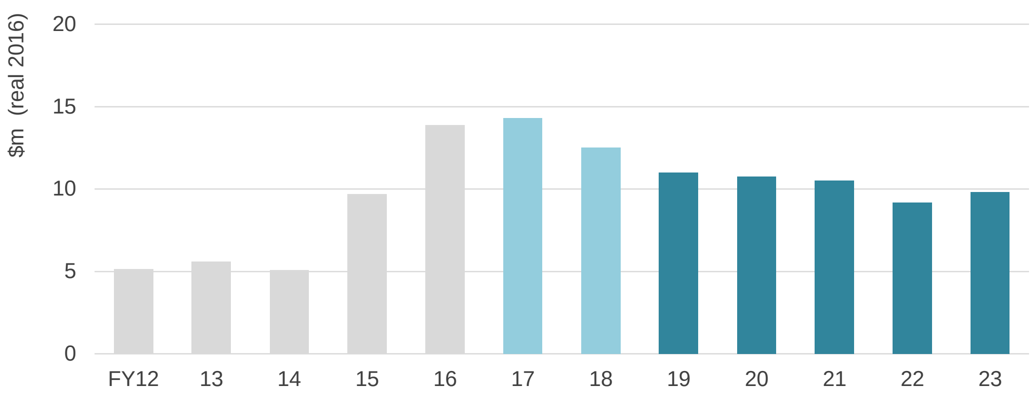
Our ICP forecast is based on household growth data, derived from regionalised econometric parameters. ICP growth correlates well with historical consumer connection expenditure. Forecast ICP growth is also used to inform our demand forecast for growth and security investments.

Our forecast assumes continuing our current capital contributions policy.

13.5.3 Proposed expenditure

Our forecast consumer connections Capex (net of capital contributions) during the CPP Period, with equivalent historical spend, is shown in Figure 13.3.

Figure 13.3: Proposed consumer connections Capex (net of contributions)



65 We have a contribution policy that determines the need for and amount of contribution. We publish a guide online to explain this.

We have limited ability to control this activity as it is driven by third parties. We also have limited scope to reschedule work year to year as we look to satisfy customer requirements as promptly as possible. We expect to see a degree of variation year-on-year as major subdivision and upgrade works occur.

There has been a significant increase in expenditure since FY14 due to post global financial crisis economic recovery in New Zealand. This economic upturn, paired with other industry drivers (such as growth in primary industry investment) resulted in a resurgence of housing development on our network footprint which has contributed to strong ICP growth. This was compounded by growth in investment in agriculture, horticultural and dairy sectors, specifically in our eastern region.

We do not expect this level of investment to continue and are not aware of any specific projects of material size beyond FY18. We are forecasting a decrease in ICP growth over the CPP Period, due to expected slowdown in regional population growth, with expenditure returning towards FY15 levels.

Box 13.1: Consumer connections justification

We are confident that our approach delivers an efficient and prudent level of investment because:

– **Customer driven**: these investments are driven by requests from our customers, enabling new housing, business expansion, and new developments.
– **Contributions level**: our capital contributions approach is in line with other EDBs and appropriately balances the cost to be borne by the connecting party and our investment.
– **Robust forecasting approach**: consumer connection forecast expenditure is based on expected ICP growth, which is forecast from regional econometric parameters developed by an independent economic consultancy.

13.6 Asset relocations

Parts of our network are often located alongside other infrastructure such as roads, water pipes and telecommunications cables. The owners of this infrastructure may require us to move assets as they undertake their own projects. A common example of this is moving overhead lines to accommodate road widening. Historically, we complete between 75 and 125 relocation projects each year. Like consumer connections, we generally require capital contributions from the third party requesting the asset relocation. The Capex associated with facilitating these asset moves, net of contributions, makes up this portfolio.

13.6.1 Expenditure drivers

Asset relocations Capex is driven by third party applications, typically one of the following.

– **Road projects**: road widening and realignment projects by the NZTA and district councils require our assets to be relocated.
– **Infrastructure projects**: owners may require us to relocate our assets as part of their developments (e.g. storm water pipelines, electricity transmission lines or telecommunications).
– **Development**: district councils, commercial organisations, farmers and residential land owners may require us to relocate our assets so they can redevelop sites or existing buildings.
– **Aesthetics**: customers can request electricity lines disrupting their views to be moved underground.

This expenditure is capitalised if assets are replaced as part of the relocation.

13.6.2 Forecasting approach

Asset relocations Capex is customer driven, often with short lead times so our ability to forecast this expenditure on a volume or project basis is limited. As such, our forecast is based on trending, using a base-step-trend approach. We use FY16 asset relocations expenditure (gross) as our baseline. This is modified by any significant project expenditure that we become aware of through consultation with councils and NZTA, capital contribution assumptions and future efficiency targets.

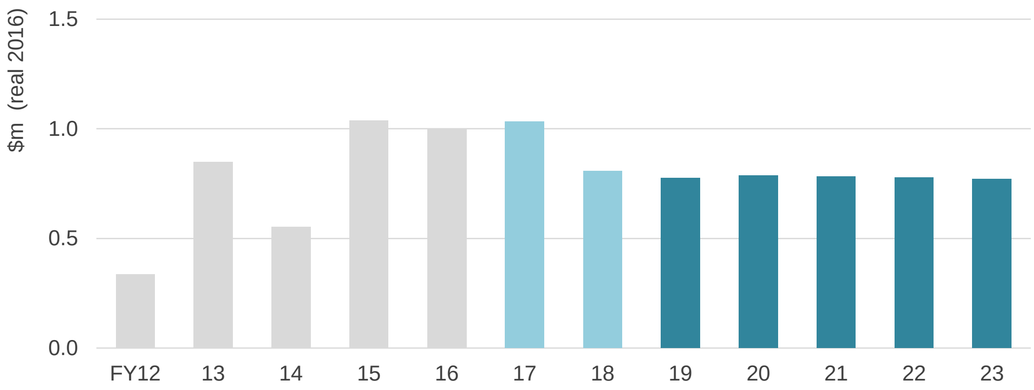
We expect to see a degree of variation year-on-year, as major projects are completed and we have limited ability to smooth the expenditure across years.

Generally, we receive contributions from the third party requesting the relocation, reducing the amount we invest. For roading and other infrastructure projects, the level of our investment is governed by legislation.[66] For smaller projects, our level of investment is guided by our capital contributions policy and our forecast assumes a continuation of our current policy.

13.6.3 Proposed expenditure

Our forecast asset relocations Capex (net of capital contributions) during the CPP Period, with equivalent historical spend, is shown in Figure 13.4.

Figure 13.4: Proposed asset relocations Capex (net of contributions)



Historical asset relocations expenditure varies year to year, mainly due to the timing of larger relocation works. Forecast expenditure is flat, based off an FY16 activity level. Forecast net expenditure is lower than FY16 net expenditure due to the particular mix of projects which led to a lower level of capital contributions in FY16.

Box 13.2: Asset relocations justification

We are confident that our approach delivers an efficient and prudent level of investment because:

- **Third party driven**: these investments are driven by requests from our other utilities and authorities enabling infrastructure projects and new developments.
- **Contributions level**: our capital contributions approach is in line with other EDBs and reflects relevant legislative requirements.
- **Historical alignment:** our asset relocations forecast is consistent with historical amounts, and includes a 1% adjustment for expected efficiency improvements by FY23.

13.7 Network evolution

Network evolution expenditure supports our corporate objectives of enabling our customers' energy choices and efficient asset utilisation now and into the future.

The electricity market is changing – driven by interrelated changes in customers' attitudes and use of our network, and emerging technology opportunities. These changes, while still relatively insignificant in New Zealand, could in time have a profound impact on the nature and operation of electricity distribution networks.

66 Sections 32, 33 and 35 of the Electricity Act 1992 and section 54 of the Government Roading Powers Act.

Emerging technology also offers substantial opportunities to improve on traditional network solutions and way of doing business. We intend to act on these opportunities, which will over time translate into improved cost efficiency and customer service outcomes.

Our network evolution expenditure will support our transition from a conventional, largely passive network into a flexible, dynamic network that will respond quickly and efficiently to changing load patterns and can be tailored to customer requirements. It provides for research and development of new network and non-network solutions or applications, testing of these applications on our network and developing promising solutions into fully-fledged business applications.[67]

13.7.1 Our view of the future electricity distribution network

We see the electricity distribution network continuing to play an important role in the future energy market. It will continue to connect our customers to external sources of electricity, and will also facilitate transactions between customers.

We recognise that rapid technological change will affect how our customers use the distribution network and the services they expect us to provide. We also recognise that we must factor technological change in our expenditure plans, to ensure that customers obtain maximum value from this investment.

Box 13.3: The changes we expect

The changing use of the distribution network will result from customers' increasing ability to cost-effectively generate and store their own energy, as well as technological and market changes, and policy and regulatory developments. These changes have implications for us and for our customers, over the CPP Period and into the future.

Future electricity demand is likely to vary in more unpredictable ways and differences in consumption patterns across the network are likely to be accentuated. There are emerging factors that may reduce overall electricity drawn from the network, while others are likely to increase it – the net impact is uncertain, but consumption patterns are likely to be more variable, with significant, rapid changes in instantaneous demand.

Many customers will generate some of their own electricity and some will export electricity back to the network.

Managing the intermittent and two-way power flows that will result from these changes, will require new technical and commercial solutions and operating models to ensure safe and stable network operation. To minimise the cost impact, adopting innovative new solutions will be imperative. We will also need to ensure equitable network cost sharing across the customer base.

On the other hand, emerging technology, on the customer and network sides, will offer many new opportunities to improve service offerings, network performance and network utilisation – and if applied judiciously, will over time support lower costs.

Current rates of change will continue to escalate, driving further innovation in the energy market, leading to new market players and services, and new unpredictable ways for our customers to use our network.

Responding effectively to the uncertain future associated with the changing energy environment requires us to develop a new range of capabilities. Responsiveness to changing customer requirements, effective innovation, and ensuring current investments will allow maximum flexibility to accommodate future needs, have to become core skills alongside excellence in engineering and asset management.

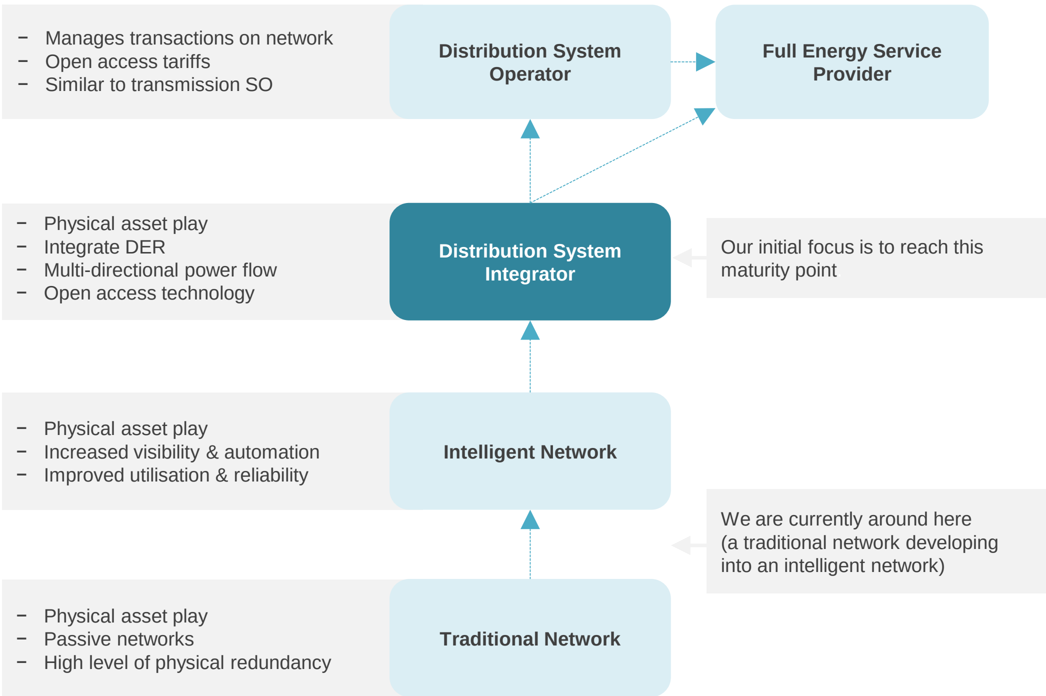
[67] It does not include the full-scale roll-out of new solutions – this would be part of business-as-usual and fall under the normal network Capex portfolios. It also does not include Opex for staff related expenditure related to Network Evolution activities – this is included within the SONS portfolio.

To respond to these changes, and to ensure the long-term sustained value of the network to our customers, we see the role of the distribution utility of the future as follows.

- responsible for keeping people (the public and our staff) safe from possible harm from the network
- we are the load serving entity, i.e. the party responsible for accepting power from bulk suppliers, delivering power to (and accepting power from) customers through an electricity distribution network that we augment, maintain and repair
- responsible for reliability of supply, which involves ensuring appropriate real-time distribution capacity to balance supply and demand, monitoring and ensuring network needs like compliant voltage and signal quality are met
- making the distribution network available as an open-access platform to which customers can connect (within safe bounds) any devices they require, or over which they can transact with others as they see fit.

Reflecting this, we have adopted a corporate objective to evolve to a distribution system integrator in the medium term (5 to 10 years), shown in Figure 13.5.

Figure 13.5: Our network evolution objective[68]



Achieving this evolution will involve traditional network techniques, as well as new and innovative non-network solutions where these better serve the long-term interest of consumers. With reference to the latter, we will research and develop our own solutions, but also look to partner with others where they can provide appropriate solutions more cost-effectively than ourselves.

We also note that the rate and extent of technology and customer demand change is uncertain. It is not prudent or efficient for us to undertake significant investment and lock ourselves into a particular technology direction at an early stage. Our approach is therefore to create options for the future and to identify 'least-regret' actions or investments that would make it easier to integrate new technologies and meet customers' emerging requirements, in a cost-effective manner.

[68] Figure based on the Edison Institute, Possible Pathways for the Future

Conversely, international experience suggests that investing only once significant change is taking place is inefficient and costly – a belated response often has to rely on traditional solutions, which are then the only available means of resolving issues in the short term.[69] Being ready with innovative solutions, when these are required, is substantially more cost-effective.

13.7.2 Expenditure drivers

Expenditure within the network evolution portfolio is directed at researching, developing and testing new network and non-network solutions and, where proven feasible, developing them into business-as-usual network applications. It explicitly does not include the full-scale roll out of new solutions – this would be part of business-as-usual and fall under the normal network Capex portfolios.

The solutions that we intend to develop target two broad goals:

- enabling customer choice while keeping the network stable
- realising opportunities offered by new technology.

Expanding customer choice

As cost-effective technology emerges and customers increasingly look to better manage their own energy needs, expectations will change for many. This will drive further innovation in the energy market, which means the role of existing energy market providers, including us, will have to adapt.

A key part of our network evolution strategy is to facilitate our customers' future energy choices and to make it easy for them to connect to and innovate over our networks. The environment in which we operate is changing rapidly. Technologies such as solar generation, battery storage, and electric vehicles are becoming mainstream, with further energy management applications emerging.

At present we are starting to see our customers take up new opportunities to generate a portion of their own energy, share this at a local level, but continue to access the network when their demand is higher than their own devices can provide for. Our vision for the future is one where our electricity distribution network not only provides a safe and reliable link to existing external energy sources, but also helps unlock more flexibility, competition, and value for our customers who wish to transact their own energy over the network.

However, this variability in generation levels, together with new electricity applications, such as electric vehicles, which represent a major, but very intermittent additional network load, holds potential for unstable networks and compromised supply reliability. These problems have been reported in several overseas jurisdictions where rapid uptake of new distribution edge devices has required distribution utilities to undertake major network augmentations. Current uptake rates of edge devices on our network are still very low, but we consider it likely that similar issues will arise here in the future, which will require intervention and additional investment from us.

To minimise this impact, we intend to not only monitor the situation and take early action where required, but also to prepare and develop a suite of effective new solutions, which overseas experience has demonstrated will rely heavily on innovation and new technology.

Together, these trends are driving changes in the way networks are managed and the types of assets and systems deployed. To meet these needs in the most cost-effective manner, while facilitating maximum flexibility for our customers, will require us to adopt an optimal mix of conventional and innovative technologies and service solutions.

Our proposed investments will support the expanding customer choice discussed above. It will enable us to adapt our services to our customers' evolving needs and to address change in the wider sector. We will facilitate innovative services and increased customer choice, as well as ensure that the network remains safe, stable and reliable. In particular, our proposed investment will allow for:

[69] For example, work undertaken for the ENA (UK) in developing the Transform model (by EA Technology and partners), indicated that applying conventional solutions to emerging network issues are significantly less efficient and more expensive than dealing with these through innovative means.

- enhanced customer liaison and research on evolving customer requirements – ensuring that we listen to our customers and tailor our services to their requirements
- ongoing research and analysis on emerging distribution edge devices – making sure that the electricity network will remain stable and reliable, and relevant to our customers' future needs
- developing and testing innovative solutions – working with customers to expand and improve our services, and finding cost-effective solutions that will allow the network to operate as an open-access platform without compromising stability and reliability.

Realising opportunities from new technology

New electricity network technology is emerging at an escalating rate. This is driven in part by improved materials and manufacturing, but is largely the result of the increased efficiency with which network devices can be remotely monitored and controlled, and incorporated into automated systems. New technology is also supporting increased application of non-network solutions, such as demand side management (load reduction or load shifting) or dynamic electricity tariffs.

These new solutions are being widely researched and tested, and increasingly used in permanent, large-scale applications. Widespread international evidence is emerging of how innovative solutions can outperform conventional network applications on function, flexibility and cost-effectiveness. In light of the considerable investment we face to renew assets and augment our network, it is paramount that we seize these opportunities to minimise costs without compromising service levels.

Examples of where we see major benefits that could arise from applying emerging technologies include:

- increased asset utilisation and asset lives, allowed by real-time asset performance and condition monitoring
- deferring augmentation by peak demand reduction, through energy storage or demand management schemes
- load shifting, and self-healing networks, through network automation schemes
- improved network planning and asset utilisation, through enhanced understanding of customer load patterns and associated incentive development.

We can learn much from others who have already tested these solutions, including other distribution businesses, academia, research institutes and suppliers, and are also keen to share our learnings with others. However, ultimately we also need to apply the solutions to our own network to test their efficacy for our customers, in our environment and with our back-office and enabling systems. For this we propose a research and development programme, with pilot projects to test solutions on the network. Solutions that are found to be technically and economically feasible will then be rolled out as part of our normal suite of network applications.

Our proposed investments will support our ability to realise the benefits associated with emerging technology. It will enable us to adopt new solutions that will enhance our services to customers, and lead to more cost-effective outcomes than can be achieved through purely conventional investments. In particular, our proposed investment will allow for:

- research on emerging technology and non-network solutions for distribution network applications, to ensure we remain abreast of international best practice developments
- pilot programmes, to test promising solutions on our networks – helping us understand the practicality and ease of implementation, and to identify which solutions are technically and economically attractive to pursue further
- developing feasible new solutions from the concept stage to a full business-ready status – supporting the introduction and adoption of new solutions into our business-as-usual practices
- close liaison with academia, suppliers and research institutes, and jointly working on research and test programmes aimed at developing improved distribution network solutions – cooperating with and sharing knowledge with others, rather than 're-inventing the wheel'.

Planned investments

The network evolution portfolio is aimed at emerging solutions, where the practicality and benefits are not immediately clear. By its very nature, the exact scope, cost and outcome of such trials cannot be accurately predicted in advance. We have identified a number of areas that, based on literature studies and discussions with other parties who have been testing new solutions, appear most beneficial to pursue first. It is highly likely (and desirable) that further applications worth pursuing will be identified during the CPP Period – and we will respond appropriately.

Box 13.4: Planned network evolution investments

The main programmes that we have currently identified as priorities during the CPP Period are:

- **Automatic fault location and isolation**: expand our trials of remote fault detection devices, communications systems, and automated switches for fault isolation
- **Energy storage**: trialling energy storage devices such as flywheels and batteries on the network
- **Real-time asset ratings**: trialling techniques to remotely measure asset status in real time, to allow higher loading, inform load shifting and provide condition information
- **Self-healing networks**: extend the fault detection and restoration work to include automatic restoration of supply to non-affected areas. Will also tie in with energy storage and local generation.
- **State estimation and network automation**: investigate further applications to extend self-healing networks and fault isolation work, and also allow dynamic load shifting
- **Voltage support applications**: trial various means of providing voltage support, including integrating potential customer side solutions
- **Integrating community energy schemes**: trialling how these can be effectively integrated into the network, allowing maximum customer flexibility while retaining network integrity
- **Network insights**: expanded network monitoring and metering, including on low voltage networks (this is also enabling technology for many other network evolution applications)
- **Electric vehicle charging control systems**: investigate various means of integrating and managing EV charging stations

Table 13.1 sets out the expected benefits for each of these investments.

Table 13.1: Intended beneftis of network evolution investments

INVESTMENT	INTENDED BENEFITS
Automatic fault location and isolation	– **safety**: immediate identification of outages; isolation of potentially unsafe feeders – **cost efficiency**: accurate identification of fault location leads to less fault-finding time and reduced travel – **reliability**: quicker fault response and therefore restoration times; isolation of faulted sections could allow remote restoration to other parts.
Energy storage	– **safety**: continuity of supply to critical devices – **cost efficiency**: peak-lopping can defer need for reinforcement; power quality stabilisation reduces need for network reinforcement; diminished need for network redundancy; potential to participate in ancillary services market – **reliability**: ride through shorter faults; power quality stabilisation.
Real-time asset ratings	– **safety**: continuity of supply to critical devices – **cost efficiency**: improved asset utilisation and extended asset lives – **reliability**: avoid potential overload situations.

INVESTMENT	INTENDED BENEFITS
Self-healing networks	– **safety**: early detection of (potentially dangerous) problems – **cost efficiency**: planned response to outages rather than reactive; exact fault location known – **reliability**: reduces extent of outages; increased network resilience.
State estimation and network automation	– **safety**: continuity of supply to critical devices; early detection of (potentially dangerous) problems – **cost efficiency**: improved asset utilisation and extended asset lives – **reliability**: avoid potential overload situations; reduces extent of outages; increased network resilience through backup supply routes.
Voltage support applications	– **safety**: continuity of supply to critical devices and avoid dangerous voltage excursions – **cost efficiency**: improved asset utilisation and reduced cost compared with conventional solutions – **reliability**: avoid potential network instability and power quality issues; avoid potential network shutdown.
Integrating community energy schemes	– **safety**: safe integration and connection of customer schemes – **cost efficiency**: defer reinforcement and reduced cost to avoid network stability issues – **reliability**: allow customer networks to automatically disconnect from the grid during emergency situations.
Network insights	– **safety**: early warning of potential overload situations and warning of customer issues such as broken neutral connections – **cost efficiency**: better targeted reinforcement investments and reduced cost to avoid network stability or power quality issues – **reliability**: avoid overloads and associated reliability issues; avoid voltage quality issues; improved understanding and management of LV network impact on customer supply quality.
Electric vehicle charging control systems	– **safety**: avoid network overload and potential customer shutdowns – **cost efficiency**: avoid need for network reinforcement and reduced cost to avoid network stability issues – **reliability**: avoid overloads and associated reliability issues and avoid voltage quality issues.

13.7.3 Forecasting approach

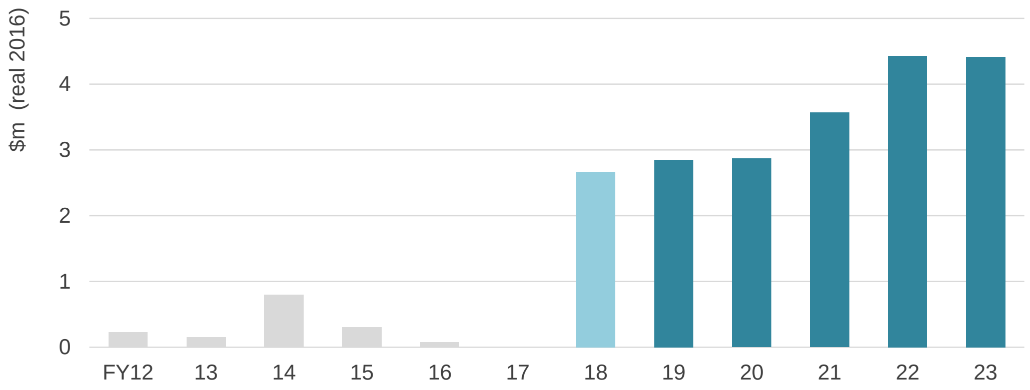
The costs associated with these investments are based on assessment of similar projects conducted in the past, on literature research, observing the work done by others, and on engineering forecasts. By definition, the exact scope of work, cost of components and outcomes are less certain than for conventional projects using conventional solutions with clearly defined outcomes. Our cost estimates for the network evolution portfolios are therefore inevitably more conceptual than detailed.

The work is intended to identify and apply promising new solutions. When these have been proven and are ready for large scale network roll out (substituting for conventional reinforcement or renewal investments) more accurate cost estimates will be possible.

13.7.4 Proposed expenditure

Our forecast network evolution Capex during the CPP Period, with equivalent historical spend, is shown in Figure 13.6.

Figure 13.6: Proposed network evolution Capex



Historically, our investments in this area have generally been categorised as part of our network enhancements expenditure, with some small trials and pilot programmes run as network evolution programmes. Starting with our 2016 AMP, we split out this expenditure in recognition of its growing importance. Expenditure is forecast to increase as we expand our proof-of-concept trials.

Box 13.5: Network evolution justification

We are confident that our approach will support an efficient and prudent long-term level of investment. Network evolution projects are not intended to deliver direct customer benefits by themselves, but will be the basis to provide material longer term customer benefit.

- **Prudent investment**: opportunities presented by emerging technology to cost-effectively increase network and asset utilisation (defer reinforcement), extend asset lives (defer replacement), improve safety and reliability, and improve operations.
- **Better customer outcomes:** managing the distribution network as an open-access platform will provide maximum customer flexibility, and allow customers to innovate as they see fit – with us being an enabler for this
- **Network performance**: avoiding network instability and deteriorating reliability that may result from the connection of certain types of customer devices, particularly variable generation. Adopting innovative means of ensuring this stability has been proven to be substantially more cost effective than traditional network reinforcements.
- **Expected benefits**: the cost benefit from individual programmes will vary. However, international literature quotes multiple examples of substantial benefits arising from these solutions.[70]
- **Moderation**: feedback from the verifier on the overall scale of the portfolio led us to moderate spend and defer some investment.

[70] A credible recent example is work for Ofgem (the UK electricity and gas regulator) to review the value to customers from the Low Carbon Network Fund innovation incentives. Its analysis, supported by analysis from economic and technical consultants, suggest that the discounted net benefit to distributors who trialled new solutions is between 2.5 and 54 times the initial investment made on researching and testing the solutions. The report is available here.

14 NON-NETWORK CAPEX

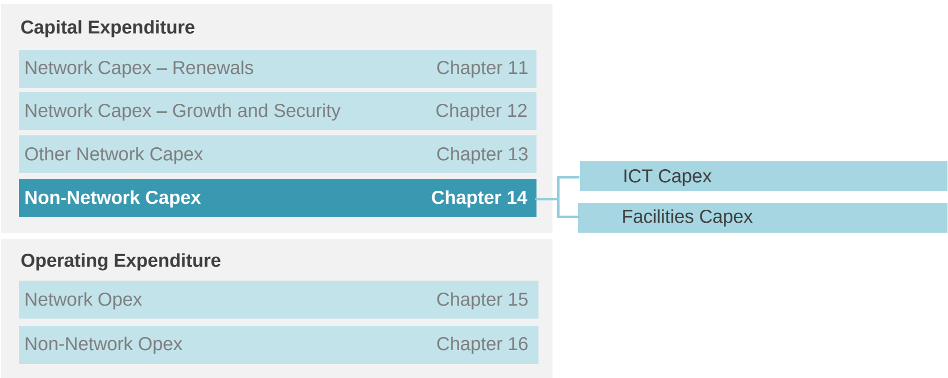
Non-network refers to the business functions that support our network distribution operations. It includes corporate functions such as finance, HR and ICT support systems as well offices and facilities for our staff. Capital investment in these functions, particularly ICT, is required to support the planned increase in network work programmes and improvements in our asset management capability. Key investments are summarised below.

- 70% of our proposed ICT Capex maintains existing capabilities. An Enterprise Resource Planning (ERP) programme will replace a large number of outdated legacy systems with a single solution. This integrated solution is more cost-effective than piecemeal replacements. The ERP will also provide a platform for lifting our asset management capability.
- The increase in employee numbers to deliver our investment plans requires more office space in New Plymouth. A cost-benefit analysis concluded that consolidation and expansion of our Junction Street site is the most efficient and prudent long term option, and will increase the resiliency of our Network Operations Centre.

14.1 Expenditure category and portfolios

The following diagram illustrates where non-network Capex sits within our overall expenditure and lists its portfolios.

Figure 14.1: Expenditure category map showing non-network Capex portfolios



The non-network Capex category includes the following expenditure portfolios.[71]

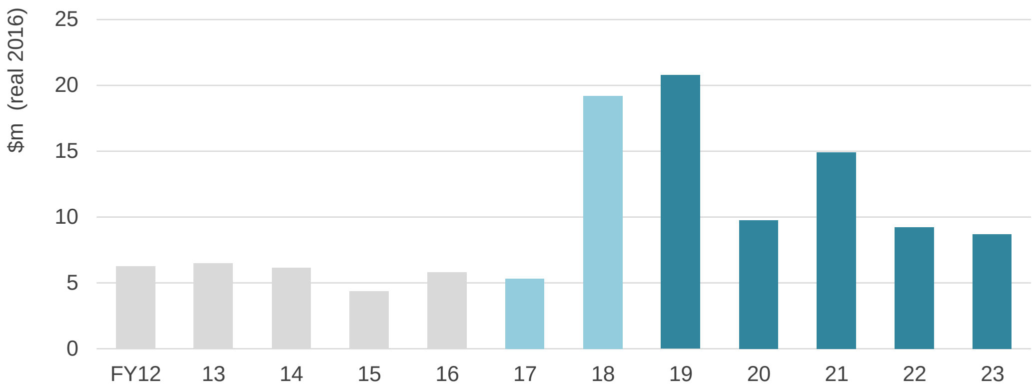
- **ICT Capex** discussed in Section 14.5
- **Facilities Capex** discussed in Section 14.6.

71 These portfolios expand on those specified by Information Disclosure as they better reflect the way we plan these investments.

14.2 Overview of non-network Capex

Our proposed non-network Capex during the CPP Period, with equivalent historical spend, is shown in the following chart.

Figure 14.2: Proposed non-network Capex



During the CPP Period we expect to invest $63m in non-network Capex. This accounts for 7% of our total Capex over the period.

The step change in Capex in FY18 and FY19 corresponds to our investment in expanded office facilities in New Plymouth and the first two years of our ERP implementation. The latter is the planned replacement of our current legacy finance system and the rationalisation of business applications.

The ERP will include new work management functionality to support investment delivery and our asset management improvements. This work is forecast to continue into the first two to three years of the CPP Period. The replacement of the current billing system and related customer management tools is scheduled for FY21 after the core ERP implementation is complete. Annual average capital expenditure returns to historic levels in FY24 after we have completed the enhancement of our network management platform – planned for FY22 and FY23.

The multi-year ERP programme and expanded office facilities in New Plymouth have both been subject to a comprehensive business planning process and both are essential enablers of the planned network works programme and asset management improvements we need to deliver over the CPP Period and beyond.

In summary our forecast non-network Capex includes investment in:

- **ERP**: Replacing several discrete legacy systems with a modern ERP that will support the efficient delivery of the planned works programme through enhanced information and workflow and will also support lifting our asset management capability.
- **Other ICT systems**: Investment in network operations and customer engagement systems, ICT hardware and cyber security systems.
- **Facilities**: New Network Operations Centre (NOC) with increased capacity and resiliency to support the larger planned work programme, new office space to accommodate uplift in employee numbers and consolidating two office locations into one at Junction Street, New Plymouth.

14.3 Key drivers and forecasting approaches

Below we discuss the main drivers for our non-network Capex over the CPP Period and explain how we forecast the associated levels of expenditure.

14.3.1 Key drivers

Our investments in non-network Capex are driven by:

- **Safety**: the current facilities in New Plymouth are at capacity. To mitigate the issues this causes for staff and to ensure we can support the demands of the business during the CPP Period we will invest in new facilities in New Plymouth with increased capacity.
- **Deliverability of our investment plans**: investments in facilities and maintaining the currency of our ICT capabilities are prerequisites to delivering increased network work programmes efficiently and effectively.
- **Efficiency and improving practices**: investment in new ICT systems will create an opportunity to introduce new workflow and streamline our core business processes. We anticipate that once these new systems are in place the need for some manual processing steps will be reduced. We have reflected these potential future efficiencies in our forecasts.
- **Facilitating better asset information**: information is an asset and drives effective business decisions. In recent years we have invested in systems and applications that manage asset-related data (e.g. our asset modelling tool and regulatory asset ledger). The planned rationalisation of our legacy finance and asset systems through the investment in ERP combined with a focus on identifying critical information requirements to support effective decision making will lift our planning performance to the next level.
- **Analysis capability**: as we collect more information and as future energy challenges arise, we will need new tools and skills to translate data into information that drives high quality decision-making. All parts of our business will be enabled to perform their own analytics to find answers to problems and create new business value.

14.3.2 Forecasting approach

ICT Capex investments have been forecast using a 'bottom-up' approach that started with a clearly articulated needs and options analysis and then built up the various components and costs of preferred solutions using up to date and benchmarked market information.

Our facilities forecasts are based on a combination of tender responses and desktop estimates the latter being informed by historical tenders and discussions with vendors.

14.4 Developing our non-network Capex forecast

A formal challenge and review process for non-network Capex has been used to ensure that forecasts have been derived in a systematic and rigorous manner, and have undergone appropriate scrutiny. Below we describe this process and list key supporting documents.

14.4.1 Internal challenge and approvals

To ensure our forecasts are prudent we undertook an internal challenge and approval process. This was in addition to the top down challenge applied to the overall Preliminary Proposal (discussed in Chapter 4) and the review by the Independent Verifier (discussed in Chapter 6). In summary:

- **IS Works Plan**: our infrastructure and support team developed the ICT expenditure forecasts based on historical costs, expected unit cost and price trends. This team worked with suppliers to determine market based unit costs for replacement technologies or their modern equivalent.
- **Facilities Plan**: our facilities team developed a facilities plan in consultation with relevant business units and with the support of external specialist advisors.
- **CIO and CFO**: the non-network Capex plan was subject to challenge and scrutiny by the CIO and CFO.

- **CPP Governance Group**: a group of General Managers was established to provide oversight of the overall CPP proposal.
- **Executive management team**: the CEO and our wider General Management team performed a further challenge on the CPP Proposal.
- **Board review**: the expenditure forecasts were submitted to a CPP sub-committee of the Board and the Powerco Board for review and approval.

Further details on our non-network Capex governance approach are provided in Chapter 6 of our 2017 AMP.

14.4.2 Supporting documentation

We have used several supporting documents to inform our non-network Capex forecast for the CPP Period.

- **Asset management plan**: provides an overview of our non-network Capex.
- **IS Works Plan**: a detailed works plan for the coming 12 months derived from the IS Asset Management Model.
- **IS Capability and Expenditure**: a description of the IS capability and expenditure that we will require over the CPP Period. This document will be superseded by the IS Strategic Plan, due to be finalised in mid-2017.
- **Policies and standards**: including the IS Asset Management Policy and Standard which defines the maintenance schedule for all IS assets, and how we assess IS services to identify gaps in capability, as well as our cost allocation policy.
- **Business cases**: provide detail on options considered and the costs and benefits associated with each option for specific projects.
- **Models**: the IS Asset Management Model provides a ten-year model of the maintenance and new capability projects and their estimated cost.

This information was reviewed by the Independent Verifier and a representative subset has been included as supporting material to our CPP submission.

14.5 ICT Capex

This includes ICT assets, such as hardware (e.g. computers, servers) and software (e.g. asset management systems and network operations systems). Renewal of network communications assets are captured in the secondary systems portfolio, with investment in additional communications assets included in the minor growth and security works portfolio.

14.5.1 Our approach

Historically, our ICT approach has been to grow capability by incrementally adding new bespoke applications to our core systems. While this provided solutions that met specific business needs, over time the ICT landscape has become very complex and expensive to extend, modify and maintain (for example, we currently maintain over 130 applications, with over 120 interfaces).

Our core systems are now due for renewal. Replacement of the legacy systems with an off-the-shelf ERP system, pre-configured for the needs of electricity distribution companies is considered the optimum long term solution and a key enabler of our long-term investment plan. Consolidation of systems around a central ERP core is an approach adopted by many leading practitioners.

Given the significance of the change involved with implementing an ERP and the accompanying business process changes that these systems drive, we have spent the last three years carefully considering options and timing. After an initial industry scan, an RFI process was initiated, which was designed to evaluate a range of potential options. This RFI process was not limited to replacement ERP solutions but also sought market responses based around retaining our core best of breed point solution approach.

Responses to the RFI were assessed based on their ability to deliver functional requirements as well as other criteria including the quality of support in New Zealand and whether or not appropriate and comparable reference implementations were available to us to inform the solution selection.

Strategically, the results from the RFI and associated market due diligence exercise revealed an ERP system to be a clear preference due to reduced complexity of integration (asset and financial data would be in the same database), lower ongoing costs and the ability to phase the implementation to add more functionality in the future.

14.5.2 Expenditure drivers

During the CPP Period, our investments in ICT Capex are in response to the following drivers.

- **Lifecycle renewals**: despite the increase in overall expenditure, around 70% of the ICT Capex over the CPP Period ensures that we maintain the existing capabilities of our assets while also improving maturity and standardising management practices.
- **Enabling efficient work volume growth:** modern ERP systems have pre-configured integration and workflows which target end-to-end business processes. Where appropriate we will flex our practices to the pre-configured workflow. ERP systems provide future flexibility to scale up to meet changing transaction volumes well beyond any requirement currently envisioned, thus enabling future growth.
- **Lifting asset management capability:** our CPP work programme delivery is supported by our ongoing asset management improvement programme and achieving ISO 55000 certification is a key part of this. An ERP implementation will provide the platform for us to lift our asset management capability. The ERP solution will better integrate financial and non-financial data, allow for improved performance analytics, and as noted above will provide integrated workflow and processes from planning through to delivery in the field. Asset management decision making will improve over time as the source data feeding our management decisions improves and our analysis of that data becomes more granular and sophisticated.
- **Efficient ICT costs:** cost efficiency is a key driver for the ERP. Retaining our current point solution approach, with increasingly complex integration and escalating ongoing maintenance costs is not considered cost effective over the long term as we forecast that costs to support the current configuration will increase significantly. A phased implementation of an ERP system, with flexibility to increase scale in the future, is considered optimum from a cost perspective.
- **Information integrity and analysis:** an integrated ERP solution will direct better data and information provision. It creates a platform to develop a ‘single version of the truth’ for critical data that supports both operational decision making and financial and non-financial regulatory disclosures. The direct capture of asset-related data in the field and the publication of that data into a data warehouse linked to a core ERP system will provide more accurate and timely information about the condition and state of our assets. Ultimately this will allow us to implement advanced analytical approaches to asset management planning and optimise the effectiveness of our asset-related expenditure against the value of the services that it delivers and the risks and costs of doing so. This ultimately drives better outcomes for customers in terms of improved service provision and lower cost.
- **Delivering new capabilities**: the balance of the ICT investment delivers new IS capability where business cases have been justified. For example, this includes systems to maintain network quality and safety as our customers make increasing use of distributed energy resources, and systems to support advanced customer service.

14.5.3 Forecasting approach

ICT investments have been forecast using a ‘bottom-up’ approach that identified likely initiatives and forecast their likely cost. This includes:

- **ERP**: replacing several discrete legacy systems with a modern ERP that will also support lifting asset management capability.
- **Network operations real time tools**: scheduled for 2022-2023, this will provide an advanced distribution management system to maintain network quality as customers increasingly use new technology on our network.
- **ICT Platform**: continuing investments in our hardware and to increase the resiliency of our systems.
- **Cyber security**: lifecycle renewal of tools scheduled for 2022-2023.

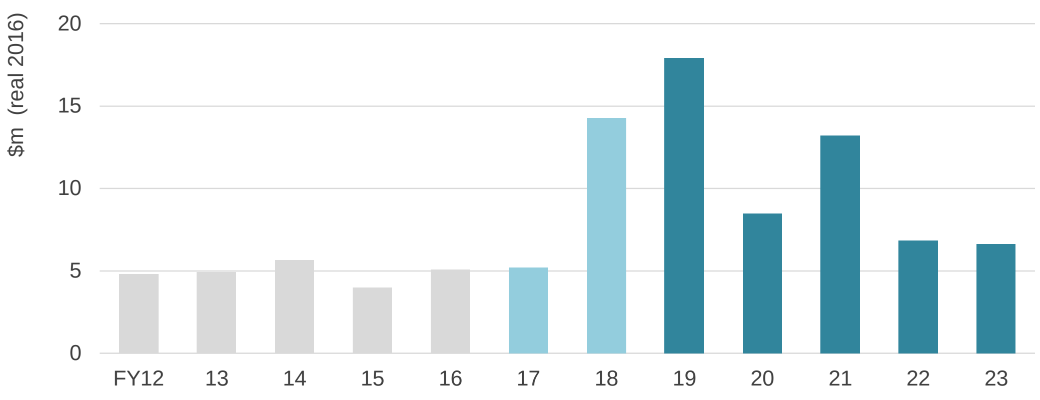
For the ERP, a comprehensive approach to costing the implementation was followed. Following an initial RFI and market discovery stage, we undertook a sixteen week investigation and exploration initiative with two vendors, where each developed a prototype using our actual data to test the capability and functionality of the respective systems. This was followed by each suppler providing a detailed costing model and details of software procurement, and associated implementation services. While this process was involved and time consuming, it allowed us to directly compare costs of both options and demonstrably test the market.

ERP implementations are complex and potentially very disruptive. The implementation risks have been considered in detail, taking into account learnings from other peer organisations who have undertaken similar implementations. We have supplemented this with independent expert review and advice from leading IT analysts, such as the Gartner Group. Reference checks have been completed, for each of the two short-listed vendors and a peer review of the vendors' costing models has been performed by our PMO to review assumptions and underlying calculations. We have also completed a data risk audit and a business change impact assessment review using external industry specialists.

14.5.4 Proposed expenditure

Forecast ICT Capex during the CPP Period, with equivalent historical spend, is shown in Figure 14.3.

Figure 14.3: Proposed ICT Capex



As previously described, historically our annual ICT Capex has been held relatively flat at about $5m a year. The increase in in FY18 corresponds to the initial phase of the ERP implementation, during which we will replace our current enterprise finance system.

This work is forecast to continue in the first part of the CPP Period and functionality will be extended to include support for works management. The replacement of our billing system and related customer management tools is scheduled for implementation around FY21 after the core ERP implementation is complete.

Box 14.1: ICT Capex summary

We are confident that our approach delivers an efficient and prudent level of investment because:

- **Prudent**: the ERP business case demonstrates that the option of replacing existing systems will cost more than migrating to a single system centred on an ERP solution. We have undertaken an industry best practice solution selection, evaluation and procurement process.
- **External reviews**: external expertise has been brought-in to assist with developing the IS strategy and options analysis.
- **Better customer outcomes**: ICT Capex is an important enabler of our customer vision.
- **Efficiency targets**: rather than allowing ICT support costs to inflate with the complexity of our IS environment we aim to lower like-for-like support costs through standardisation and simplification of our applications over the CPP Period and hold these costs constant in real terms. We have already included anticipated efficiency targets in FY22 and FY23 reflecting our expectation that we will make additional improvements over the period.

14.6 Facilities Capex

Facilities Capex relates to expenditure on property assets to accommodate our staff and resources, such as offices and depots.

14.6.1 Our approach

We operate from facilities strategically located throughout our network footprint. This has many advantages, including that our employees have local knowledge and are situated close to customers and service providers and the assets we have under our management.

We have a mixed portfolio of facilities that includes ownership of office buildings, workshops and depots. We also lease some office space.

14.6.2 Expenditure drivers

Our approach to facilities management aims to ensure our offices and depots:

- are safe and secure for our employees and contractors
- are functional and fit for purpose
- support future staff growth
- support improved productivity and efficiency
- are cost effective to procure and operate.

Our current facilities are operating at capacity and are not able to accommodate the required increase in employee and contractor numbers we have identified we need in order to deliver our future investment plans to meet customers' long term service expectations. Investment in our facilities is required in two areas:

- **Network Operations Centre (NOC)**: our control room is one of the busiest in the country. Last year, the NOC delivered over 400,000 control operations, restored approximately 3,500 HV and 27,600 LV faults, and processed over 15,400 network permit applications. These volumes have increased by more than 40% over the past five years and continue to rise steadily. The NOC is too small and noisy for the functions it carries out, which has risks given voice communications are critical to safe and reliable operations. The current NOC located in New Plymouth is housed in a converted bus garage, which was not built to the desired earthquake rating for its current civil defence role. Our new NOC facility has been designed with control desk separation, noise control, and operational cohesion enabling the safe and efficient delivery of increased work volumes. This is considered to be a critical investment.

- **New office space at Junction Street**: we currently operate two office location in New Plymouth (Junction St and Liardet St) and both are almost at capacity. Junction Street is at 94% capacity and we expect it will exceed its capacity by 2019. The Junction St site does also not meet good practice requirements of a network operator. For example, there are a number of emerging safety concerns associated with the Junction Street site relating to traffic movements (especially given the increasing headcount) as Junction St is also an operational depot for Downer.

14.6.3 Forecasting approach

Our forecast facilities Capex includes investment in:

- **New NOC**: New building, rated at Importance Level 4 earthquake rating, with space to accommodate future work volumes and support new workflows that promotes safety and efficiency of operations. It will also free up the old NOC area to create new office space and meeting rooms.
- **New office space at Junction Street**: Using existing buildings, such as a gas workshop and the current NOC building, to create new office space for the forecast increase in employees as well as provide for consolidation of the two New Plymouth offices on to a single site. This will allow us to improve productivity and efficiency, and will support our ability to attract and retain a high calibre of employee.
- **Supporting assets**: Investment in facilities such as car parks at Junction Street.

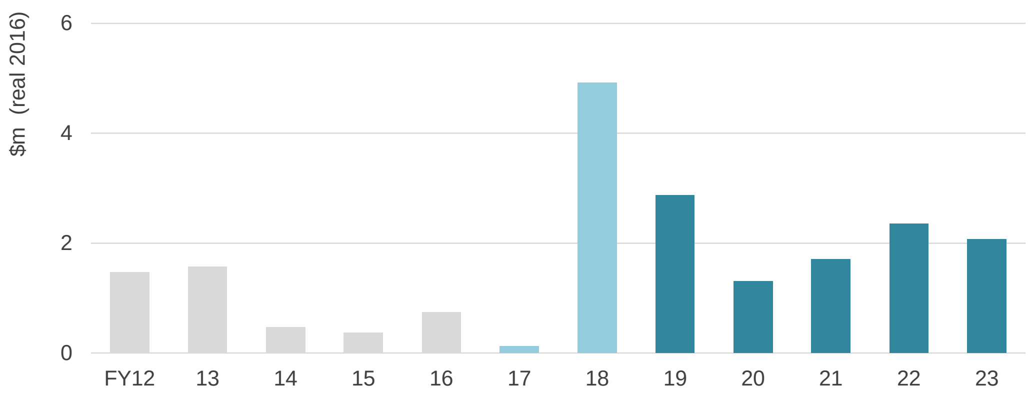
We have applied a 'bottom-up' approach to forecast project costs for the individual facilities investments. The costs are based on initial contractor tender submissions, supported by detailed reviews undertaken by building services consultants and quantity surveyors.

Detailed design and costing for the new NOC is already complete. To support the design process, we assessed control rooms at peer utilities in New Zealand and Australia. We have also had specialist advice on modern control room standards.

14.6.4 Proposed expenditure

Our forecast facilities Capex during the CPP Period, with equivalent historical spend, is shown in the following chart.

Figure 14.4: Proposed facilities Capex



The increased level of investment in FY18 and FY19 is driven by:

- the design and construction of the new NOC in FY18 and FY19 to ensure sufficient capacity and to accommodate additional work volumes without compromising safety
- upgrades of office space in Junction Street in FY19 and FY20 to safely accommodate staff

- further investments in FY21 to FY23 will provide additional facilities such as a car park and allow for the transfer of the head office to the Junction Street site. We expect annual Capex to reduce and stabilise post the CPP Period

Box 14.2: Facilities Capex summary

We are confident that our approach delivers an efficient and prudent level of investment because:

- **Prudent**: A detailed review of options was undertaken by industry specialists, including options analysis of four alternative options. The expenditure forecast applied market rate estimates from an independent contractor.
- **Confirmed benefits**: We have a thorough understanding of the investment benefits from the cost-benefit analysis undertaken by our external industry specialist.
- **External reviews**: The business cases were developed with support from independent and experienced advisors
- **Better customer outcomes**: A new NOC building will facilitate the delivery of enhanced operational practice that will benefit customer service and provide a safer and more resilient building.
- **Efficiency**: we have included efficiency adjustments in 2022 and 2023 reflecting our expectation that we will make improvements over the period.

15 NETWORK OPEX

Effective maintenance of our assets and good vegetation management are essential for the safe, reliable and efficient operation of our network, as is a capable and experienced workforce. In recent years, maintenance requirements have increased while revenue allowances have remained relatively flat. This has meant that we have been constrained in our ability to fully adopt good industry practice and stay on top of required work volumes.

We are experiencing an increasing number of asset failures and network faults and at current investment rates are building up a growing backlog of maintenance and vegetation work. These deteriorating trends are unsustainable and if not corrected, could result in a serious safety risk and deteriorating service levels. Asset failures in particular are of concern as they directly affect reliability, public and worker safety. Our proposed network Opex programme of work seeks to arrest these trends. Increased investment is required during the CPP Period, in particular to:

– address the current excessive backlog of maintenance defects, to keep overall risk at appropriate levels, consistent with good New Zealand industry practice
– adopt improved asset inspection and condition assessment techniques, to support criticality and risk-based maintenance planning
– change our vegetation management from a largely reactive approach, to a good practice proactive approach to enhance safety, improve reliability and ensure full compliance with the Tree Regulations.

To enable and deliver the increased work on our network will require asset management and operational improvements, to enhance our delivery capacity and efficiency, to help ensure optimal long-term customer outcomes. We will require:

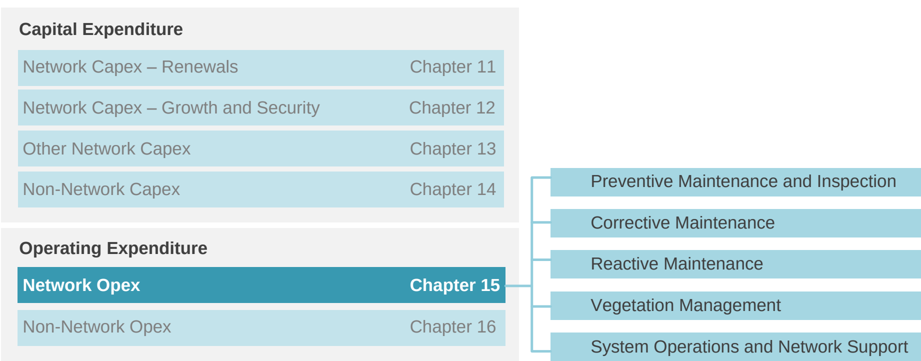
– additional internal resources for planning, design, project and contract management to deliver the proposed construction and maintenance plan
– increased internal capabilities and a broader range of skills to enhance our asset management, investment and operational decision-making, to ensure we can achieve the efficiency improvements planned for the CPP Period and we are able to respond to changing customer needs and emerging technology
– improved data quality and information management and analysis capability to underpin the planned asset management and operational improvements.

We expect the planned internal improvements will enable network Capex efficiencies of $6m per year and network Opex efficiencies of $2m per year by FY23. We have adjusted our forecasts downwards to allow for this.

15.1 Expenditure category and portfolios

Figure 15.1 illustrates where network Opex sits within our overall expenditure and lists its portfolios.

Figure 15.1: Expenditure category map showing network Opex portfolios



As shown in Figure 15.1, the network Opex category includes the following expenditure portfolios.[72]

- **Preventive maintenance and inspection**: is scheduled work, including servicing to maintain asset integrity, and inspections to compile condition information for subsequent analysis and planning. It is our most regular asset intervention and, therefore, a key source of feedback in the overall asset management system.
- **Corrective maintenance**: restores assets that have aged, been damaged, or do not meet their intended functional condition. It is undertaken to ensure assets are safe and secure, and provide reliable service. A key aim is to prevent imminent failure and to address defects timely and systematically, before they give rise to failure.
- **Reactive maintenance**: activities restore the network to a safe and functioning state following asset failures, faults and other network incidents. It is especially prevalent during and after large events such as major storms.
- **Vegetation management**: encompasses all tree trimming activities and support tasks such as customer liaison and inspections to determine the work required to keep trees clear of our overhead network.
- **System Operations and Network Support**: comprises our engineering staff and others that directly support electricity network operations. It also covers related network support expenses such as professional advice, engineering reviews, quality assurance, and network running costs.[73]

Box 15.1: Alignment with Information Disclosure

Our interpretation of activities included in the network Opex portfolios differ somewhat from that applied by the Commission in its ID requirements. Preventive activities relate to routine work only (which we control and schedule), while corrective activities covers all non-immediate repairs (for which we plan repairs, but cannot prevent from occurring).

The mapping between our definitions, and that used by the Commission, are set out below. Since we have to report for Information Disclosure purposes according to Commission definitions, there will be some variances between the CPP application, and the figures published under ID.[74]

OUR CATEGORY	ID CATEGORY	DIFFERENCES
Preventive maintenance and inspections	Routine and corrective maintenance and inspection	Our category includes only scheduled routine maintenance and inspection The ID category also includes second responses after initial fault responses and customer initiated maintenance
Corrective maintenance	Asset replacement and renewal	In addition to all costs included in the ID asset replacement and renewal Opex category our category includes also second responses after initial faults responses, and customer initiated maintenance
Reactive maintenance	Service interruptions and emergencies	None
Vegetation management	Vegetation management	None
System operations and network support	System operations and network support	None

72 Our portfolios reflect the way we undertake these activities. Some of these differ from the Commission's information disclosure categories.

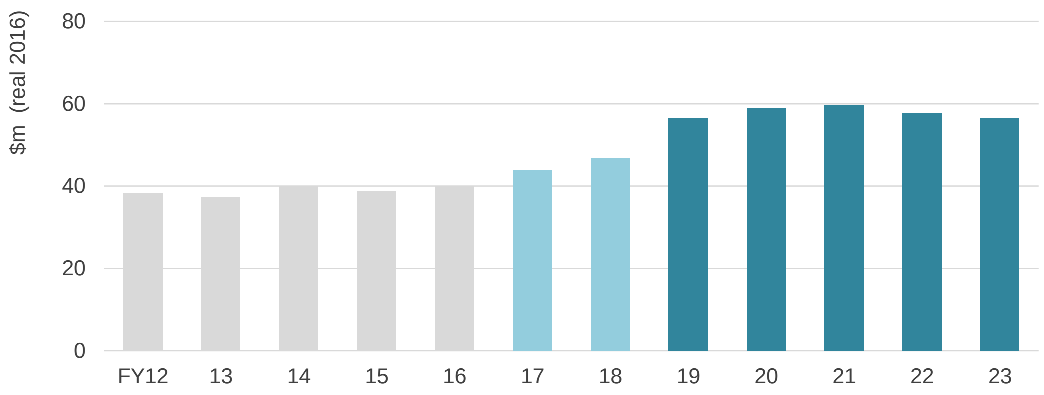
73 We classify SONS as network Opex.

74 The reconciliation between the different classifications has been tested by the CPP external auditor.

15.2 Overview of proposed network Opex

Figure 15.2 shows our historical and proposed network Opex during the CPP Period.

Figure 15.2: Total proposed network Opex



During the CPP Period we propose to spend $289m on network Opex. On average, this represents a 38% increase over the previous five years.

15.2.1 Key reasons for increased network Opex requirement

Historically, regulatory allowances have limited what we could spend on network Opex. The allowances largely reflected historical expenditure and therefore did not allow us to adapt to the changing maintenance needs of the network, to adopt emerging good practice, or evolve to meet changing customer expectations.

To address the key issues we currently face, we need to considerably increase our network Opex:

- **Defect backlogs**: the backlog of outstanding asset defects has risen considerably in recent years. We will arrest and reverse this trend, and bring the outstanding defects down to levels commensurate with a reasonable risk profile and good New Zealand industry practice.
- **Improved inspections**: recent technology advances brought about improved asset inspection and condition assessment techniques. We plan to implement some of the most successful of these on our network, including partial discharge testing of major equipment, acoustic resonance testing of wood poles, acoustic testing of insulators and conductors and aerial photography of overhead lines. This will deliver a better understanding of asset health, risk and criticality, allow enhanced asset management, and will support improved investment targeting and overall lifecycle cost-effectiveness.
- **Discovery**: associated with improved inspection and condition assessments, we anticipate an initial increase in the number of defects requiring attention. We expect this will stabilise after the initial three year round of inspections.
- **Increased device population**: as we roll out more new technology devices[75] on the network, many of which are electronic in nature, maintenance requirements will increase.
- **Vegetation management:** this helps keeping overhead lines safe and reliable. We intend to change from a largely reactive approach to an industry good practice cyclical and risk-based vegetation management approach. This will in turn enhance safety and ensure full compliance with the Tree Regulations.

[75] Such as remote terminal units, digital protection devices, intelligent metering installations or automation controllers.

Operational changes and improvements are required to achieve the maintenance strategy, improve asset management, and to support the uplift in construction and maintenance work over the CPP Period.

- **Capacity increases**: delivering the proposed increased construction and maintenance plan for the CPP Period will require additional internal resources for planning, design, project and contract management.
- **Capability increases**: our goal of good industry asset management (as we plan to demonstrate by achieving ISO 55000 certification in 2020), evolving our maintenance strategy, and responding to changing customer needs and emerging technology, requires expanding our internal capabilities and skills.
- **Data improvements**: improved data quality and information management and analysis capability will be required to underpin asset management and operational improvements.

15.2.2 Areas of increased activity

The proposed additional expenditure during the CPP Period includes two main areas of increased activity.

- **Allowance for catch-up works:** particularly on outstanding maintenance defects and vegetation management work. Once this is achieved, expenditure will reduce to a new, sustainable level. We expect it to remain above current/ historical levels, to stabilise service quality and avoid a build-up of future backlogs.
- **Additional allowance for improved maintenance, asset management and operational practices:** investments in these improvements are an essential pre-requisite to deliver and plan our future works programme and to achieve future efficiencies and service improvements. Our business case shows that benefits far outweigh the costs of the additional resources.

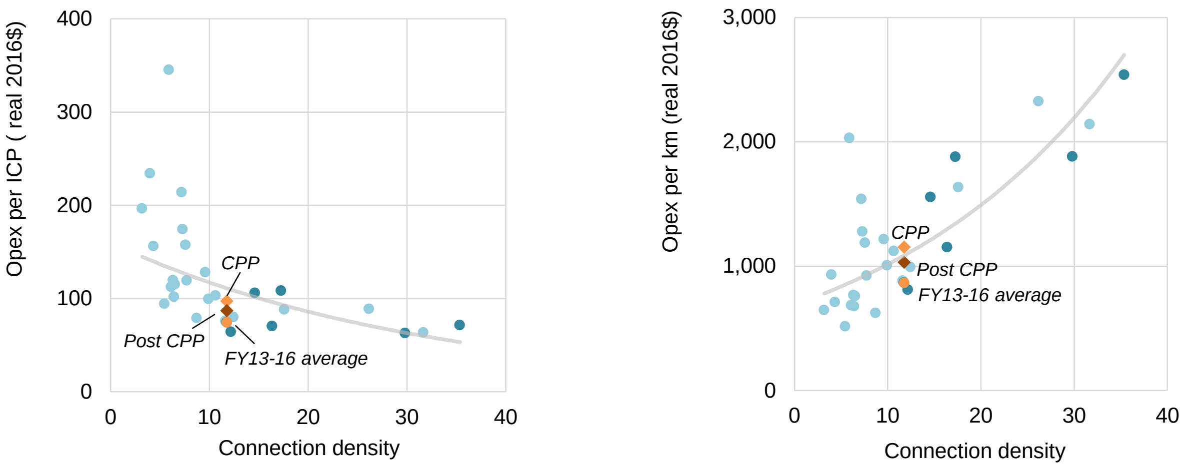
Our broad maintenance strategy is to move from a largely reactive, time-based regime to a fully developed ‘reliability centred maintenance’ (RCM) regime. As an interim step we will move to an ‘optimised time-based’ approach, which will introduce criticality and risk-based elements to our assessments. This will reduce faults, help stabilise reliability over the longer term and generally support more efficient network investment.

15.2.3 Maintenance benchmarking

In Figure 15.3 we compare our maintenance expenditure to that of other New Zealand electricity distributors. The figure shows that our current maintenance Opex (FY13-16 average) is among the lowest of New Zealand distributors.[76]

[76] Comparisons are made after normalising for customer numbers or length of network. It is also important to consider the impact of network characteristics – network density (connections per km of line) is a reasonable proxy for the intrinsic cost and effort involved. Rural networks are generally of lower density, more exposed to the elements and more costly to maintain and operate on a per ICP or line length basis.

Figure 15.3: Maintenance Opex Benchmarks (FY13-16 average)



Our customers may have benefited from our low historic maintenance costs through lower prices, but this level of maintenance (and as discussed below, vegetation management and SONS expenditure) is not sustainable, and not in their longer-term interests.[77]

The darker dots highlight the companies that are most comparable to us – the six other largest EDBs. Their scale, the number and complexity of network assets, and the systems required to manage assets are a closer match than that of smaller companies.

During the CPP Period, our proposed expenditure is expected to move closer to the (current) New Zealand average. After the initial catch-up, expenditure will reduce to a sustainable and prudent level, and is expected to return to below the country average again.

15.3 Key drivers and forecasting approaches

Below we discuss the main drivers for our network Opex activities over the CPP Period and how we forecast the associated levels of expenditure.

15.3.1 Key drivers

Our planned network Opex during the CPP Period has the following main drivers.

- **Safety**: ensuring our asset fleets remain safe to the public and to operational staff is a key management focus. The continuation of current network performance trends will increasingly compromise our ability to achieve this.
- **Asset condition**: delivery of effective maintenance and reducing the defects backlog is essential if we are to arrest and reverse the deteriorating trend in asset performance.
- **Reliability performance**: if the asset performance trends are not dealt with in a timely and effective manner, pressure on network reliability will continue to increase, and reliability performance will inevitably continue to decline.
- **Assessments**: improving asset management and associated investment and operational decisions will require good quality field information, supported by appropriate inspection and testing techniques.

77 Once network performance deteriorates beyond a certain point, the cost associated with the resulting outages becomes higher than the Opex savings.

- **Compliance**: delivering effective maintenance and managing the impact of vegetation on our network is needed for compliance with our technical standards, and with safety and Tree Regulations.
- **Improving our practices**: moving from a largely reactive, time-based regime to a RCM regime will require significant improvements in our current practices, particularly relating to improved analysis, optimised decision making and risk management.
- **Need for increased capability**: the key driver for our SONS portfolio is the need for a sustainable and competent workforce that can not only deliver the proposed work uplift, but also help position us for the future. This will require increased insights from data analytics, improved investment optimisation, and targeted research and development investment.

15.3.2 Forecasting approaches

Our network Opex forecasts are based on the following approaches.

- **Volumetric**: used for portfolios with smaller, high-volume work of similar nature, e.g. routine tasks in the preventive maintenance and inspection portfolio, and vegetation management.
- **Base-step-trend**: for activities that are largely recurring over time, e.g. reactive and corrective maintenance and system operations and network support.

These approaches are explained in Chapter 10. We include further detail on their application to individual portfolios when we discuss these forecasts in the remainder of this chapter.

15.4 Developing our network Opex forecasts

Our network Opex forecast for the CPP Period has been developed using volumetric and base-step-trend forecasting approaches.

Our historical programmes have been refined and adapted to reflect the drivers discussed above. We used a network Opex challenge and approvals process to ensure that forecasts are prudent and efficient, and have undergone appropriate scrutiny.

15.4.1 Internal challenge and approvals

To ensure our Opex forecasts are prudent and efficient we implemented an internal challenge and approval process. This process complemented the top down approach used to develop and approve our Preliminary Proposal (discussed in Chapter 4) and the detailed bottom-up review by the Independent Verifier (discussed in Chapter 6). Input to this process was provided by:

- **Forecasting team:** a dedicated team led by portfolio owners was established to develop our Network Opex forecasts, also drawing on inputs from across the business.
- **Specialist advice**: an external distribution specialist assisted us in refining our practices and provided advice on the forecasting methodology.
- **Engineering approvals**: the proposed set of maintenance programmes were reviewed, challenged and approved by planning managers and the asset manager.
- **CPP Governance Group**: a group of general managers provided oversight on the CPP proposal. This group included the electricity general manager responsible for this expenditure. This group undertook the role of challenging expenditure across portfolios, and in consultation with portfolio owners established a set of efficiency targets.
- **Executive management team**: the CEO and full executive performed a further challenge round on forecasts.
- **Board review**: the expenditure forecasts were submitted to the Powerco Board for periodic review, challenge and approval. An independent expert was appointed to also review the proposed activities and expenditure forecast, and report his findings to the Board.

As discussed in Chapter 7, we undertook a top down review as a further challenge process and to ensure that our proposals considered scope for further efficiency improvements.

Further details on our Opex governance approach are provided in Chapter 6 of our 2017 AMP.

15.4.2 Supporting documentation

The following supporting documents informed our, forecast.

- **Fleet management plans**: Fleet management plans have been prepared for all our asset fleets. These plans:
  - describe the key attributes and characteristics of assets in a fleet, and outline any known type issues, safety concerns and failure mode concerns
  - outline asset management objectives that provide high-level direction for activities across each fleet
  - sets out our systematic method for the planning, design, procurement and installation, operations, maintenance, refurbishment, renewal and disposal of assets in a fleet.
- **Maintenance strategy:** describes our current and planned approach to maintaining our network assets, along with objectives and strategies to evolve our maintenance regime.
- **Vegetation management strategy:** describes our strategy to manage vegetation growing near our network. It explains the role of vegetation management in good practice asset management, how we currently manage vegetation and areas for improvement, and our proposed cyclical and risk-based future vegetation management approach.
- **Asset Management Plan**: this core plan sets out the 10-year investment plan for the electricity network, explaining in detail how we intend to:
  - provide a safe, reliable and flexible service to our customers
  - help our customers access emerging energy options
  - increase investment in our network (facilitated through our CPP application), to ensure we can continue to provide electricity distribution services to our customers in the long term, at the quality they require
  - using advanced asset management to optimise network investment and operations.
- **Portfolio overview documents**: summarise the underlying drivers, extent and justification for our SONS, maintenance and vegetation management forecasts.
- **Policies and standards**: our well developed and extensive suite of standards and policies guide our selection, maintenance, inspection and management of network assets.
- **Models**: we have developed expenditure forecast models for each of our network Opex portfolios.

We provided the supporting document listed above to the Independent Verifier and a representative subset has been included as supporting material to our submission.

15.5 Preventive maintenance and inspection

Preventive maintenance and inspection activities are undertaken on a scheduled basis to ensure the continued integrity of our asset fleets, and to compile condition information for analysis and Capex and maintenance planning. It is our most regular asset intervention process and is a key source of feedback to our asset management and operational teams. If we don’t have a comprehensive preventive maintenance and inspection regime, our assets will deteriorate. This will result in worsening reliability and increasing safety risk.

15.5.1 Activities and expenditure drivers

Preventive maintenance and inspection work is work that is scheduled in advance. This portfolio deals mainly with the following activities:

- **Inspections**: including checks, patrols and testing to confirm the safety and integrity of assets, assessing fitness for service and identifying follow-up work. We will increase inspections during the CPP Period with resulting additional expenditure of approximately $1.0m per year.
- **Condition assessments**: are performed to assess and monitor asset condition and to provide systematic records for analysis, to support further maintenance and asset management planning. We will increase assessments during the CPP Period with resulting additional expenditure of approximately $1.7m per year.
- **Servicing**: includes regular maintenance tasks performed on an asset to ensure its condition is maintained in accordance with our standards. We will increase servicing activities during the CPP Period with resulting expenditure of approximately $1.5m per year.

Expenditure drivers

Our base level of preventive maintenance and inspection Opex is largely driven by our maintenance standards (see Box 15.2) and the number and types of assets installed on the network. We aim to undertake the optimum level of maintenance throughout the life of the asset, balancing cost and benefits.

Box 15.2: Our maintenance standards

We maintain and regularly update an extensive suite of asset maintenance standards which have been developed over many years. These standards are the cornerstone of our maintenance regime and largely represent current good New Zealand industry practice.[78] Our standards have been built from manufacturers' data and recommendations and our knowledge of specific maintenance, operational and service requirements for various asset types. Our standards also take into account the regulatory requirements for safety and integrity inspections.

These standards prescribe the type and frequency of maintenance, testing and inspections required for each asset type. The level of maintenance is informed by the type and criticality of assets.

Our standards have been adopted by many EDBs in New Zealand. We regularly update the standards, taking into consideration feedback from our field staff and that of other EDBs, as well as research undertaken by our asset management team and information provided by manufacturers/suppliers.

The overall volume of preventive maintenance and inspection work depends on:

- **Types and quantities of assets:** in service on our network, their age profiles, and the level of diversity in types and manufacturer.
- **Network risk and criticality:** including whether they are subtransmission, urban, remote rural assets. For example; subtransmission lines receive more frequent inspections and testing than distribution lines, as the latter pose less risk.
- **Ageing characteristics/drivers of deterioration:** of our network assets.
- **Compliance:** some activities are influenced by a need to comply with safety regulations.
- **Standards:** for each of our asset fleets, our standards define the required frequency of maintenance, and the specific actions required.

Our current maintenance standards operationalise this approach by setting out the maintenance tasks to be undertaken, and the frequency of each task. Our forecast is based on rolling these tasks ahead to the

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[78] Emerging good practice inspection techniques, such as acoustic pole-top monitoring, laboratory testing of conductor samples, and acoustic pole testing are not yet fully reflected in the standards. We are starting to use these now and will fully implement them during the CPP Period. Over time, this will be reflected in our maintenance standards.

end of the CPP Period. The resulting base expenditure forecasts is for a relatively consistent work volume made up of a large number of inspections, testing and servicing tasks.

In addition to this base-amount we identified additional tasks (discussed below) required to achieve our maintenance objectives:

- **Need for improved asset information – condition assessment**: appropriate asset information over the life of an asset is an essential enabler of good practice asset management. Through access to more accurate information and with effective analysis, better optimised investment and operational decisions can be made which will contribute to substantial additional benefit to consumers over the long-term – both in terms of cost savings, and network performance.
- **Need for improved asset information – defects:** the current process of identification of defects by visual inspection is limited and will not detect all defects. Certain assets, for example pole-top assemblies or conductors, cannot be fully assessed from visual inspection at ground level. In addition, internal asset defects, such as rotting poles or eroding conductors can only be identified through further tests. To expand asset defect information and allow intervention before serious asset deterioration or failure, we will expand our range of inspection techniques. Avoiding faults due to defects before they occur is substantially less costly and less disruptive to consumers.
- **Increased servicing:** new types and additional equipment such as communication systems, remote monitoring and automated devices will require servicing as they are rolled out across the network. Our standards will be expanded to provide for the effective maintenance of these.
- **Asset population**: is a direct driver for preventive maintenance and inspections. We therefore allow for increased expenditure to reflect increases to the asset base. (As asset growth is small relative to the overall asset base, this represents a relatively minor uplift.) The impact of asset renewal on this maintenance category is minimal, as even new assets are inspected, assessed and regularly serviced.

How we have reflected the impact of Capex on our maintenance plans is discussed in Chapter 10.

15.5.2 Forecasting approach

We apply a volumetric approach to the baseline preventive maintenance and inspections forecast. Most preventive maintenance activities are scheduled in our Gas and Electricity Maintenance (GEM) system. GEM applies our maintenance standards to the asset records register, to schedule the required activities each year – the baseline for this forecast. Historical activity-based costs (largely as agreed under our field services agreement) are used to forecast expenditure.

For the remainder of expenditure, we apply a base-step-trend method, as described in Chapter 10. For preventive maintenance and inspection forecasts we modelled:

- actual FY16 expenditure as the representative base year (for the portion of expenditure that is not driven by the GEM system)
- step changes arising from the expenditure drivers noted above
- expenditure trends arising from network growth. We have built on the Commission's modelling undertaken for the 2015-20 DPP and modified the input assumptions to reflect the latest customer number and network length forecasts.[79]

15.5.3 Proposed expenditure

Our forecast preventive maintenance and inspections Opex during the CPP Period, with equivalent historical spend, is shown in Figure 15.4.

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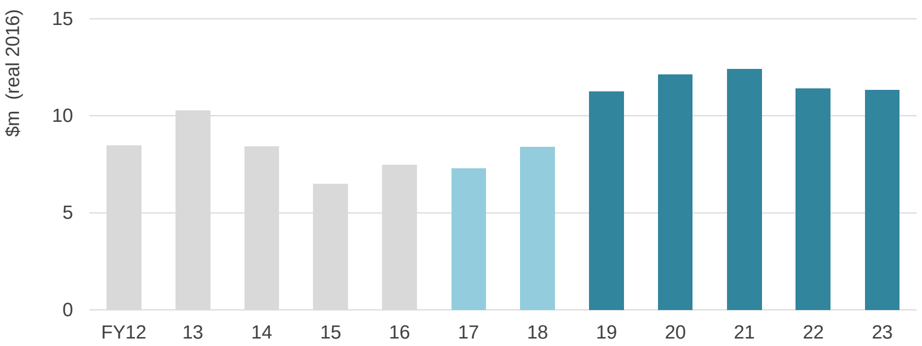
[79] Commerce Commission, Opex Projections model, EDB DPP 2015-2020. The Commission's model applied a network scaling factor of 0.36%. Our updated scaling factor is 0.62% per year.

Figure 15.4: Proposed preventive maintenance and inspections Opex



The proposed increase in expenditure from FY19 reflects the changes required to meet our maintenance objectives. Historically we have had to constrain available network Opex, and have therefore concentrated expenditure on largely time-based maintenance (GEM-scheduled) activities. Our inspection techniques have not fully kept up with modern good practice, which limits the extent and accuracy of asset data we can collect.

Data quality impacts on our asset management ability, in particular in relation to asset analytics and optimised decision making. There are also categories of assets for which attributes are not fully recorded for which our schedules have to be expanded.[80]

The increase in preventive maintenance and inspection activity is driven by the need to move to current good practice. We will do this by increasing:

- the range and scope of asset condition assessments to improve the quality of our asset information used for supporting improving asset management practices. This overlaps with the activities proposed for additional defect inspection, and also includes:
  - programme to capture low voltage switchgear and conductor condition information – important from a safety and reliability perspective.
- the range and scope of asset inspections carried out to identify defects, including:
  - use of fly-over photography to allow accurate assessment of pole-top assemblies
  - acoustic testing of overhead line components, to enhance our visual inspections and to identify incipient faults
  - inspection of new types of assets on the network and programme of additional inspection for potential failure points on critical lines
  - acoustic resonance testing of wood poles
  - partial discharge testing of switchgear and cable terminations – improving condition assessment.
- our range of servicing activities. This will cover new types of assets installed on the network as well as address areas where current standards are deficient. Specific activities include:
  - systematic maintenance of substation buildings
  - maintenance of additional network insight, communication and automation devices.

80 In our CPP forecasts, we recognised the potential impact of data insufficiencies through allowing for efficiency improvements, including a "discovery" efficiency allowance. It is also important to note that actual renewal projects are based on detailed inspections, and assessment of actual asset condition – which avoids data insufficiency problems.

15.5.4 Why the proposed expenditure is prudent and efficient

In the box below we summarise why the proposed preventive maintenance and inspections expenditure is prudent and efficient.

Box 15.3: Preventive maintenance and inspections justification

Our approach to preventive maintenance and inspections reflects an efficient and prudent level of investment:

- **Strong baseline:** our existing maintenance standards are a strong basis to build on for our planned improvements. Many other New Zealand EDBs have adopted our standards. We use feedback (including from other businesses) to continually improve the standards.
- **Safety and reliability**: additional expenditure targeted at improving our understanding of asset condition will allow us to arrest deteriorating safety and reliability trends on the network and support our overall move from a largely time-based maintenance approach to a more risk-based, proactive approach.
- **Benchmarking**: despite the cost pressures we face as a predominantly overhead, rural network, our normalised maintenance expenditure is among the lowest among New Zealand distributors (see Figure 15.3). The CPP expenditure brings us closer to current industry average levels, and after FY23 is expected to stabilise again at a level lower than the CPP average.
- **Capability improvements**: improved information about our assets maintenance will support our asset management improvements – which in the longer term will deliver cost efficiencies and improved network outcomes.
- **External reviews**: of our proposed expenditure supported the intent and direction of our proposal.
- **Efficiencies**: improvements in our maintenance are in the long-term interest of our customers. We expect that our improvements will at least pay for themselves through expected cost efficiencies starting towards the end of the CPP Period. This will result in particular from enhanced asset management practices which would not be possible without the additional information. We have allowed for an efficiency improvement equivalent to a 2.5% reduction in expenditure by FY23.[81]

15.6 Corrective maintenance

The corrective maintenance portfolio involves interventions to restore defective assets to their intended condition or function, to ensure assets can safely and efficiently remain in service. These works include defect rectification and repairs to correct issues noticed during earlier routine inspections, or when advised of issues by others. It also includes second response to outages (later follow-up work, after the initial activity to make a situation safe or to restore supply). Corrective maintenance is an essential activity that allows us to operate the network in an efficient manner while delivering reliable supply to our customers.

15.6.1 Activities

The main corrective maintenance activities are:

- **Defect management**: correcting condition-based defects that are identified from preventive and reactive activities. We currently have a backlog of defects that will be addressed through increased expenditure during the CPP Period. We propose to increase our defect management work by $2.6m per year on average.
- **Asset replacements requiring Opex**: replacement of minor, low cost assets or asset components. We will increase this during the CPP Period by $380k per year on average.

[81] This is measured against a counterfactual of expenditure reflecting our current asset management practices (which by themselves already reflect the improvements made in preparing for the CPP). This efficiency gain is anticipated to grow further in the period following the CPP, as the full benefits from improved maintenance, information and asset management are achieved.

– **Asset repairs**: includes works to repair damage and prevent failure or rapid degradation of equipment. We will increase this during the CPP Period by $380k per year on average.

15.6.2 Expenditure drivers

Our level of expenditure on corrective maintenance work is largely driven by the size and underlying condition of the asset base, and the resulting number of asset defects that have to be addressed. Key factors are:

– **Asset condition:** as influenced by:
  - age: as assets age, the volume of defects is expected to generally increase
  - geographical location: assets in some areas are more exposed to damage
  - asset types: different asset types have different lives, reflected in defect numbers
  - physical location of assets: assets exposed to severe weather or environmental conditions are more prone to external damage.

– **Network risk and criticality**: the relative importance of assets on the network, or the safety risk they pose.

– **Network size:** generally a larger network, with greater numbers of assets, will have more defects.

– **Other activities:** external damage caused by third parties.

– **Standards**. Changes in asset management approaches, leading to a change in standard, can result in changes in the number of defects.

– **Compliance**: requirements to comply with safety regulations.

Corrective maintenance expenditure levels can vary materially between years, reflecting external conditions. For example, during years with a higher incidence of major storms, there is typically a larger volume of follow-up repair works.

Box 15.4: Defects

Asset defect is an industry term that means an asset has an elevated risk of failure or reduced operability. Defect categories are assigned to assets during inspections and condition assessments. We use three categories that reflect operational risk:

– **Red**: requires immediate rectification (repair or replacement).

– **Amber**: apply a risk-based approach to prioritisation, targeting rectification within 12 months.

– **Green**: apply a risk-based approach to prioritisation, targeting rectification within 36 months.

Red defects are addressed as soon as practicable after they have been identified. This is mostly done under urgency, hence on a reactive basis.

Work on green and amber defects on the other hand is generally scheduled well in advance, optimising logistics and work-crew utilisation.

During the CPP Period, our corrective maintenance expenditure requirement increases mainly due to the need to:

– to rectify our amber defects backlog.

– rectify expected newly identified defects from enhanced assessment techniques

– deliver planned corrective work programmes.

Defects backlog

Asset defects contribute substantially to our deteriorating asset performance. We have a large number of amber defects requiring intervention (Opex) as they have been left past our targeted resolution timeframes.

This undesirable situation has arisen largely as a result of a combination of funding and operational (release of network) constraints. The high number of defects is also an outcome of improved inspection techniques and better record keeping since around 2011, with more defects being identified than in the past (albeit that we cannot fix them at the same rate that they are identified).

Addressing the backlog in a reasonable time is essential to arrest the deteriorating asset performance trend. Untreated, these defects will worsen with time, until they become a serious safety or reliability risk that requires immediate (and more expensive) intervention. We aim to reduce the number of amber defects to a prudent operational level.

Newly identified defects

As part of our enhanced inspections regime under the preventive maintenance and inspection portfolio, we expect to identify additional amber defects. We will have to rectify these within reasonable time to avoid further growth of the amber defect backlog.

Over the longer term it is most cost-effective to identify defects as early as feasible and to fix these in a reasonable time. When a defect escalates to the extent that it causes an outage, or safety issue, the impact on customers is far more severe.

In addition, a reactive strategy may reduce the total cost in the short term – as fewer defects are rectified – but in the longer term it tends to be considerably more expensive. To fix reactive faults generally does not allow much pre-planning, or packaging into larger jobs, so it costs more than a planned repair. It is also considerably more expensive to fix assets in a more severely damaged state. As the volume of corrective work that can no longer be deferred starts to grow, the total cost of a reactive strategy will become far greater than a proactive strategy.

Corrective work programmes

We have identified the need for systematic intervention (but not complete renewal) repair or renewal programmes for a number of asset classes. This includes work on distribution transformers and kiosks, customer neutral connections, and 11kV service lines maintenance. In the past, work on these assets has been approached on a largely reactive basis.

15.6.3 Forecasting approach

We apply a base-step-trend method, as described in Chapter 10. When used for forecasting corrective maintenance expenditure we modelled:

- FY16 expenditure, adjusted to average historical levels[82], as the representative base year
- step changes arising from the drivers and factors described above
- expenditure trends arising from network growth. We have built on the Commission's modelling undertaken for the 2015-20 DPP and modified the input assumptions to reflect the latest customer number and network length forecasts. In addition, we adjusted the network growth factor to only reflect expected growth in corrective work that is outside our control. [83]

15.6.4 Proposed expenditure

Our forecast corrective maintenance Opex during the CPP Period, with equivalent historical spend, is shown in Figure 15.5.

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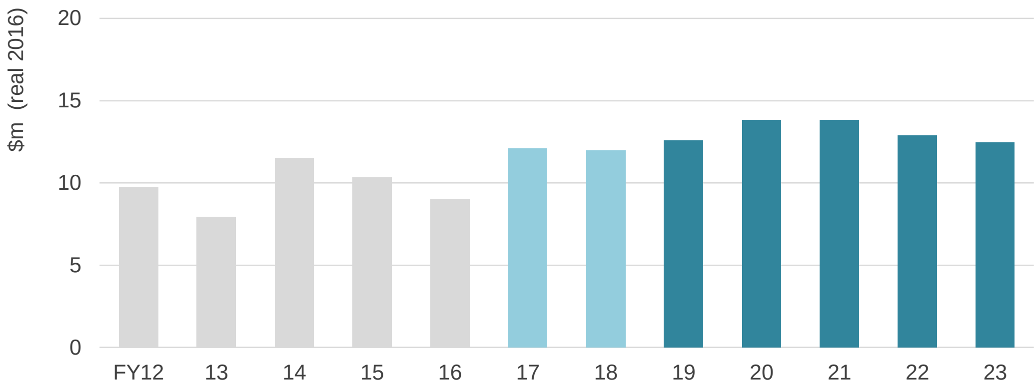
82 During FY16 we experienced unusually benign weather patterns. As a result, corrective maintenance expenditure was reduced to well below historical levels.

83 Commerce Commission, Opex Projections model, EDB DPP 2015-2020. The Commission's model applied a network scaling factor of 0.36%. Using the Commission's DPP model and inputs resulted in a scale factor of 0.19% per year for corrective maintenance. After updating the ICP and line length forecasts, this increased to 0.33% per year.

Figure 15.5: Proposed corrective maintenance Opex



Corrective maintenance is often the first category to be re-prioritised during years with major storms, as more money has to be spent on reactive maintenance to keep the network up and running. This has contributed to our current major defect backlog. Another feature of historical spend is the variability between years – this reflects the availability of funds, impact of weather, or when other expenditure was prioritised.

The major proposed uplift in corrective maintenance mainly reflects the work associated with catching up on our defect backlog. We intend to reduce the amber defect backlog (which should be rectified within 12 months) from the current estimated level of 3 years' work volume, to around a 6-month volume.[84]

We have started to increase corrective maintenance already. The reason for the increase in FY17 and FY18 is largely to avoid the backlog pool expanding further. The additional increase from FY19 onwards will reduce the size of the pool to a sustainable and prudent level.

Other proposed expenditure uplifts are required to:

- rectify additional defects identifed during our improved and expanded condition inspections
- planned repair programmes, including to distribution transformers and kiosks, customer neutral connections, and 11kV service lines maintenance.

15.6.5 Why the proposed expenditure is prudent and efficient

The box below summarises why the proposed corrective maintenance expenditure is prudent and efficient.

Box 15.5: Corrective maintenance justification

We are confident that our approach to corrective maintenance delivers an efficient and prudent level of investment because:

- **Addresses safety and reliability risk**: the current defect backlog represents an unacceptable risk to the network, adding to the increasing faults and asset failures we have been seeing over an extended period. The proposed plan will bring the situation under control and represents an optimal balance between the risk posed by the remaining number of defects, and the ability to cost-effectively address these.
- **Benchmarking**: despite the cost pressures we face as a predominantly overhead, rural network, our normalised maintenance expenditure is among the lowest among New Zealand distributors (see Figure 15.3). The CPP expenditure brings us closer to current industry average levels, and is expected to reduce again after the CPP Period.

84 At this volume, there will still be a large enough pool to achieve scale benefits (e.g. grouping tasks) while ensuring that amber defects do not remain unaddressed for longer than the specified 12 month period.

- **Strong baseline:** our existing maintenance standards are a strong basis to build on for our planned improvements. Many other New Zealand EDBs have adopted our standards. We use feedback (including from other businesses) to continually improve the standards. Our approach to the classification of defects, and the definition of defects – including the time within which these need to be addressed, are in line with standard industry definition.
- **External reviews**: of our proposed initiatives and expenditure supported the intent and direction of our programme.
- **Moderation - Capex/Opex trade-off**: As substantial asset renewal programmes are proposed for the CPP Period, in time we expect a reduction in maintenance defects – not only where defected assets are replaced, but also because newer assets are less prone to maintenance defects. Accordingly, we have included a Capex/Opex adjustment in our forecasts, reducing corrective maintenance by 5% by the end of the CPP Period.
- **Efficiencies**: as we improve our asset management and works delivery processes we expect to be able to gain future efficiencies. We see cost efficiencies starting to be achieved towards the end of the CPP Period, particularly from enhanced asset management practices. Accordingly, we have included an efficiency adjustment later in the CPP Period, equivalent to a 3.5% reduction in expenditure.[85]

15.7 Reactive maintenance

Reactive maintenance involves interventions in response to network faults and other incidents. There is no advanced scheduling of this work other than ensuring that there are sufficient resources on standby to respond to network faults. Reactive maintenance is all about safety switching and restoring the supply to customers.

15.7.1 Activities

The main reactive maintenance activities are as follows:

- **First response**: involves the attendance of a fault person to assess the cause and extent of an incident on the network, and to provide immediate response to eliminate a safety risk or, when possible, to avoid loss of supply.
- **Fault restoration**: includes switching, fuse replacement or minor component repair in order to restore supply, when this can be safely done. Further ‘second response’ work such as pole replacement following vehicle damage is undertaken as a corrective activity.

15.7.2 Expenditure drivers

By its very nature, reactive maintenance requirements cannot be accurately predicted for any particular year. Annual expenditure on reactive work is driven by the frequency and severity of network faults. Other than from poor asset condition, network faults are mainly influenced by external, often random, events.

Our reactive maintenance work volume is driven by underlying network and asset fault trends, reflecting:

- **Asset condition**: over time, deteriorating asset condition contributes to higher reactive maintenance requirements. Deteriorated assets are more prone to in-service failure, and are also less resilient to external events.
- **Weather patterns**: particularly wind and flooding, is a major driver for the need for reactive response. Changing long-term weather patterns therefore influence expenditure.

85 This is measured against a counterfactual of expenditure reflecting our current asset management practices (which by themselves already reflect the improvements made in preparing for the CPP).This efficiency gain is anticipated to grow further in the period following the CPP, as the full benefits from improved maintenance, information and asset management are achieved.

- **Other external events:** reactive response is also driven by other external influences, such as third party damage or interference. Changing patterns, such as residential developments in the vicinity of network assets can therefore influence reactive expenditure.

The condition of our asset base has deteriorated in recent years, but we intend to arrest this trend through the proposed CPP work. We are unable to robustly forecast the impact of weather, or other external influences on the network. We therefore assume that the expenditure requirement on reactive maintenance for the CPP Period will be similar to historical levels.

Our forecast allows for increased expenditure of $640k ($130k per year) for additional fault personnel, who are needed to meet our required service standards and response times.

Our approach to reflecting the impact of Capex on our maintenance plans is discussed in Chapter 10.

15.7.3 Forecasting approach

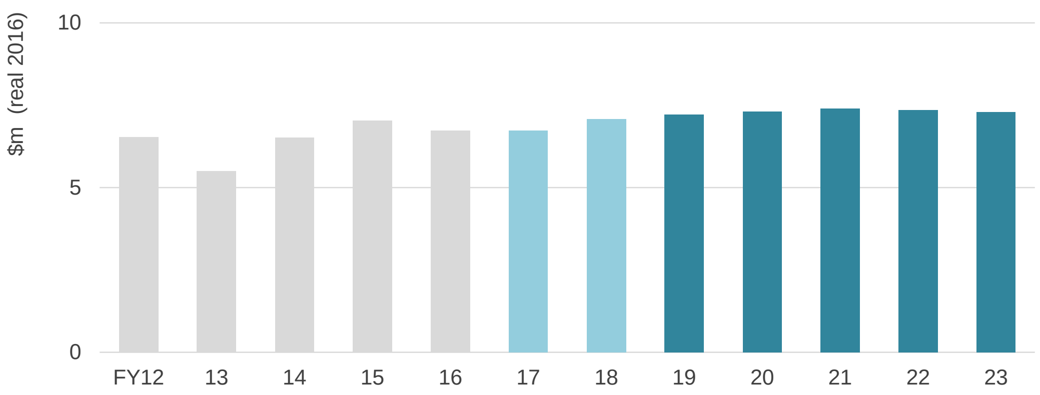
We applied a base-step-trend method to forecast reactive maintenance expenditure, using the methodology described in Chapter 10. We modelled:

- FY16 expenditure as the representative base year
- a step change for additional fault personnel as discussed above
- expenditure trends arising from network growth. We have built on the Commission's modelling undertaken for the 2015-20 default price and modified the input assumptions to reflect the latest customer number and network length forecasts.[86]

15.7.4 Proposed expenditure

Our forecast reactive maintenance Opex during the CPP Period, with equivalent historical spend, is shown in the following chart.

Figure 15.6: Proposed reactive maintenance Opex



No significant change in expenditure is proposed from historical trends. An initial small increase during the CPP Period is planned for additional fault personnel. However, towards the end of the CPP Period we expect to achieve efficiencies (resulting in a reactive maintenance expenditure reduction) resulting from improved asset management practices and the significant asset renewal programme.

15.7.5 Why the proposed expenditure is prudent and efficient

The box below summarises why the proposed reactive maintenance expenditure is prudent and efficient.

86 Commerce Commission, Opex Projections model, EDB DPP 2015-2020. The Commission's model applied a network scaling factor of 0.36%. Our updated scaling factor is 0.62% per year.

Box 15.6: Reactive maintenance justification

We are confident that our approach to reactive maintenance delivers an efficient and prudent level of expenditure because:

- **Strong baseline:** our existing maintenance standards are a strong basis to build on for our planned improvements. Many other EDBs have adopted our standards. We use feedback (including from other businesses) to continually improve the standards.
- **Safety**: our networks are operated in a safe and responsible manner, as evidenced by our good safety performance. Safety performance will be maintained with the level of reactive expenditure as our programmes are delivered as planned.
- **External reviews**: of our proposed expenditure supported the intent and direction of our programme.
- **Efficiencies and Capex/Opex trade-off**: towards the end of the CPP Period we expect efficiency improvements, reflecting the impact of enhanced asset management practices and benefits from the proposed renewal programme. We have accordingly moderated expenditure in years 4 and 5 of the CPP Period, equivalent to a 3.0% reduction in expenditure.[87]

15.8 Vegetation management

Vegetation management is a key activity that enables our assets to perform as expected. We undertake vegetation management to keep trees clear of overhead lines and other assets. This is necessary to minimise vegetation related outages and comply with relevant obligations.

15.8.1 Activities

The main vegetation management activities are:

- **Tree trimming**: the physical works involved in trimming or felling and removal of trees.
- **Inspections**: periodic inspections of tree sites to determine whether vegetation work is required.
- **Liaison**: interactions with landowners to including the arrangement of access to land, issue of trim/cut notices, and follow-up calls on notices.
- **Traffic management**: as necessary to manage traffic on public roads to accommodate tree trimming.

15.8.2 Expenditure drivers

Vegetation management is essential for safe and reliable network operation, as well as being a legal and regulatory obligation. Below we explain vegetation management expenditure drivers.

Safety

Trees are a hazard near power lines, with potential for major safety risks, including structural damage that can lead to injury, electrocution, or fires resulting from flashovers.

Maintaining adequate distances between overhead lines and trees is therefore an essential safety requirement. This is achieved mainly through trimming or cutting trees, but in some cases structures are replaced or undergrounded if this is more cost-effective.

[87] Measured against a counterfactual where similar outcomes will be delivered, but with early CPP approaches and current rates. This efficiency gain is anticipated to grow further in the period following the CPP, as the full benefits from improved maintenance, information and asset management are achieved.

Compliance

We have to meet several compliance obligations in respect to vegetation management. Key among these are the Tree Regulations[88], which prescribe the minimum distance that trees must be kept from overhead lines, and set out responsibilities for tree trimming. The New Zealand Electrical Code of Practice for Electrical Safe Distances (NZECP 34) sets minimum safe electrical distance requirements for overhead line installations, including the minimum safe approach distances for the public, and requirements for workers who need to work within this distance.[89]

Under the Tree Regulations, if we become aware of a (potential) breach of minimum clearance distances, we have to correct it in a prescribed time.

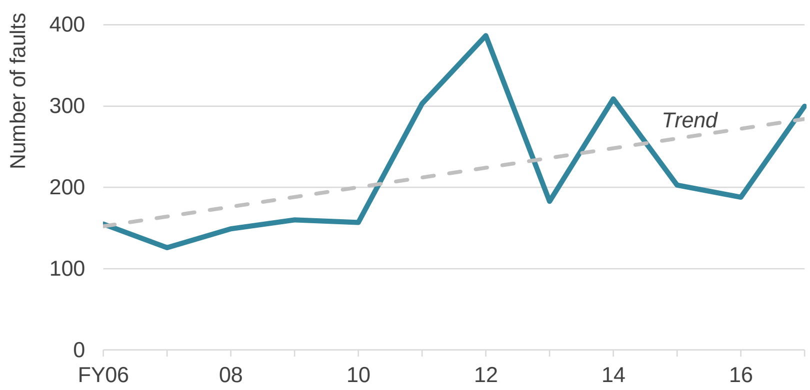
Under our current approach we typically only respond to issues as we become aware of them, either through line inspections, when notified by affected parties or following faults. This practice is still used in parts of New Zealand, but good practice is moving to a proactive approach – to have ongoing, regular visibility of the status of vegetation around lines and taking preventive action to prevent issues from arising. We have assessed our current practice and come to the view that full compliance with the Tree Regulations will require such a proactive approach. This is the approach we intend to adopt over the CPP Period.[90].

Reliability

The same vegetation related factors that affect safety, also affect the reliability of the network – tree contact or damaged structures lead to outages.

Figure 15.7 illustrates how vegetation related faults have been increasing over time. Arresting this trend requires the additional expenditure proposed for the CPP Period.

Figure 15.7: Historical trend in vegetation related faults



Tree population and network size

Vegetation management expenditure is directly related to the number of trees in close proximity to overhead lines. Line length and tree density are therefore key drivers of expenditure. We not only have the longest overhead lines network in New Zealand, but also our lines run through some of the areas with the highest tree density.

88 Electricity (Hazards from Trees) Regulations 2003

89 Further regulations to which we have to adhere include those set out in the Occupational Safety and Health Approved Code of Practice (OSH ACOP) for safety and health in tree work around power lines; the MBIE approved code of practice for safety and health in arboriculture (MBIE ACOP) and the Conservation Act 1987.

90 This change has to be phased in, as is not practical to change our practice in a short time, both from a management and actual vegetation contractor availability perspective.

Wind patterns

The large majority of faults caused by trees are associated with wind. For example, swinging branches cause line clashes, broken branches blow into conductors, and trees topple onto lines.

Good practice require line designs to reflect the prevailing wind patterns in an area, with lines in higher wind areas having to be constructed to a higher standard. Changing wind patterns can also cause changing fault numbers. In the fault trend above, the annual variance can be clearly seen – reflecting the major impact that the weather, especially wind, has on these faults.[91]

Box 15.7: Tree sites

A tree site is a central concept to the way we manage and forecast vegetation growing near our network. A tree site is defined as a site on a property with one or more trees in a group, and the trees' foliage is within the 'Notice Zone' or the 'growth limit zone' for the adjacent overhead line.

- A tree site is limited to one span of overhead line. If there are multiple properties within the span (for example in an urban situation) these are treated as separate sites.
- They align with a Cut or Trim notice prescribed in the Trees Regulations. Separate sites require separate notices. Any tree site in an adjacent span is a separate tree site even if the property ownership is the same for both spans. This definition is widely used in the New Zealand industry.
- For comparison; in Australia, a 'vegetation maintenance span' is used as a measure of where tree work is to be undertaken. A 'vegetation maintenance span' is a span where there are trees within the growth limit zone of the line.

In the UK, a 'tree affected span' is used as a measure of where tree work is to be undertaken. This is similar to the Australian 'vegetation maintenance span'.

15.8.3 Our new vegetation management strategy

In light of the deteriorating trend, the significance of vegetation management for network reliability and public safety and emerging industry views on what compliance with regulations implies, we are proposing significant changes to our vegetation management strategy, which will bring us in line with New Zealand good industry practice. Key to delivering this strategy are:

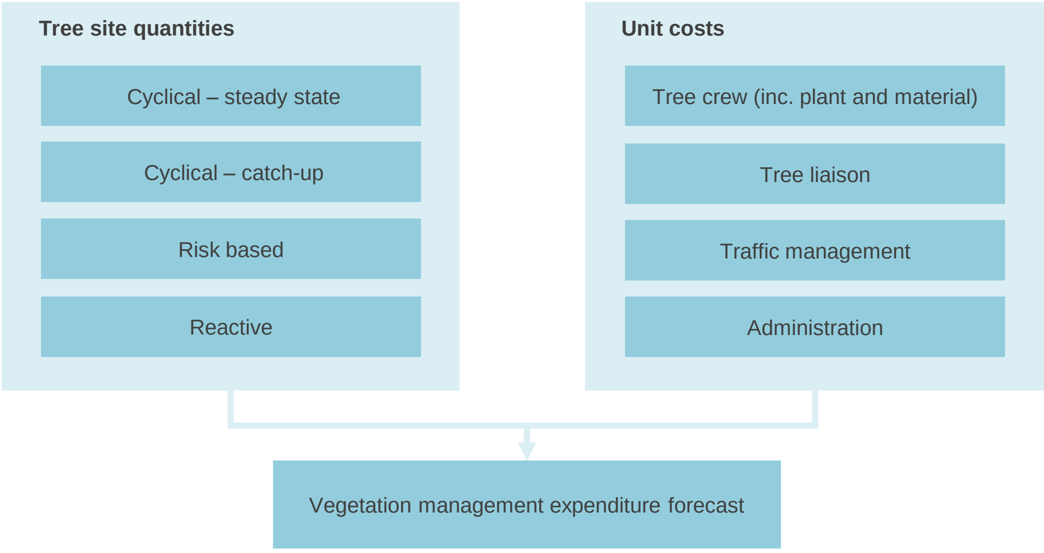
- **Moving to a cyclical trimming approach, instead of our current reactive approach**: this will ensure that all tree sites along our lines are inspected on a regular basis and that trees are trimmed or removed in a planned manner.
- **Achieve steady state**: as part of the first cycle we will undertake higher levels of work than in subsequent cycles as we will attend many sites for the first time. This catch-up will ensure the cyclical regime is sustainable.
- **Risk-based approach**: implementing a risk-based approach to tree management and extend trimming and removal in locations where specific trees are deemed a higher risk.
- **Improved liaison**: adopt an independent liaison model to enhance interaction with tree owners and achieve more cost-effective outcomes.

[91] For example, FY16 was an exceptionally benign year in terms of wind. Analysis of wind-speed gusts at ten weather stations across our network indicated that the prevalence of high-speed gusts at eight of the ten stations (which result in the most network faults) was much lower than the ten-year average (the other two were average). This corresponds with anecdotal evidence from the field.

15.8.4 Forecasting approach

We have used a volumetric (or bottom-up) approach to forecast the work volume and expenditure required to move to industry good practice.[92] The main components of our forecast are set out in Figure 15.8.

Figure 15.8: Vegetation management forecasting process



We model four types of tree sites across six regions. This ensures that our expenditure forecast reflects that:

- the resources required for each type differs
- the work composition is expected to change over time
- the work volume and work composition is expected to differ across sites.

Our unit costs are based on:

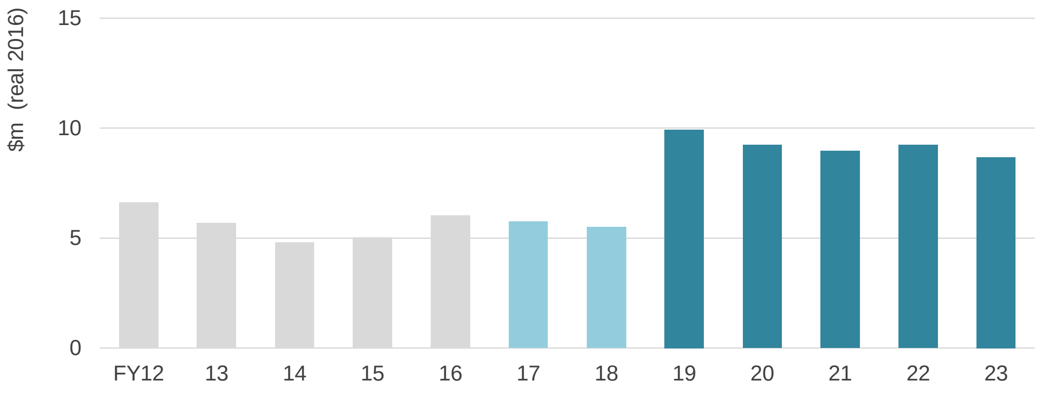
- Market tested rates for typical tree crews (including plant such as elevated platform vehicle). The number of tree crews is driven by the number of tree sites.
- Market tested rates for tree liaison persons. The number of liaison persons is driven by the number of tree crews.
- Historical average rates of traffic management costs. The number of sites requiring traffic management is driven by the number of tree sites.
- Historical average rates of administrative costs

92 As we are proposing a substantial step increase in expenditure, a base-step-trend approach to forecasting is not appropriate.

15.8.5 Proposed expenditure

Our forecast vegetation management Opex during the CPP Period, with equivalent historical spend, is shown in the following chart.

Figure 15.9: Proposed vegetation management Opex



Historically the level of our regulatory Opex allowance have been constrained, which is reflected in similar constrained expenditure on vegetation management. This has contributed to the rising trend in vegetation related faults, and is has prevented us from adopting good industry vegetation management practice across our network.

We propose additional expenditure during the CPP Period to fund prudent and efficient increases in vegetation management work volume in the following areas:

- **Cyclical trimming**: moving to a 3-year cyclical inspection and trimming approach, instead of our current largely reactive approach. This will be implemented in two 3-year tranches.
- **Catch-up**: the initial cycle will involve higher work volume at each site than in subsequent cycles. To establish a sustainable regime that delivers the expected benefits the first cycle involves catching up on work.
- **Risk-based work**: a risk-based vegetation management work component will involve some additional trimming or removal of high-risk sites.

To implement our new approach will require an uplift in expenditure from historical levels for a 6-year period (corresponding to two three-year cycles).[93] After this vegetation management expenditure and reliability is expected to settle at lower, steady state levels.

While a proactive approach represents significant savings per tree site compared with a reactive approach, the overall number of tree sites to be inspected and trimmed will increase at a higher rate. The steady state expenditure level is therefore expected to be higher than current levels, but delivering a much improved level of compliance and better safety and reliability outcomes.

The step change reflects the amount of work required to implement our new vegetation management strategy. We are negotiating with service providers to ensure that sufficient capacity is available to achieve the planned work volume (see the deliverability discussion in Chapter 8).

93 The last year of the 6-year period will be outside the CPP Period.

15.8.6 Why the proposed expenditure is prudent and efficient

The box below summarises why the proposed vegetation management expenditure is prudent and efficient.

Box 15.8: Vegetation management justification

We are confident that our approach to vegetation management reflects an efficient and prudent level of investment:

- **Good practice**: the proposed vegetation management maintenance standards represent good New Zealand (and international) industry practice.
- **Reliability and safety**: The current vegetation management approach is unsustainable due increasing vegetation related faults and safety risks. Over time our new approach will help stabilise network performance and reliability.
- **Compliance**: the proposed approach will ensure full compliance with the Tree Regulations (and other associated regulatory requirements).
- **Benchmarking**: historically our vegetation management expenditure (per km of line managed) has been lower than the New Zealand industry average, and has been along the lowest among our comparators. As we address our backlog and introduce the cyclical approach we will move closer (but still below) to the industry average and increase to a level similar to our closest, well performing comparators (refer to Figure 15.10). We consider that the envisaged relative position is an efficient position for a company like us that has substantial length of rural lines, passing through large areas with very dense tree populations, and areas exposed to high winds.
- **Reduced costs**: we will reduce unit costs as we move to a proactive, cyclical approach and reduce volumes of higher-cost reactive work.
- **Specialist advice**: an industry specialist also assisted us in refining our practices and provided advice on the forecasting methodology
- **Moderation**: we are implementing our new approach in a staggered way over a six-year period to allow us to decrease the cost impact of the step change and allow us to learn from implementing the approach in other regions. We adopted this approach following a comment by the Independent Verifier on our original proposal.
- **Efficiency targets**: we expect to make efficiency savings towards the end of the CPP Period – reflecting the improvements from enhanced analytics, improved information and better works planning. We have allowed for an efficiency moderation in expenditure levels, equivalent to a 4% reduction in expenditure on the overall portfolio.[94]

15.8.7 Vegetation management benchmarking

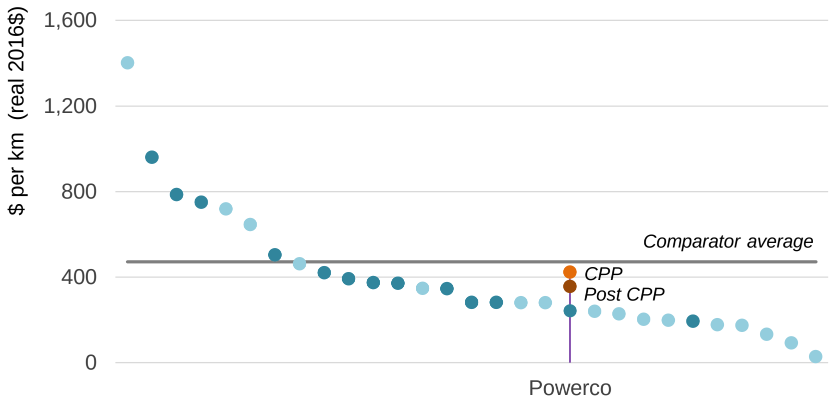
Comparisons with other businesses provide a useful top down cross-check on whether our historical and forecast expenditure is prudent and efficient. As with any comparisons with other businesses, care is needed to ensure that any comparisons are appropriately normalised for inherent business-specific differences.

Figure 15.10 compares our vegetation management expenditure per km of circuit length to those of other NZ electricity distributors.[95] Our benchmarking shows that our comparators are spending $470 per circuit km of overhead line (FY14-16 average). This compares to our average spend of $242 per circuit km (FY14-16 average).

94 Supra note 19

95 We use circuit length rather than route length because that is comparable to data published by other companies. We use route length in developing our work estimates.

Figure 15.10: Vegetation management benchmarking (FY14-16 average)



Not all businesses are comparable to us in their characteristics. Some companies have limited overhead networks, have worse reliability than us or their network is substantially different (e.g. mainly urban, compared to our network which has a comparatively high proportion of network in rural and deep rural areas). In the chart above we have highlighted (as darker dots) the distributors that are comparable to us in terms of their network characteristics and reliability performance.

15.9 System operations and network support expenditure

The System Operations and Network Support (SONS) portfolio covers our costs related to managing and operating our electricity network. This relates mainly to salary and associated costs, but also includes network support expenses such as professional advice, quality assurance, and utility costs. [96] Expenditure on capital projects (including the professional advice on these), network equipment or service providers, as well as corporate costs are excluded from this portfolio.

15.9.1 Activities

Our SONS expenditure covers the following activities and external costs.

- **Salaries and wages for internal network staff:** to the extent that these costs cannot be capitalised against projects.
- **Supporting expenditure associated with internal staff:** including training and development.
- **Network related external support:** including professional advice, engineering reviews, quality assurance.
- **Utility costs:** associated with running the network.

15.9.2 Expenditure drivers

During the CPP we propose increase our level of expenditure in line with the following main drivers:

- **Uplift in construction and maintenance works:** to deliver the uplift in Capex and Opex work associated with the CPP, we need to increase our internal capacity, particularly in relation to planning, designing and managing the delivery of the work. We will also have to manage an increased number of service providers, as well as increased network outages and switching requirements.
- **Expanding our internal skills and capabilities:** Our core business is to deliver electricity to customers, safely, reliably and efficiently. Sustaining this against a background of changing

96 This is the cost for water, electricity, communications and rates associated with our network facilities.

customer requirements and expectations, and a changing operating environment, requires us to enhance our processes and skills in several areas. Key among these are:

- positioning ourselves for the network of the future – including the capability for increased network analytics, a focus on innovation, and conducting research and developing proofs of concepts for future network applications
- enhancing our asset management capability – this is essential in order to achieve the efficiency gains foreseen for the CPP, with associated cost savings for consumers. As asset management is a foundation of our business we are working towards achieving internationally accepted good practice standards (as will be evidenced by achieving certification against the ISO 55000 standard). See the box below for a further discussion
- better focusing on our customers' needs and expanding our services - this includes establishing an in-house fault call centre, to improve communication with our customers during events.

– **Asset management certification**: We recognise that in some areas our asset management is not currently at good industry levels.[97] We have set ourselves a target to achieve this consistently by 2020. We will seek ISO 55000 accreditation to measure and demonstrate this. ISO 55000 is a leading, internationally recognised asset management standard, which provides a framework of required competencies measures and maturity stages. Achieving good industry practice against these competencies will be a substantial step forward for us. Good industry practice asset management has been widely demonstrated to support the most cost-effective delivery of sustainable, high quality services to customers. We intend to use external advice to support our ISO 55000 accreditation process.

– **Data quality improvement programme**: Access to accurate asset data – attributes, condition, performance and defects underpins effective asset management. While the overall quality and breadth of our database has improved in recent years, there is still much to do. We therefore intend to implement a review of all of our asset data attributes, defect, performance and condition records and to update our records to acceptable accuracy levels. This will be a considerable undertaking, involving many parts of our business (and will also involve external support).

Box 15.9: Improving our asset management capability

To effectively deliver the CPP programme, and manage our network in the long-term interest of customers, good practice asset management is a pre-requisite. Asset management practices are improving along with emerging technology and new techniques, but given the constrained environment within which we have been operating in recent years, there are areas where we have not kept pace with good industry practice. While we have taken steps to address this, more work is needed over the CPP Period.

In Chapter 9 we discuss several improvement initiatives we intend to undertake during the CPP Period. To deliver these will require us to enhance our asset management capability, which in turn relies on expanded skills and improved practices. In particular, we will focus on:

– **Improving our asset management framework:** in recent years we have refined our documentation, governance and planning frameworks. These significant changes support prudent and efficient expenditure plans. We however still see scope for further improvement, particularly in our works delivery model, project prioritisation and tracking and managing delivery progress.

– **Enhanced modelling:** we have been implementing more robust models to better understand the current and expected future performance of our assets and the overall health of our network assets. This will be complemented by improving the quality of information we maintain in relation to asset and network attributes and performance (see below).

[97] This is evidenced, for example, in our self-assessment against the AMMAT tool developed by the Commerce Commission – as reported in our 2013 and 2016 asset management plans.

- **Improved analytical capability**: good practice asset management requires good asset and network information. We will increasingly rely on data mining, data-visualisation, optimisation, and various other forms of analysis to inform our investment and operational decisions. In addition, data-intensive analysis is needed for planned improvements such as fully quantified risk management, probabilistic planning standards, and developing a future network architecture.
- **Asset management capability**: our asset management competencies and capabilities have developed over decades, often organically. Historically fit for purposes, these now need to evolve to meet the needs of a modern distribution business, reflecting emerging good industry practice.
- **Data quality initiatives**: good asset information and analytics is built on accurate and comprehensive data. While the overall quality and breadth of our data has improved, there is still much room for improvement. We will review our asset data attributes, performance, and condition records, the manner in which these are collected and the quality control that is carried out.
- **Investment optimisation:** a modern asset manager must consider a range of factors – lifecycle cost, asset risks, safety and environment, customer preferences, compliance and commercial implications in long-term investment planning. We will expand our focus and skills in the areas underpinning this analysis including quantified risk assessment, lifecycle costing studies, Opex/Capex trade-off studies, and cost-benefit analysis.
- **Future readiness of the network:** emerging customer and network technology offer threats and opportunities for us. We intend to embrace the opportunities and effectively mitigate the threats, which will require us to expand our capabilities in research and development, innovation, trialling new solutions, and bringing successful solutions into business-as-usual.
- **Asset management certification:** working to gain ISO 55000 certification will provide important guidance when implementing our proposed asset management improvements. It will give us clear goals to work to, that are demonstrably aligned with good asset management practice. We will also be able to measure our progress objectively, and demonstrate this to our stakeholders.

Through these asset management improvements, we intend to achieve significant cost efficiencies. We estimate that by the end of the CPP Period we will achieve Capex efficiencies of around $6m per year and Opex efficiencies of around $2m because of asset management improvements. These savings have been reflected in the various Opex and Capex portfolios.

Given the structural improvements we are planning, these efficiencies will not only persist, but will grow in future years as the longer-term benefits sets in. Improved asset management is seen as a key area that will contribute to the long-term interest of our customers.

15.9.3 Forecasting approach

We use a base-step-trend approach as described in Chapter 10. For our SONS forecast we have used FY16 as the representative base year. While we have seen increasing SONS expenditure in recent years, reflecting asset management improvements already made and an increasing works programme, our normalised SONS expenditure remains among the lowest for EDBs, including our closest comparators (see Figure 15.12).

We have modelled step changes arising from the factors described in Box 15.9. These reflect:

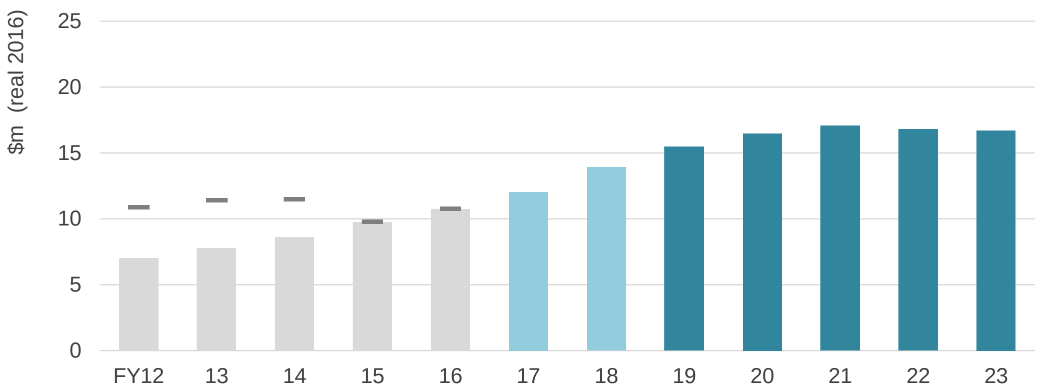
- **Capacity increases**: delivering the increased work volumes proposed for the CPP Period will necessitate additional resources, particularly in planning, design, project management and network operations. The extent of this increase is proportional to the work volume. The headcount forecast is based on analysing the work volumes currently delivered by our workforce, the increased work volumes require for the CPP, and scaling up the workforce accordingly. We applied an efficiency factor to this upscaling, which reflects scale benefits and already existing internal support systems that do not need to be increased.
- **Capability increases**: increased headcount associated with delivering the required capability and skills uplift is estimated based on the number of roles at current average salary levels.
- **External support**: including professional support required for ISO 55000 assessment and certification and the proposed data improvement programme.

As we have allowed for increases in volume by modelling headcount increases directly, we have not allowed for a separate output growth trend factor.

15.9.4 Proposed expenditure

Our forecast SONS Opex during the CPP Period, with equivalent historical spend, is shown in Figure 15.12.

Figure 15.11: SONS Opex

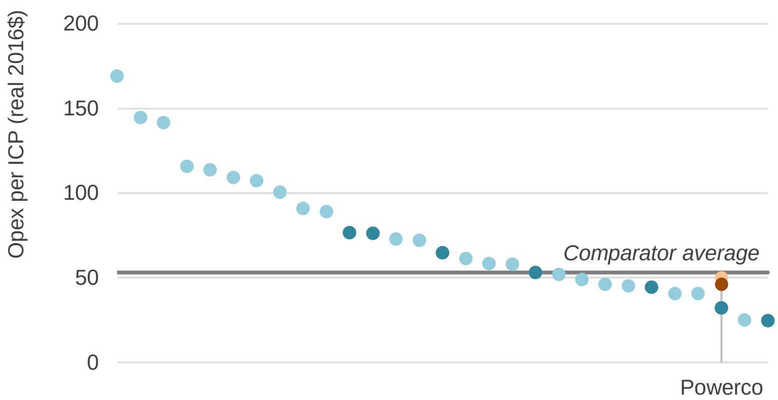


To allow a 'like-for-like' comparison we have adjusted historical SONS from FY12-14 to reflect our new internal cost capitalisation approach which we adopted from FY15. The 'bars' in the figure above reflect our current capitalisation approach. The dotted line indicates the SONS amounts disclosed in our information disclosures, which reflects the capitalisation approach that applied at the time.

To build our required staff capacity and capability, as discussed in this section, will require increases in SONS expenditure until FY21. After this point we expect expenditure to stabilise and then slowly decrease as we achieve efficiency improvements and the volume of CPP construction and maintenance work starts to wind down. This wind down will continue till after the CPP and will result in staff reductions at the time.

Our historic SONS expenditure—per the unadjusted series—has been reasonably stable with increases from FY14 as we increased asset management capability and managed larger work programmes. In our view, SONS expenditure has been too low in the past as suggested by the industry benchmarking shown in Figure 15.12.

Figure 15.12: SONS benchmarking



The scope and complexity of activities within SONS activities is likely to differ between larger and smaller distributors. We therefore consider that other larger electricity distributors are the most relevant comparators for us. The chart identifies these relevant comparators with as darker markers.

To achieve the efficiency improvements planned for the CPP, with the associated long-term benefit for consumers, asset management improvements are required. Capacity to manage the additional CPP workload is also necessary. For this, SONS expenditure will need to increase over the CPP Period, bringing us closer to the current average of our closest comparators, but still well below the average.

The increase in SONS activity is driven by the need to:

- deliver increased work volumes requiring an increase of 46 FTEs by FY21, adding $1.1m in Opex per year to the SONS portfolio by FY21[98]
- increase capability and skills to achieve our planned asset management improvements and positioning for the future; this requires 18 additional FTEs, adding $3m per year to the SONS portfolio by FY22[99]
- bring fault calls in-house by establishing a call centre, with an associated cost of $600k per year from FY20
- contract professional support to achieve ISO 55000 certification by 2020 ($1.5m spread over three years)
- deliver a data quality improvement programme including extensive field surveys and data capturing ($1.3m per year).

It will take time to hire the specialists we need, train new people and structure ourselves in the most effective way to efficiently deliver our work programme. This is allowed for in our deliverability plan and in our recruitment plans.

Our recruitment plan will initially focus on the priority areas of increased planning and design resources. This is essential in order to prepare the work plan for the first year of the CPP Period (FY19). This will be followed by increased project management resourcing.

In parallel with this, we have started building our asset management capability. As this will be an essential part of ensuring the optimal planning and delivery of the CPP work, the work on the asset management improvements (see Chapter 9) will being in advance of the CPP Period.[100]

98 The increase in SONS reflects only the non-capitalised portion of salaries. The capitalised portion of salaries are included as part of network Capex.

99 As staff working in these areas are not directly involved in capital projects, we do not apply capitalisation to these increases.

100 This implies some risk in that we have to build capacity before the CPP is formally reviewed and we have certainty about available revenue. To mitigate against the risk, we will limit the initial capacity increases.

15.9.5 Why the proposed expenditure is prudent and efficient

The box below summarise why our proposed SONS expenditure is prudent and efficient.

Box 15.10: SONS expenditure justification

We are confident that our approach delivers an efficient and prudent level of investment:

- **Support for work programme**: the increased capacity is required to deliver the additional network investments during the CPP Period.
- **Efficient delivery**: our estimates are based on higher delivery levels (versus supporting Opex) than we currently deliver reflecting expected efficiencies. While our current delivery is efficient, based on benchmarking against other EDBs, we will improve this by leveraging economies of scale and scope.
- **Delivers future efficiencies**: the proposed uplift in headcount to expand our capability and skills is associated with improving our asset management capability and to better position the network for a changing future. This is anticipated to deliver material efficiency improvements, as reflected in reductions in our other forecasts and will support stabilised network performance by the end of the CPP Period.
- **Cost-benefit analysis**: forecast cost and reliability benefits to customers from the increased internal skills, measured over a ten-year period, substantially outweigh the costs associated with the additional resources (on a net present value basis).
- **ISO 55000 certification**: achieving ISO 55000 certification by 2020 will help demonstrate our improvement as asset managers. Working to certification will give a benchmark by which to set targets and monitor our progress in achieving the improvements we propose for the CPP and the associated benefits. It will also allow objective verification of our performance by external stakeholders, to a widely used, internationally accepted standard.
- **Benchmarking**: our SONS expenditure is low compared to EDBs, in spite of operating challenges posed by a low density, largely overhead, rural network. When allowing for the additional expenditure proposed for the CPP, as shown in Figure 15.12 our expenditure is in line with our closest well performing comparators and below the New Zealand industry average.
- **Efficiency:** we expect make efficiency savings towards the end of the CPP Period – reflecting the improvements that will arise from enhanced analytics, improved information and better works planning. We have accordingly allowed for an efficiency adjustment equivalent to a 2% reduction in expenditure. This efficiency gain will persist after the CPP. In addition we the number of capacity/volume related FTEs will reduce as network Capex work volumes reduce.

16 NON-NETWORK OPEX

Non-network Opex provides a wide range of services and supporting functions to enable delivery of our network services. It ensures we can operate as an effective and well governed business.

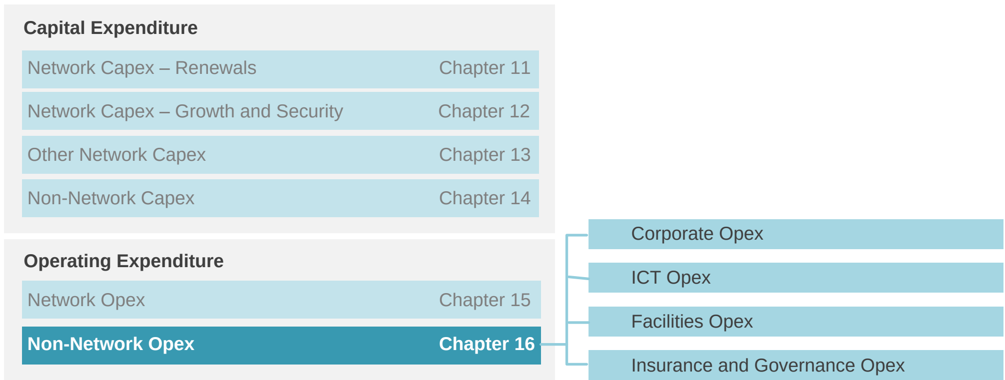
- **Corporate Opex**: includes staff in functions such as finance, information services, human resources, and health and safety. A small number of additional staff will be needed during the CPP Period as network work programmes increase.
- **ICT Opex:** increases over the CPP due to software licensing costs increasing with user numbers and increased Opex costs associated with the new ERP.
- **Insurance and governance Opex:** remains relatively flat, with only a minor increase in insurance due to increases in assets and employees.

Overall, we currently benchmark well compared to other EDBs. We expect to continue to benchmark well following our proposed 10% increase in non-network Opex.

16.1 Expenditure category and portfolios

The following diagram illustrates where non-network Opex sits within our overall expenditure and lists its portfolios.

Figure 16.1: Exenditure category map showing network Opex portfolios



As shown above, the non-network Opex category includes four expenditure portfolios.[101]

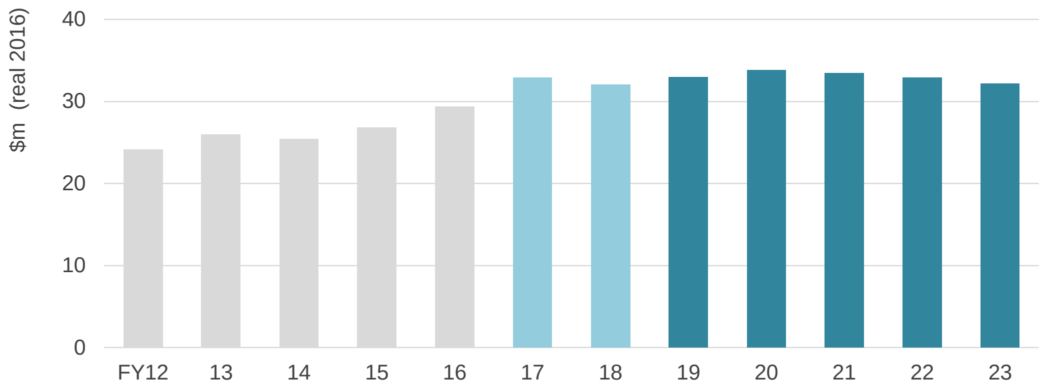
- **Corporate Opex**: relates to activities that provide ongoing business support to our electricity division including managing financial transactions and providing human resource support. This portfolio includes the labour-related costs of our staff and external support.
- **ICT Opex**: includes expenditure related to software licensing, system support and maintenance, equipment leases and outsourced services.
- **Facilities Opex**: primarily covers expenditure on corporate facilities such as office leases and our expenditure on vehicle leasing.
- **Insurance and governance Opex**: includes expenditure on insurance premiums for our network assets, costs related to corporate governance, and activities required to ensure compliance with legal and regulatory requirements.

101 These differ from those specified by Information Disclosure as they better reflect the way we undertake these activities.

16.2 Overview of proposed non-network Opex

Our proposed non-network Opex during the CPP Period, with equivalent historical spend, is shown in the following chart.

Figure 16.2: Proposed non-network Opex



During the CPP Period we expect to incur $165m of non-network Opex. This accounts for 36% of our total Opex spend over the period.

Historically, non-network Opex costs have been held relatively constant. While we have delivered an increasing volume of work, regular reviews and restructures of teams have delivered improved productivity benefits. In some cases, teams have been running too lean, and we've increased the headcount accordingly. For example, the HSEQ team has recently increased its headcount to provide more dedicated resource to focus on each electricity region.

Increases in FTEs in FY16 and FY17 have been due, in part, to the additional work involved in preparing and submitting our CPP application. Additional drivers for increasing spend up to FY20 include:

- our human resources team will need to support our plans to increase our delivery capability and asset management competency
- during the ERP implementation (which occurs from FY18 to FY20) we require additional resources to support both the new ERP and the legacy systems. Overall headcount increases will also lead to increases in licensing and support costs
- an increase in financial support associated with a larger number of transactions required to efficiently deliver our investment plans.

Beyond FY20, we expect our non-network Opex to reduce as we begin to see the benefits of initiatives such as our ERP implementation. This reduction is reflected in our CPP efficiency targets.

Our total non-network costs are also split between our gas and electricity business. The cost allocation approach used was first developed to meet the IMs, and has been regularly audited and disclosed to the Commission (see Section 7.2 of the FAMI).

16.3 Key drivers and forecasting approaches

Below we discuss how our proposed non-network Opex will support our activities over the CPP Period and how we forecast the required levels of expenditure.

16.3.1 Key drivers

Our non-network Opex during the CPP Period is driven by the following factors.

- **Safety**: our health and safety team provides specialist advice and analytical support to the electricity business. This advice and oversight helps ensure we continually improve our performance and will be increasingly important as we align our processes with the Health and Safety at Work Act 2015.
- **Asset management support and deliverability**: to allow us to undertake the increased level of financial transactions (e.g. materials purchasing) that will be required to efficiently deliver our CPP work programme.
- **Need for increased capability**: our human resources team will support our plans to increase our delivery capability and asset management competency over the period.
- **Operational excellence**: ensuring that we are a well-managed business, making optimal decisions based on reliable and up to date information, and our workforce is appropriately skilled and qualified.
- **ICT Opex**: many aspects of ICT Opex are directly related to headcount (e.g. software licenses). The ERP implementation will also require temporary support of two systems during the transition period (the new ERP system and the legacy systems).
- **Governance**: expenditure will help ensure that we maintain appropriate corporate governance and oversight over our increasing expenditure. This is necessary if we are to challenge our approach and deliver our efficiency targets.

16.3.2 Forecasting approaches

We applied a base-step-trend forecasting methodology to derive non-network Opex forecasts for the CPP Period. This involved selecting a recent year's actual Opex which was tested to represent an efficient 'base' Opex. This base Opex was then adjusted to remove any one-off or non-recurrent cost items that would not be reflected in the company's future expenditure.

The base Opex, together with any adjustment, becomes the starting point from which the forecasts are projected. Forecasts are derived by assessing and testing futures cost drivers as explained later in the chapter.

Cost allocation ratios have been held constant throughout the forecast period (see Section 7.2 of the FAMI).

16.4 Developing our non-network Opex forecast

Our non-network Opex forecast for the CPP Period has been developed using a base, step and trend approach. Our challenge and approvals process was then used to ensure that forecasts have been derived in a systematic and rigorous manner, and have undergone appropriate scrutiny. Given that the bulk of our non-network costs relate to staff requirements or FTEs, the challenge process focused on assessing the justification for any increase in headcount (and linking this to future increases in business scale / work volumes where appropriate). We also challenged the unit rates applied in the forecast, in this case the remuneration and salary assumptions applied to any increased or new FTEs.

16.4.1 Internal challenge and approvals

While our non-network Opex forecast is largely stable, we undertook a robust internal challenge and review process to test the underlying cost drivers and to understand the scope for efficiencies. In areas with increasing expenditure we have sought business cases and cost-benefits analysis.

This challenge process was in addition to the overall 'top down challenge' used to develop and approve our Preliminary Proposal (discussed in Chapter 4) and the review by the Independent Verifier (discussed in Chapter 6).

- **Forecasting team:** a dedicated team, led by our Treasurer, was established to develop our non-network Opex forecasts.
- **Specialist advice**: an external consultant assisted us in developing certain business cases and cost-benefits analysis.
- **CPP Governance Group**: a group of accountable general managers was established to provide oversight of the CPP proposal. This group included general managers responsible for the majority of expenditure.
- **Executive management team**: the CEO and our wider general management team performed a further challenge of the CPP Proposal.
- **Board review**: the expenditure forecasts were submitted to the Powerco Board for review and approval.

16.4.2 Supporting documentation

Several supporting documents inform our CPP forecast.

- **Portfolio overview documents**: provide a summary of each of the expenditure portfolios.
- **IS Capability and Expenditure document**: a description of the IS capability and expenditure that Powerco will require over the CPP Period. This document will be superseded by the IS Strategic Plan, due to be finalised in mid-2017.
- **Policies and standards**: including our HR, remuneration, and contractor engagement and management policies.
- **Business cases**: provide detail on options and costs and benefits of each option.
- **Models**: including those for our BST approach.

This information was reviewed by the Independent Verifier and a representative subset has been included as supporting material to our submission.

16.5 Corporate Opex

Corporate Opex is driven by the human resource requirements of the business. It covers expenditure related to the divisions that support the electricity business (primarily the labour-related costs of staff, consultants and contractors).

16.5.1 Expenditure drivers

Corporate Opex covers expenditure on direct and indirect staffing costs and external support as well as advice we use to complement our internal resource. The key functions supported by this expenditure portfolio include:

- **Health and safety**: providing leadership and coordination of safety policies and approaches in support of our operational teams, including contractors.
- **Customer support and public relations**: manages our day-to-day customer interactions, including consultation, contract management, and general communications.
- **Finance**: includes managing our working capital and debt, purchasing and transactions functions, financial analysis, corporate reporting, and advice.
- **Human resources**: is responsible for attracting and retaining capable and effective people, managing skills and competency development and ensuring a positive working environment. This will be increasingly important as we grow our capability and competency levels over the CPP Period.

- **Legal and regulatory**: function that supports compliance with all statutory requirements, including regulatory and environmental obligations.
- **ICT staff:** ICT staff are included in corporate Opex.

Expenditure drivers during the CPP Period

Our level of corporate Opex over the CPP Period will be largely driven by:

- **Staff numbers**: directly impacts staff costs. As our activity levels grow we will require increasing numbers of capable staff. Salary and indirect costs (e.g. consumables and travel) are driven by our overall staffing levels.
- **External labour market:** staff salaries and other benefits are impacted by the general employment market. Demand for skilled staff, particularly regionally, will impact the level of competitive salaries on offer.
- **Business support requirements**: as our network work programme expands, work volumes for all areas of corporate Opex will increase.

16.5.2 Forecasting approach

We applied a base-step-trend methodology to forecast non-network Opex. This uses the general methodology described in Chapter 10. When applied to corporate Opex we used FY16 expenditure as a starting point as this is the most recent year of audited data. The forecasts were adjusted for each individual business unit based on the future resource requirements by the executive manager responsible for that business unit. The combined forecasts were then challenged and moderated, as appropriate, by the non-network forecasting team and the CPP governance group.

Our approach to remuneration and human resource management reflects good industry (domestic and international) practice. We are confident that if the needs case for any incremental FTEs is robust and justified then our HR policies will ensure that we secure fully capable and competent staff at market competitive rates.

Box 16.1: Overview of our human resources approach

There are four facets to our approach human resources management which ensures we run an efficient and effective team.

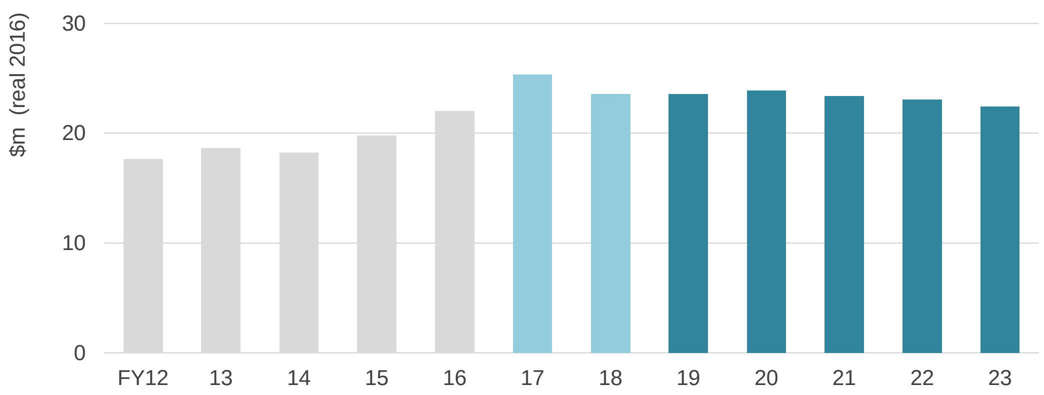
1. **Human resource management:** our human resources approach benchmarks well compared to similar New Zealand businesses. Our staff turnover in FY16 was 8%, compared to the national average of 19%. Our unscheduled absenteeism is in line with the private sector and better than the public sector. We also evaluate our ability to attract and retain staff by:
   - **Recruitment:** our recruitment strategy is to get the right people with the right skills at the right time. This means making sure we evaluate the skills required for now and the future. We make best use of social media, advertising and recruitment specialists (where appropriate) to reach the best people available.
   - **Remuneration:** our remuneration strategy is to pay the majority of roles at the market median based on figures and data supplied annually by Strategic Pay. This ensures we remain competitive and are viewed as a good employer in terms of fair pay, thereby reducing risk of high turnover and loss of skills.
   - **Retention:** turnover is currently low which, while it means we retain expertise, the challenge is to create enough space for development of talent and enable more career pathways. Appropriate restructuring of teams and functions takes place when necessary to ensure we have the right roles and skills required to deliver the long term business plan and have structures and practices which support internal development. Exit interviews and results are analysed and indicate we have a strong positive culture.

2. **Staff capability development:** we create an environment in which people can excel. We use a number of techniques to manage staff capability and ensure that each employee is delivering to their optimal potential in line with our goals.
   - **Bi-annual performance review process**: we always ensure our staff have personal objectives and development plans in place for their roles. Our performance review process is best practice and encourages an active dialogue between manager and employee across the entire business throughout the year.
   - **Career growth and skill development:** we have comprehensive staff capability development programmes, a graduate development programme and a number of secondment opportunities. Our training hours and training expenditure is in line with best practice benchmarking.
   - **Leadership and management coaching:** we recognise and value the impact of effective leadership in our organisation. Training and development includes NZIM Level 5 in Frontline Management, selected Auckland Business School programmes and internal higher role secondments.
3. **Effective business and tactical planning:** we ensure that human resources are effectively managed by providing a well understood and communicated roadmap for all staff to understand goals of the organisation and how this translates into individual objectives. These are:
   - **Business planning:** our rolling five-year business plan is reviewed on an annual basis. It provides clear guidance on focus areas and metrics.
   - **Tactical planning:** teams translate organisational goals into team objectives within annual tactical plans.
4. **Integrated culture of continuous improvement:** we regularly test our business efficiency and provide mechanisms to ensure we gain efficiency and other improvements via line management.
   - **Continuous improvement capability**: appropriate training and coaching is available for managers to achieve organisational and individual performance goals for their business units.
   - **Continuous improvement resourcing:** we have a core capability of business analysis who can provide internal consultancy services for managers looking to drive efficiency into their teams. This may take the form of minor system, process or culture improvements.

16.5.3 Proposed expenditure

Our forecast corporate Opex during the CPP Period, with equivalent historical spend, is shown in the following chart.

Figure 16.3: Proposed corporate Opex



Corporate Opex over the CPP is similar to the FY16 base year amount. We are able to keep increases down despite significant planned increases in network investment over the CPP Period, which drives part of our corporate Opex work volumes.

Our forecasts incorporate expected efficiencies (arising from scale, systems improvements and general productivity improvements). These efficiencies are responsible for the expenditure reductions towards the end of the CPP Period.

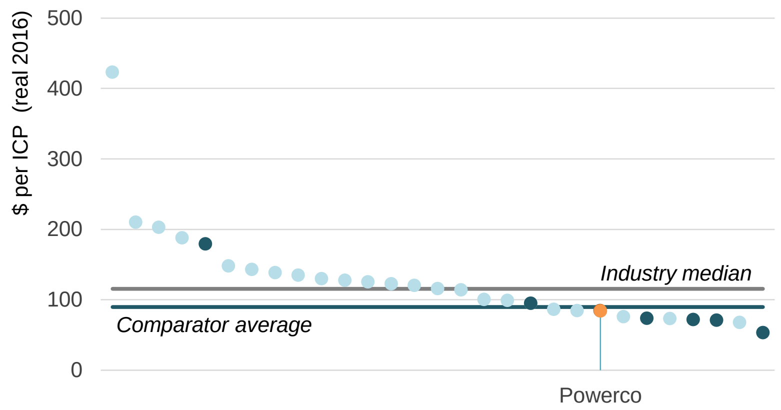
We have identified the need for increased FTE capacity in the following areas:

- **Health and safety:** an additional 1 FTE will be added to the existing team of 5, to meet the health and safety obligations of the increased company-wide staff numbers and higher levels of network activity.
- **Human resources:** an additional 2 FTEs (added to the existing team of 6) will be required to meet the ongoing obligations of good HR practices and to recruit the additional staff required.
- **Finance:** an additional 3.5 FTEs (added to the existing team of 33) to deal with increased invoice processing, and fixed asset and management accounting from the larger network work volume.
- **Legal and regulatory:** an additional 1.5 FTE (added to the existing team of 4) to deal with increased easements and contracts associated with higher work volume.
- **ICT:** an additional 10 FTEs (added to the existing team of 66) to deliver the ERP implementation and administer the increased company-wide staff numbers and higher network work volumes.
- **Customer support and public relations**: an additional 3 FTEs (added to the existing team of 24) as increased capital work increases our communications with customers on planned outages and associated engagement.

As noted, we place an ongoing focus on improving our staff utilisation and general efficiency and are confident that further improvements can be made. We have included efficiency targets towards the end of the CPP Period and these have already been factored into our expenditure forecasts.

Shown below is our historical business support expenditure compared to other EDBs.

Figure 16.4: Business support benchmarking (FY13-16)



Our current expenditure compares well with comparator EDBs (darker dots), and is below the industry median. We have used the median for comparisons with the overall industry to avoid giving undue weight to outliers.

Box 16.2: Corporate Opex justification

We are confident that our approach delivers an efficient and prudent level of investment because:

- **Prudent**: we have not included increases to reflect additional (unpredictable) demands and requirements that will lead to upward cost pressures.
- **Efficiency targets**: we have adjusted our forecasts for efficiency improvements in FY22 and FY23, reflecting our expectation that we will able to make process improvements over the period
- **External reviews**: we have engaged a number of external experts to assist us in preparing our forecasts and to help evaluate our structure and approach. We use Strategic Pay benchmarking of salaries to ensure our levels of remuneration remain in line with the market.
- **Benchmarking**: our business support Opex is lower than that of comparable EDBs. Corporate Opex is the largest component of this Information Disclosure category.

16.6 ICT Opex

ICT Opex covers costs such as software licensing, system support and maintenance, equipment leases, and outsourced services.

16.6.1 Activities and expenditure drivers

The main ICT Opex activities are:

- **Software licensing and licensing support**: Paying for licenses to use third party software, as well as ongoing support such as bug fixes and maintenance packs.
- **Data centre services**: Server and storage infrastructure on which our business applications run, housed and managed in data centres.
- **Internet and data communications and customer contact technology**: Digital connectivity and communications.

Expenditure drivers

Our level of ICT Opex during the CPP Period will be primarily driven by:

- **Electricity business staff numbers**: our CPP work programme will see our staff numbers increase as we deliver increased work volumes. As a result, the number of people using our IS systems will increase. Our licence agreements and related costs for third party applications and hardware are a function of headcount. Our licence-related costs will rise in line with FTEs during the CPP Period.
- **ERP implementation**: will also have a material impact on our ICT Opex. We will have to support two systems while the ERP is being implemented (the legacy systems and the ERP). Although project support costs will be capitalised, we will have higher system support costs for the first three years of the period because legacy systems cannot be decommissioned until the end of Phase 3 of the ERP programme.

Our approach to reflecting the impact of ERP on this expenditure is discussed in Chapter 10.

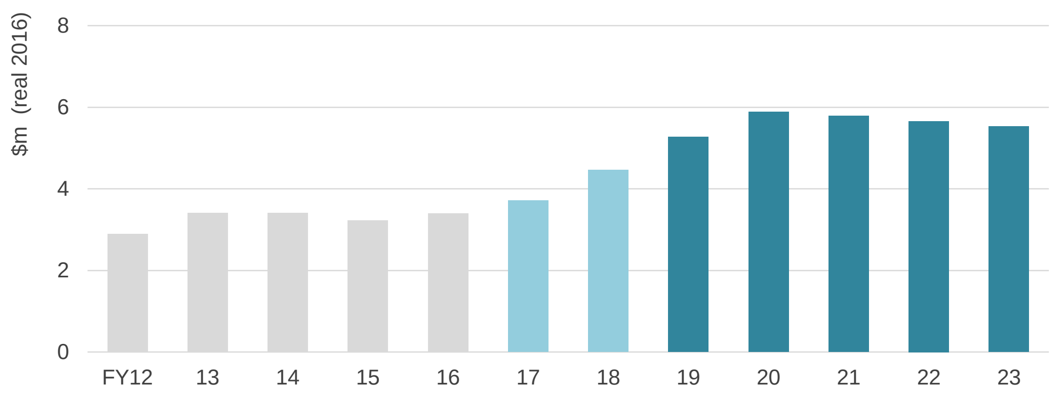
16.6.2 Forecasting approach

We applied a base-step-trend methodology to forecast non-network Opex. This uses the general methodology described in Chapter 10. When applied to ICT Opex we used FY16 expenditure as a starting point as this is the most recent year of audited data.

16.6.3 Proposed expenditure

Our forecast ICT Opex during the CPP Period, with equivalent historical spend, is shown in the following chart.

Figure 16.5: Proposed ICT Opex



As described above, our ICT Opex increases over the CPP Period due to higher employee numbers and the ERP implementation.

The ERP implementation creates a short-term increase in our operating costs. In future, our new standardised ERP environment will allow us to better manage upward cost pressures by rationalising our ICT systems and simplifying data integration and processing requirements.

Box 16.3: ICT Opex justification

We are confident that our approach delivers an efficient and prudent level of investment because:

- **Prudent**: our Opex relates in part to the ERP business case, which shows our approach is the most efficient option.
- **Market tested**: we run regular tenders and reviews for contestable services to know we are getting a competitive market tested price.
- **External reviews**: reviews have informed our move to increased standardisation.
- **Benchmarking**: our business support Opex, which includes our ICT Opex, is in line with, or better than, comparable EDBs.
- **Efficiency targets**: we have adjusted our forecasts for efficiency improvements in FY22 and FY23, reflecting our expectation that we will able to make process improvements over the period

16.7 Facilities Opex

Facilities Opex includes a range of costs related to our offices, such as office leases, office repairs and maintenance, office utilities and rates and office consumables.

16.7.1 Expenditure drivers

Expenditure drivers

Our level of Opex in this portfolio is driven by a range of factors including:

- **Staff numbers:** as our staff numbers and office spaces grow, our Opex will increase, particularly for office consumables.
- **Commercial property markets:** our office leasing costs are subject to market forces and are increasing in areas such as Tauranga where the local economy is growing.

- **Lease versus purchase**: we have a considered strategy about the extent to which we own or lease office space. This weighs up factors such as relative total costs, the strategic importance of the location and likely future changes to office needs.

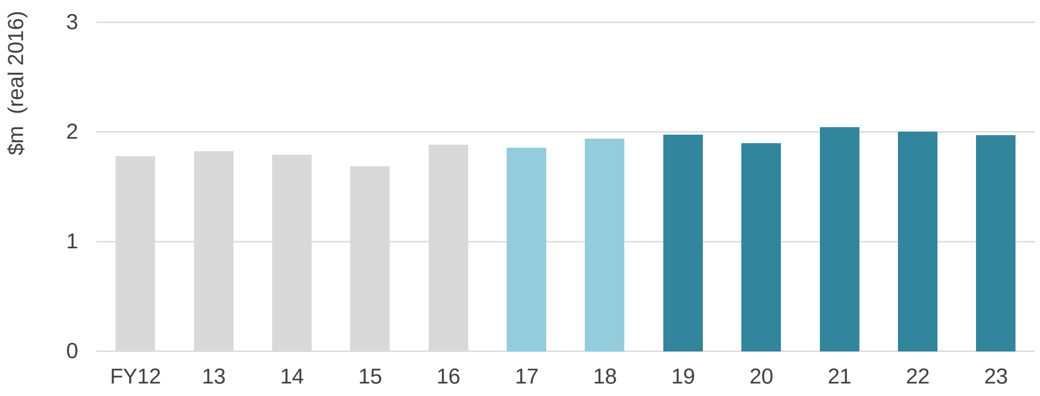
16.7.2 Forecasting approach

We applied a base-step-trend methodology to forecast non-network Opex. This uses the general methodology described in Chapter 10. When applied to facilities Opex we used 2016 expenditure as a starting point as this is the most recent year of audited data.

16.7.3 Proposed expenditure

Our forecast facilities Opex during the CPP Period, with equivalent historical spend, is shown in the following chart.

Figure 16.6: Proposed facilities Opex



Our facilities Opex costs have been relatively flat, and we forecast this will continue into the CPP Period. While we forecast increasing staff numbers, and costs rising due to this, we also consider there will be some offsetting gains, such as combining the two office spaces in New Plymouth into one site.

Box 16.4: Facilities Opex justification

We are confident that our approach delivers an efficient and prudent level of investment because:

- **Prudent**: with advice from industry specialists, we completed a detailed review of our facilities options which included cost-benefit analysis of the leases in our primary location.
- **External reviews**: we used independent and experienced advice when completing our facilities Opex forecast.
- **Market tested**: most of our facilities Opex is subject to competitive tendering. We review contracts and leases periodically to ensure they are aligned with market conditions, and provide value for money.
- **Efficiency targets**: we have adjusted our forecasts for efficiency improvements in FY22 and FY23, reflecting our expectation that we will able to make process improvements over the period.

16.8 Insurance and governance Opex

Insurance and governance Opex covers costs such as insurance premiums for our network assets, costs related to corporate governance, and activities required to ensure compliance with legal and regulatory requirements (e.g. audit fees and listings fees).

16.8.1 Expenditure drivers

Insurance and governance Opex covers requirements for the following:

- **Insurance**: insurance is the single largest expenditure item in this category. Our insurance program consists of a suite of general insurances appropriate for a business of our type and size, with the main policies providing coverage for material damage and business interruption, general and products liability (including professional indemnity), directors and officers liability, statutory liability, crime, motor vehicle, marine cargo, corporate travel, employers liability and employee death and total permanent disablement.
- **Corporate governance**: costs associated with corporate governance and supporting the Powerco Board, including directors' fees and associated costs. This ensures that our business is governed by a team of knowledgeable and experienced directors.
- **Compliance activities**: there are a range of fees we incur in order to meet legal and regulatory requirements. This includes audit fees (statutory and regulatory audits), listing fees and trustee fees.

Expenditure drivers

The level of Opex in this portfolio is largely driven by:

- **Asset base**: in relation to our material damage insurance, we insure around a third of our assets (being substations, depots and ground mounted transformers). Our forecast increase in network investment and maintenance activity will drive an increase in the value of assets to be insured.
- **Staff numbers**: some insurance premiums are directly related to employee numbers.
- **Regulatory and compliance requirements:** as described above, we incur a range of costs to meet statutory obligations. This includes regulatory obligations under the Commerce Act (for example, auditing Information Disclosure statements and price-path compliance statements), the Companies Act (auditing of financial statements), the Financial Reporting Act and the Financial Markets Conduct Act.
- **Insurance market**: we review and rigorously market test our insurance program each year with the assistance of our broker, Marsh. However, we are still subject to pressures that impact the overall market. For example, since the Christchurch and Kaikoura earthquakes, insurers have been more rigorous in relation to coverage levels and there has been an increase in the cost of material damage cover.

16.8.2 Forecasting approach

We applied a base-step-trend methodology to forecast non-network Opex. This uses the general methodology described in Chapter 10. When applied to insurance and governance Opex we have used 2016 as the base year. The following cost components have been taken into account.

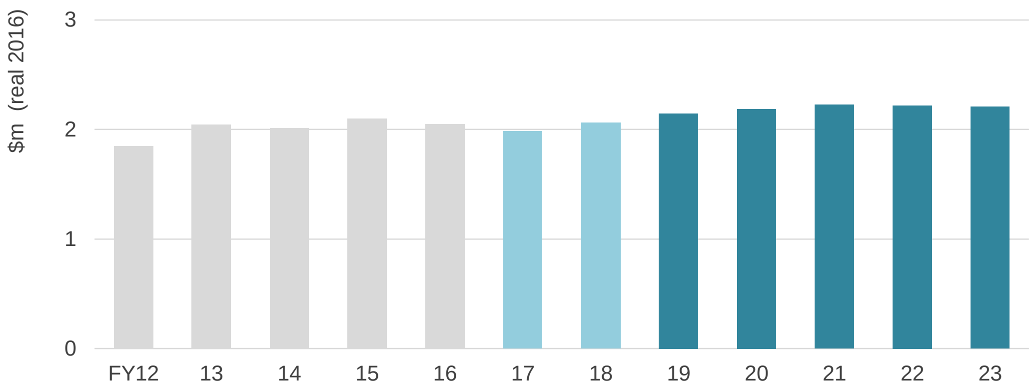
- **Insurance**: forecast insurance costs are based on the current programme of policies, as per the last renewal, projected forward by our insurance broker. Per this approach, there are no wholesale changes to coverage or insurable assets included in the projections. We do not materially alter our insurance programme from year to year without a strong business case. Marsh's report specifies the detailed assumptions that they have used when forming their view on our future insurance premiums.
- **Corporate governance:** relevant fees are reviewed annually in compliance with our human resources and Remuneration Committee Charter. We are not forecasting a change in the size of the Board or any changes to these governance arrangements or costs. No changes to scope have been forecast for listing fees and association fees and these forecast costs remain flat in real terms. Our fees are benchmarked against the Institute of Directors, and the total fees paid to directors are below average. Our forecast annual directors' fees for the CPP Period are unchanged in real terms from the base year.

– **Compliance activities**: our forecast audit costs associated with our Annual Financial Statements, Interim Financial Statements, Electricity Disclosure Accounts, Electricity Compliance Statements and trustee reporting will continue at historical levels with no change to scope. We expect our auditors to find efficiencies in their processes to offset any rising costs of professional service advice.

16.8.3 Proposed expenditure

Our forecast insurance and governance Opex during the CPP Period, with equivalent historical spend, is shown in the following chart.

Figure 16.7: Proposed insurance and governance Opex



Historically, our insurance and governance costs increased after the Christchurch earthquakes and increasing compliance obligations, particularly from the regulatory regime. In recent years, the trend has flattened.

Over the CPP Period, we are forecasting a small increase, mainly driven by increasing insurance costs from the growing asset base and employee numbers.

Box 16.5: Insurance and governance summary

We are confident that our approach delivers an efficient and prudent level of investment because:

– **Prudent**: even though we expect there to be pressures for increases in insurance costs (such as from the Kaikoura earthquake), we have not factored this into the forecast. We will rely on our negotiating ability to keep costs such as audit fees flat.

– **External reviews**: Marsh, as an independent broker, has provided an insurance forecast based on its experience in dealing with the competitive insurance market.

– **Benchmarking**: we use a range of techniques to benchmark our costs, including insurance benchmarking and Strategic Pay reports for director fees.

– **Efficiency targets**: we have included efficiency targets in FY22 and FY23 reflecting our expectation that we will make process improvements over the period.

17 OUR PROPOSED CPP QUALITY PATH

Although fault rates on the network have doubled during the last 10 years, our SAIDI and SAIFI, which are lagging indicators of network performance, have not deteriorated at the same rate. This is largely the result of effective application of network automation, and expanding the number of distribution feeders – which both help to reduce the average number of customers affected by an outage.

However, we are now at a stage where the scope for economically extending these mitigating measures is starting to diminish.

Our customers advise us that they do not expect improved reliability where this comes at a cost (other than in poor performing pockets of the network). However, they would not accept deteriorating performance.

Our proposed CPP investments reflect this, by seeking to arrest deteriorating asset performance and stabilise network SAIDI and SAIFI at present levels.[102]

Due to the increase in construction and maintenance work during the CPP Period, with associated shutdown requirements, we will not be able to operate within our current reliability limits. We are therefore proposing a new quality path.

Our proposed quality path is largely based on the existing DPP approach and retains SAIDI and SAIFI as its basis. Existing incentive and compliance approaches will remain in place, with the following changes, which will be simple to implement and monitor.

- SAIDI and SAIFI target, cap and collar calculations will align with the CPP Period and be based on our performance over the ten-year period: 1 April 2008 to 31 March 2017.
- The boundary value for identifying major event days will be calculated based on our reliability figures over the same ten-year period: 1 April 2008 to 31 March 2017.
- Planned SAIDI and SAIFI will be given a 0% weighting when calculating our target, collar and cap.
- Our planned SAIDI and SAIFI performance will be given a 0% weighting when assessing our compliance and determining incentive outcomes.

We have proposed a zero-weighting for planned outages to remove any potential incentive for reducing planned work. If this incentive remains, it may perversely compromise the delivery of the CPP programme, should we have to reduce shutdowns in order to avoid exceeding regulatory quality caps, or to pursue a revenue bonus.

At the same time, the proposed approach will retain the existing incentives and sanctions to ensure that underlying (unplanned) network performance does not deteriorate.

17.1 Background

A key objective of our CPP is to arrest deteriorating asset performance. This will, among other things, ensure that network reliability does not deteriorate from current levels. It will be achieved through substantial additional volumes of construction and maintenance work.

This additional work, in particular the large increase in proposed overhead line renewals and corrective maintenance, will inevitably require increased shutdowns to allow work to proceed safely and efficiently. The resulting increase in planned outages during the CPP Period would cause us to consistently exceed the current DPP regulatory SAIDI and SAIFI limits. We are therefore applying for a customised quality path for the period that would facilitate the uplift in work, particularly in relation to planned outages.

We are already experiencing increasing pressure on network reliability from unplanned outages, mainly because of deteriorating performance associated with ageing assets. However, we will continue to

[102] The investments are also intended to avoid the increasing safety issues associated with deteriorating assets.

manage this over the CPP Period and are not proposing any dispensation around this. We anticipate that underlying asset performance trends will have largely stabilised by the end of the CPP Period.

17.1.1 What our customers tell us about their performance expectations

We have been talking to our customers over recent years about their experience of the service we provide, their suggestions for improvement, or new services required, and their appetite for trading off price and quality of supply.

For the CPP, we specifically undertook an intensive customer consultation process, as described in Chapter 5. The detailed findings from this consultation are discussed in that chapter, but at a high level the main quality-related messages are:

- our customers place high value on a safe, secure and reliable electricity supply. In general we meet their expectations in delivering this
- ‘quality’ in the mind of consumers encompasses a bundle of attributes, and is broader than the regulated reliability measures. The price quality trade-off is assessed at an overall level – having regard to overall price and quality, is the package fair and competitive? Consumers tend to not ‘price’ individual attributes of quality separately
- there is little appetite for enhancing quality if this comes at additional cost
- conversely, customers expect the reliability of their supplies to remain at least at historical levels – i.e. to not deteriorate
- network resilience is important and customers would like to see us reduce the impact of storms on their supply.
- providing sufficient capacity and security of supply to towns and cities is important, particularly in light of how this supports economic growth in a region (or the absence thereof would inhibit this)
- good customer communication is very important. Especially during outages it is essential that information about the issue and progress on restoration is readily available
- while meeting all of the above may imply improved service levels, customers do not expect to pay more for this in the longer term. There is relatively good understanding and acceptance however of the need to increase short-term expenditure to avoid deteriorating service levels.

Meeting these customer expectations forms a core part of our CPP plan. In particular, the requirement to avoid service level deterioration is integral to the proposal, while ensuring that our proposed investments will not lead to materially improved quality levels, for which customers have to pay extra. We do however note that in working to stabilise the current deteriorating trends, there may be areas where service levels may improve.[103] This is a positive, but unintended secondary outcome.

17.1.2 DPP quality path

DPP quality regulation focuses on two reliability indices, SAIDI and SAIFI. While it is recognised that other measures are important, notably around customer service and ensuring acceptable reliability in the worst served areas of the network, performance against these latter measures is not currently regulated.

Under the DPP, planned and unplanned outages are jointly considered to set annual SAIFI and SAIDI targets. An EDB’s reliability performance is measured on an annual basis and compared to its targets. The targets are based on average historical performance for the ten-year period prior to a regulatory reset and quality targets are set for the full five-year regulatory period.[104] In setting the target, and measuring

[103] Some exceptions exist, particularly in the worst-served parts of our network. Here we will deliberately target improved service levels.

[104] Allowance is made for normalising the SAIDI and SAIFI impact of major event days in the measurement period, prior to determining the average performance level.

performance, planned outages are weighted at 50% of the actual annual values while unplanned outages are weighted at 100%.

There is a compliance requirement, where exceeding the cap on any measure is a regulatory breach unless a cap has not been exceeded in both of the preceding two years.

There is also an incentive scheme in place, under which EDBs can earn a revenue bonus if the network performs better than target, or a penalty if worse - up to a cap and collar for both SAIDI and SAIFI.[105]

Box 17.1: What are SAIDI and SAIFI?

A SAIDI of 120 minutes means that on average customers on the network did not have supply for 120 minutes during the year.

A SAIFI of 2 means that on average customers on the network experienced two outages during the year.

The measures do not include outages arising from faults on the low voltage network, and do not include outages shorter than one minute.

In measuring performance against the regulatory target, the reliability impact of major event days is normalised. Major event days are those where the impact of unplanned outages on any day exceed a boundary level pre-determined by the Commission. Normalising means that the measured SAIDI or SAIFI performance for that day is reduced to the boundary value.

An alternative way of looking at this is that 1 SAIDI minute on our network is the equivalent of New Plymouth being off supply for about 15 minutes.

17.1.3 Our current quality path

Our current quality path was established as part of the 2015-2020 DPP. The parameters that apply to us are set out in Table 17.1.

Table 17.1: Our current quality path parameters

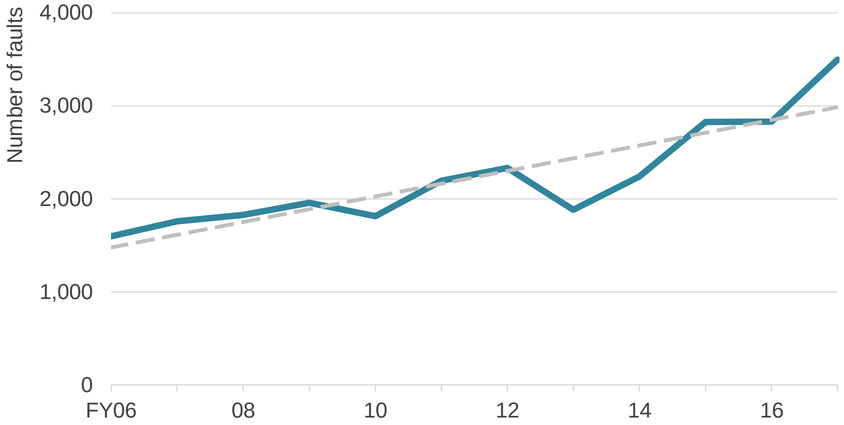
PARAMETER	SAIDI	SAIFI
Cap / limit	210.6	2.52
Target	188.9	2.34
Collar	167.1	2.16
Unplanned boundary value	11.2	0.06

17.1.4 Our recent network performance

The last 10 years' network performance has seen worsening underlying asset performance, with increasing faults and defect numbers, and worsening asset health indices (see Chapter 11 for a discussion on asset health). The fault trend on the network is illustrated in Figure 17.1.

105 The cap and collar are based on historical network reliability performance, and are set at one standard deviation above or below the "target".

Figure 17.1: Unplanned network outages lasting more than 1 minute



Note that this trend is not the same as the SAIFI or SAIDI trends – it does not reflect the number of customers affected by a fault, or fault duration. There is a correlation between faults and network reliability, and all else being equal, over time increasing faults rates translate to deteriorating reliability.

To prevent the underlying asset performance trends leading to a similar deterioration in overall network reliability (as measured by SAIDI and SAIFI) we have implemented several mitigating measures in recent years. Chief among these were:

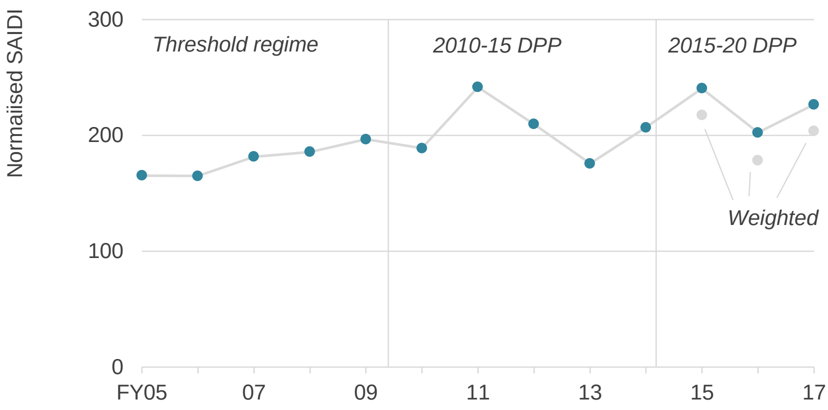
- **Increased network automation:** by rolling out automated reclosers and sectionalisers on a large number of overhead feeders. This improves overall reliability by facilitating automatic fault restoration within a short period for a large proportion of faults, or where faults cannot be fully cleared, to reduce the extent of outages. Under regulatory rules SAIDI and SAIFI are only measured for outages longer than 1 minute, so shorter outages do not count in the indices.
- **Installation of more distribution feeders**: by installing more distribution feeders, the average number of consumers per feeder in certain areas can be reduced. That in turn means that the average impact of a feeder outage is reduced.
- **Installing tie lines between feeders**: this allows supply to be restored from an alternative direction, should an upstream interruption occur. It allows more scope for automatic fault restoration, or in the event of longer duration faults, allows crews to minimise the number of customers affected during the repair period.
- **Increased maintenance**: increased focus on maintenance and vegetation management on the parts of our network with higher customer density – where outages would have the highest impact on customers and the network reliability measures.

As a result of these measures, overall network reliability has not deteriorated to the extent anticipated when looking at actual fault numbers and asset condition trends.

17.1.5 Performance against the DPP quality path

Despite the measures described above there has still been a gradually worsening SAIDI trend, and we are experiencing increasing pressure to maintain network performance within regulatory limits. SAIDI and SAIFI trends are illustrated in Figures 17.2 and 17.3 respectively.

Figure 17.2: Historical SAIDI performance[106]



In assessing historical SAIDI performance, the following is noted:

- the SAIDI figures above include planned and unplanned outages. However, for Information Disclosure purposes, since FY15 the impact of planned outages is only weighted at 50%. To allow comparison across the whole period, the trend above is for planned outages at a 100% weighting. The Information Disclosure figures are shown as light grey markers
- the SAIDI figures above are normalised by removing the impact of major event days, as per the Commission rules. This improves visibility of the underlying network performance trends
- overall, SAIDI has deteriorated over the last ten years[107], albeit at a slower rate than network faults (Figure 17.1). The reason for SAIDI not following the network fault trend is mainly the effective application of network automation, and expanding the number of distribution feeders, particularly over the last six to seven years. These programmes both helped to reduce the average number of customers affected by an outage
- we intend to carry on with our automation program, but in the medium to long term we expect the efficiency of these programmes to diminish as the network becomes saturated with automation devices and no low cost improvement options remain. In the longer term, automation cannot continue to mask the impact of increasing numbers of network faults. We therefore anticipate SAIDI performance to continue to decline, unless the underlying network issues are addressed
- in years with high unplanned SAIDI figures, we curtail planned outages in an effort to avoid exceeding the cap. This normally happens towards the end of the financial year, when the actual reliability outturn for that year is becoming clearer. This has happened more frequently in recent years. While it does help avoid regulatory breaches, ultimately this practice is counterproductive and not in customers' long-term interest, as reduced maintenance and renewal works then contribute to more pressure on unplanned outages, leaving even less opportunity for planned work and leading to further deterioration of the asset base.

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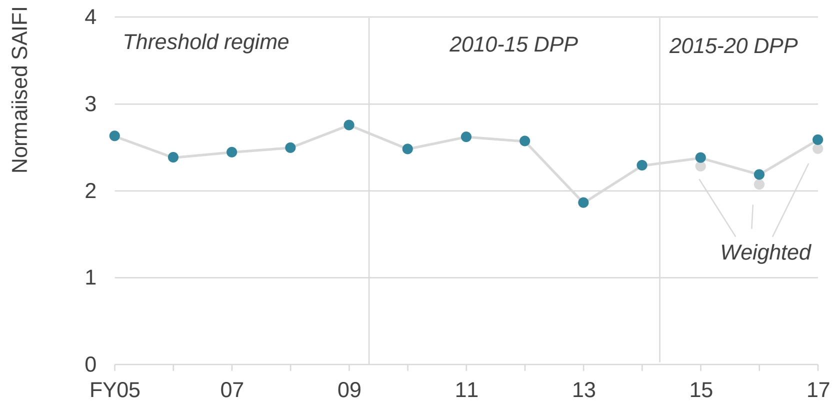
106 The way in which reliability targets were set changed in FY10 and again in FY15. It is therefore not possible to compare targets directly over the period.

107 This is even more marked if FY05 is used as the starting reference.

Figure 17.3: Historical SAIFI performance



Our conclusions from the SAIFI trend are set out below.

- the same normalisation and weighting of planned outages that were noted above for SAIDI applies to the SAIFI figures
- the success of our automation programme and adding additional distribution feeders to avoid deteriorating SAIFI is evident. We have seen an overall decline in the average number of customers affected by faults and as a result, average SAIFI has improved in recent years, in spite of the rising number of faults on the network
- as noted before, we intend to carry on with our automation program, which will continue to deliver benefits in the short term. In the medium to long term our ability to continue mitigating the impact of increasing fault numbers will diminish and we expect these to be reflected in deteriorating SAIFI unless arrested though increased renewals and maintenance. While it is premature to reach firm conclusions, given the small sample size, the SAIFI performance of the network over the last five years already suggests such a trend.

Given that the SAIDI has increased over the same period that SAIFI has reduced, it means that the average time to restore power after an outage is increasing. There are many potential reasons for this, and we will be undertaking further analysis to inform whether these need to be responded to. Potential contributors include:

- the increased difficulty of fixing assets that are in a worse general state than in the past
- decreasing resilience of the network as asset health deteriorates, meaning that events that in the past would have had limited impact on assets now have a more substantial impact (e.g. more asset failing due to an event, or higher degree of asset damage), particularly from extreme weather events
- response times may be increasing as a result of traffic congestion, more onerous set up and switching requirements associated with more stringent safety requirements than in the past, or increased need for traffic management
- as a result of increased line sectionalising, on average the sections of feeders further away from zone substations would be more likely to experience outages than sections closer to the substation. These far end sections also tend to be the most remote and difficult to access.

17.1.6 Other service performance measures

Below we discuss other service performance measures that we use to track our performance.

Established service performance measures

Besides SAIDI and SAIFI, we measure our performance against a set of service performance measures that reflect the broader experience of our customers and other stakeholders. We know that they value a wider range of service attributes than merely reliability, including safety, environmental responsibility, legislative compliance, customer engagement, fault response and power quality.

Our AMP sets out the range of performance objectives and targets that we measure ourselves against, with many of these relating directly to the service performance measures that our customers have indicated they value.

The service measures can be broadly categorised into network performance, management performance, and customer engagement performance. The associated measures are published in the AMP and, where noted, published in Information Disclosure. The measures we use are shown in Table 17.2.

Table 17.2: Service performance measures

SERVICE ASPECT	MEASURE
Technical Performance Reliability Fault response Fault restoration Power quality	– SAIDI (ID) – SAIFI (ID) – Interruptions per asset class (ID) – Voltage stability (measured based on reported instances were regulatory limits are exceeded) – Harmonic voltage (measured based on reported instances were regulatory limits are exceeded) – Feeder FIDI (feeder interruption duration index) compliance
Management Safety Legislative compliance Environmental responsibility	– Lost Time Injury Frequency Rate (LTIFR) – Environmental programme delivery – SF_6 leakage rate
Customer Engagement Satisfaction Future network capability	– Complaint resolution – Reliability satisfaction surveys – Complaints responded to within 24 hours

While we propose only SAIDI and SAIFI as the regulated quality standards for the CPP Period, we acknowledge that our customers want to see the results of the investment programme, to receive assurance that they are getting value from the additional expenditure. We therefore propose to increase transparency in reporting on our annual performance against the range of measures noted above.

17.2 Our reliability modelling

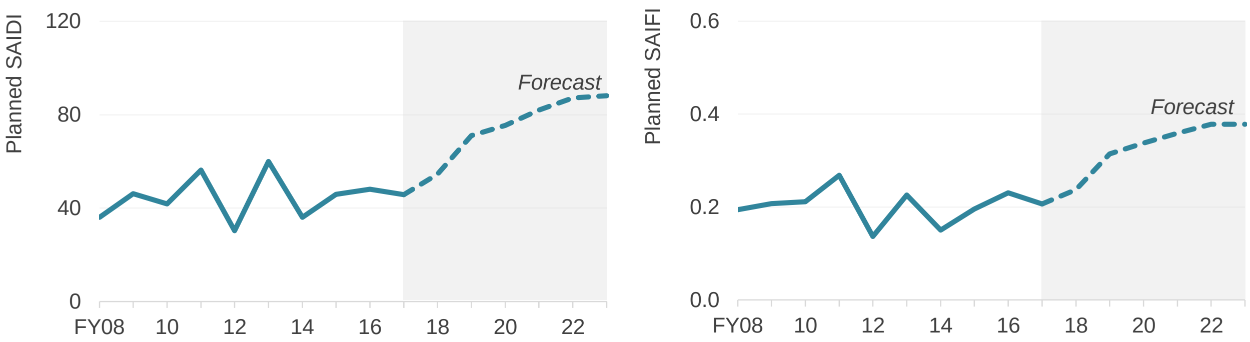
We have developed models to forecast planned and unplanned network SAIDI and SAIFI over the CPP Period and beyond. However, the use of such models should be caveated:

- models to forecast unplanned SAIDI and SAIFI performance are complex, and rely on a large number of assumptions and figures that often vary widely between years. Analysing the impact of external factors on component performance, and in turn on overall network reliability, is not straightforward, and is further complicated by the lack of comprehensive, accurate data
- planned SAIDI and SAIFI modelling is less subject to variance and actual works can be better predicted. These models are therefore more straightforward and accurate, although still subject to a degree of uncertainty
- as a result, the modelling outputs – especially for unplanned reliability - should be used for indicative, directional purposes only. We are not able to accurately forecast SAIDI and SAIFI in any particular year.

17.2.1 Forecast planned SAIDI and SAIFI

The additional construction and maintenance work proposed under the CPP will require substantially more planned outages. Our modelling of what this will mean for planned SAIDI and SAIFI over the CPP Period is indicated in Figure 17.4 below.

Figure 17.4: Forecast planned SAIDI and SAIFI



The increases in forecast planned SAIDI and SAIFI are a direct result of the planned increases in construction, maintenance and vegetation management activities. While this work will, in the longer term, stabilise network reliability (or improve reliability in comparison with the DPP counterfactual), in the short term more planned outages are inevitable, reflecting the shutdowns required for working safely on the network.

Our forecasting model considers the historical impact of maintenance and construction activities on planned reliability. We derive the forecast by using these historical relationships combined with our proposed construction and maintenance work volumes for the CPP Period. Note that post-CPP, planned SAIDI and SAFI are anticipated to improve over the CPP level, though the new equilibrium will reflect the higher work volumes (relative to current day) that will be required on an ongoing basis.[108]

Since the model is based on current work practices, it reflects our existing approach to minimising planned outages – an outcome for which we are strongly incentivised. This is achieved through efficient planning and works execution, and also through judicious application of live-line work and generators. We will continue to manage the frequency and impact of planned outages during the CPP, with a view to keeping this at the lowest practicable level.

Live-line work

The model forecasts the proportion of work that will be carried out live, with no interruption to customers. The actual amount of work that will be carried out on live lines in the future is uncertain at this time, and material changes to this could have a significant impact on planned SAIDI/SAIFI. The Health and Safety at Work Act, and its requirement to minimise risk so far as reasonably practicable, has led to some EDBs largely ruling out live-line work, but it is not yet clear whether this is indeed a general or reasonable response. Live-line work could potentially be ruled out through legislation, but this is still under review.

We are continuing to undertake live-line work, but have commenced a detailed risk/safety review with our service providers. We also participate in industry bodies, such as the Electricity Networks Association, that are looking into the matter.

Our modelling assumes the proportion of work that will be carried out live will reduce by 20% during the CPP Period. This assumption may need to be changed in future to reflect policy decisions.

108 All things being equal, after the CPP planned outages will still be at a higher level than currently experienced. This reflects the ongoing need for maintenance and construction work at higher levels than pre-CPP, ensuring that future network condition will remain stable and that the impact of ageing assets is effectively mitigated.

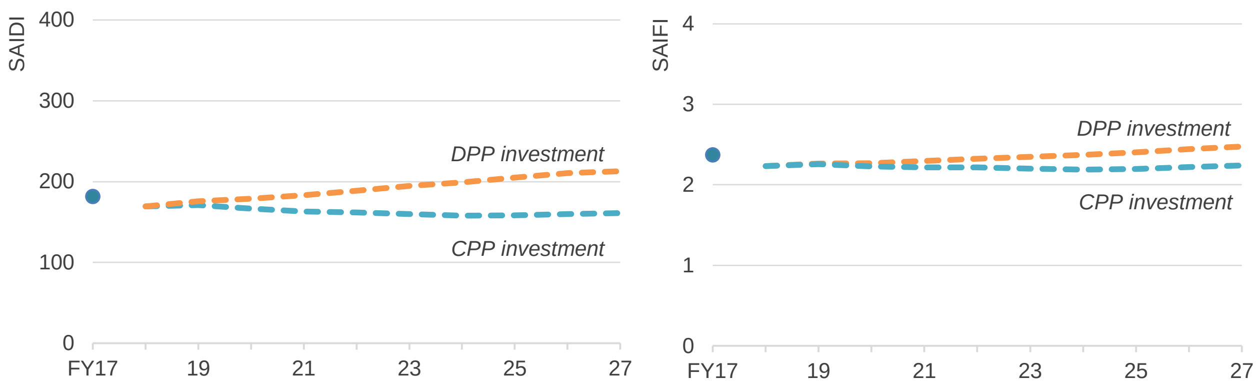
Communication with customers

Given the proposed increase in planned outages during the CPP Period, it is essential that we improve our customer communications to effectively ensure advance notification. We also intend to enhance our ability to communicate with customers during outages, and provide up to date information about progress and expected restoration times. For this, we propose to bring fault calls in-house (see Chapter 15), as well as establish real-time communications using a range of media channels.

17.2.2 Forecast unplanned SAIDI and SAIFI

The outputs of our modelling for unplanned SAIFI and SAIFI are illustrated in Figure 17.5. This shows reliability under both current (DPP) expenditure and proposed CPP expenditure levels. As noted before, modelling unplanned SAIDI and SAIFI is intrinsically complex and subject to multiple assumptions. It also cannot accurately forecast the quality outcomes in a specific year.

Figure 17.5: Unplanned SAIDI and SAIFI — forecast scenarios



In interpreting these charts, we note:

- although the forecasts are shown as (relatively) straight lines, this reflects an anticipated trend rather than the actual outturn. There is a significant range of uncertainty around the forecasts, and future values are likely to reflect the same variability as historical performance. The important takeaway from the chart is the comparative trends, rather than the actual forecast values
- the starting position for the FY18 forecasts is based on average historical network fault rates. This could appear somewhat inconsistent with the actual FY17 (current) performance
- should we continue on the DPP, we anticipate that the current deteriorating asset performance and network fault trends will persist.[109] As our ability to mitigate this is diminishing (as discussed earlier in this chapter) the increased faults will translate into increasing SAIDI and SAIFI
- conversely, with the proposed CPP investment which targets stabilising asset performance trends, the pressure on network reliability will be reduced. Under these conditions we believe SAIDI and SAIFI will stabilise and potentially even improve slightly by the end of the CPP Period.[110]

Based on the above, our modelling does not suggest that if the CPP proceeds as planned, that there should be any significant shift in underlying unplanned SAIDI and SAIFI in the foreseeable future

109 There are signs that this trend is actually accelerating.

110 While we are not targeting an improvement in SAIDI, a minor improvement is a potential by-product of the proposed CPP investments, as shown. Given the uncertainty associated with this type of model however, the suggested improvement is well within the margin of error of the output variability.

17.3 Factors considered in developing our proposed quality path

This section describes the factors we considered in developing the proposed quality standards to apply during the CPP Period.

17.3.1 Selection of quality measures

The Commission's 2014 quality standards, targets, and incentives paper provide a strong case for SAIDI and SAIFI being appropriate quality standards in a price-quality regime.[111]

> *"2.2 The quality standards focus solely on reliability. This is because reliability is generally considered to be the most important aspect of quality by consumers. For example, the ENA Working Group on quality of service summarised customer surveys, undertaken by distributors, and found the frequency and duration of power cuts to be the most important aspect of quality for consumers. The sole consideration of reliability for the compliance assessment is generally supported by submitters.*
>
> *2.3 We use SAIDI and SAIFI as the measures of reliability for the purposes of the quality standards. SAIDI and SAIFI are internationally recognised and the most common method of measuring reliability. There is also a significant amount of historic SAIDI and SAIFI data available and SAIDI and SAIFI would continue to be measured in the future even if it were not required for the quality standards. A higher SAIDI or SAIFI represent poorer reliability performance.*
>
> *2.6 The use of a quality standard that aggregates all consumers for each distributor is a simple, cost effective, and transparent method of applying quality standards. However, distributors should still address, where practicable, the preferences of individuals, groups, or classes of consumers."*

We support the Commission's view and also believe that retaining SAIDI/SAIFI as the quality standards during our CPP is appropriate because:

- the measures are consistent over time and can be compared to our previous DPP (and future control periods), and can be compared to other EDBs. We have a long time-series of accurate, audited performance data which allows this.
- SAIDI/SAIFI provide composite measures of the range of actions/investments taken by the EDB.

We considered including more service measures, from the list discussed in Section 17.1.6. However, we decided against this, on the following grounds:

- we do not have a long, audited time-series of performance information for any of the additional measures. These are therefore not an appropriate basis for setting performance targets that could have material revenue or regulatory sanction implications
- also resulting from the limited historical performance data, we cannot accurately model the impact of the additional planned work during the CPP Period (where material) on the alternative performance measures. Developing forecast quality paths for other measures is therefore problematic, as historical performance levels cannot be simply extrapolated
- no other EDBs are measured and regulated against other service measures – there is therefore no accurate objective means of assessing whether our performance against these is reasonable
- following the CPP, we may revert back to a DPP environment, where only SAIDI and SAIFI are used as reliability measures. The effort in developing information and auditing standards for measures that will only be used temporarily is not justified.

We therefore decided to retain SAIDI and SAIFI as the only measures of service quality for the CPP Period. We however recognise the validity and importance of alternative measures and, should the

[111] Commerce Commission, "Default price-quality paths for electricity distributors from 1 April 2015 to 31 March 2020; Quality standards, targets and incentives", 28 November 2014

Commission in future decide to expand the list of quality measures for the DPP, we will contribute positively to the process.

17.3.2 Quality path objectives under the CPP

In determining what the SAIDI and SAIFI quality path should look like for our CPP application, we considered the following objectives.

- **Consistency with historical measures:** the way SAIDI and SAIFI are calculated over the CPP should be entirely consistent with the DPP methodology.
- **Simplicity of application:** the proposed quality path should be simple to apply; preferably not involve any additional calculations or data over what would already be used under the DPP.
- **Sufficient allowance for additional CPP work:** the proposed quality path should make sufficient allowance for the required additional construction and maintenance work without running the risk of exceeding quality limits.
- **Maintain incentives to avoid quality deterioration:** regulatory incentives aimed at ensuring that the underlying reliability of service to customers does not deteriorate from historical levels should remain in place during (and after) the CPP – while recognising that over the CPP Period there is a need for more planned outages.
- **Avoid incentives to limit planned outages to avoid penalty:** there should be no incentive or need to restrict planned work to avoid SAIDI/SAIFI revenue penalties or to avoid exceeding the regulatory limit. These would inhibit our ability to deliver the CPP programme and be detrimental to its success.
- **Avoiding incentives to limit planned outages to gain financially:** there should be no opportunity to gain financially by reducing planned outages to less than the proposed quality path. That would effectively mean that customers would have to fund not only the additional CPP work, but also reward us for carrying out less work.
- **Supporting flexibility in the delivery programme:** while a CPP works programme is proposed in the application, it may be beneficial to adapt the programme within the period. This can be to reflect the impact of years with a high (or low) incidence of severe weather events[112], or to allow our field service providers to better optimise their workforce. The quality path should support such flexibility, which will improve the CPP outcomes and could lead to longer-term efficiency gains, benefiting customers.
- **Avoiding uncertainty about future forecasts:** models to forecast SAIDI and SAIFI performance are often inaccurate. They rely on a large number of input assumptions – some of which cannot be fully supported by accurate data. Furthermore, the annual variance in reliability performance, and the factors underpinning this, is significant. The use of such models to set annual targets should be avoided as much as possible (unless significant allowance is made for margins of error, which would introduce further complexity). Target setting is further complicated by the potential for new factors to arise that makes accurate forecasting impossible. For example, views on the treatment of live-line work are still emerging and the industry position is yet to be finalised. This could have substantial future implications on planned, and to a lesser extent unplanned, outages.

17.3.3 Incentive regime for the CPP Period

The current incentive regime rewards or penalises us depending on our network performance against the SAIDI and SAIFI quality measures. Achieving higher reliability than the target results in a positive revenue adjustment (reward) up to an incentive limit. A reliability measure achieving or falling below the collar earns an incentive of 1% of the MAR specified in the determination. The mechanism is symmetrical, with

[112] Construction and maintenance work is compromised by severe weather events.

an equivalent penalty applied if the SAIDI or SAIFI target is exceeded, up to the cap level (where 1% of revenue is at risk).

The cap and collar values are the target plus and minus one standard deviation of the previous 10-years total SAIDI/SAIFI.

This incentive is appropriate under stable network operating conditions. However, it was not designed with the substantial temporary uplift in work volume in mind that is associated with a CPP programme such as ours.

Reflecting the objectives noted in Section 17.3.2 above, we propose that the incentive regime during the CPP Period should only apply to **unplanned** outages, because:

- the incentive on **unplanned** outages should remain in place as this will help ensure that underlying reliability does not deteriorate
- the incentive on **planned** outages should be removed as this may introduce perverse incentives that may undermine the efficient delivery of the CPP programme or lead to unwarranted additional cost to customers.

We considered the application of forecast-based quality-paths for planned SAIDI and SAIFI as a basis for continuing the incentive regime over the CPP Period. However, the benefit this would have (protecting customers from excessive planned outages) is less material than the potential downside associated with not being able to deliver the CPP programme fully, or to do so at less than optimal efficiency. The latter would result if work had to be scaled back in any particular year to avoid penalties.

In addition, the uncertainty associated with forecasting exact SAIDI and SAIFI values would mean that to use this for target setting with enough leeway for the CPP programme to remain deliverable, will realistically require a substantial additional uncertainty allowance, to avoid unnecessary breaches. This will largely negate the goal of having such a quality path in the first place.

17.3.4 Compliance regime for the CPP

Compliance with the DPP is achieved in each year of that DPP if that year's SAIDI and SAIFI are lower than the respective regulatory limits. A breach occurs if this position is not achieved for the second time in a rolling three year period. The regulatory limits are set, and performance measured based on the sum of the unplanned and planned SAIDI and SAIFI, with a 50% weighting applied to planned values.

This compliance regime is appropriate under stable network operating conditions. However, it was not designed with the substantial temporary uplift in work volume in mind that is associated with a CPP programme such as ours.

Reflecting the objectives noted in Section 17.3.2 above, we therefore propose that the compliance regime during the CPP Period should only apply to **unplanned** outages, because:

- the reliability limits and compliance sanction on **unplanned** outages should remain in place to help ensure that underlying reliability does not deteriorate
- **planned** outages should be removed from compliance as the current historical-based approach would prevent the efficient delivery the CPP programme.

The same arguments against using tailored planned quality paths as described above also apply here.

It is therefore proposed that during the CPP Period the compliance regime should only apply to SAIDI and SAIFI arising from unplanned outages.

17.4 Overview of our proposed quality path variation

Based on the considerations above, we propose the following quality path for the CPP Period.

The existing DPP quality path and the methodology applied to derive this will remain in place for the CPP Period, with the changes noted in Table 17.3.

Table 17.3: Proposed quality path elements

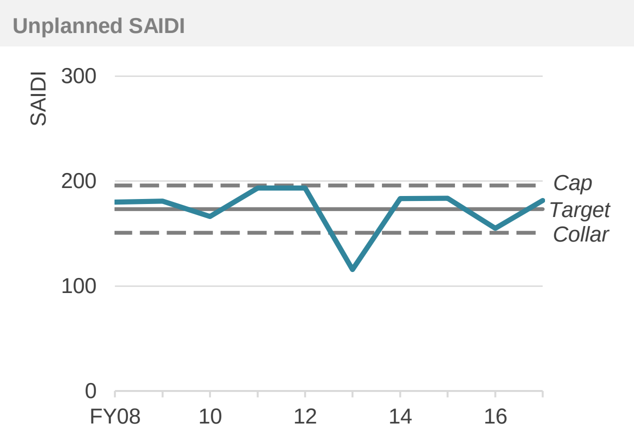
ELEMENT	PROPOSED CHANGE
Historical period used for calculating the SAIDI and SAIFI targets, caps and collars	Updated time period to reflect timing of application: 1 April 2008 to 31 March 2017
Historical period used for calculating the boundary value to identify Major Event Days	Updated time period to reflect timing of application: 1 April 2008 to 31 March 2017
Calculation of the incentive targets, caps and collars for SAIDI and SAIFI	Planned SAIDI and SAIFI will carry a weighting of 0% in the calculations
Calculation of the compliance limit	Planned SAIDI and SAIFI will carry a weighting of 0% in the calculations
Annual measurement of SAIDI and SAIFI performance for quality path assessment	Planned SAIDI and SAIFI will carry a weighting of 0% in the measurements

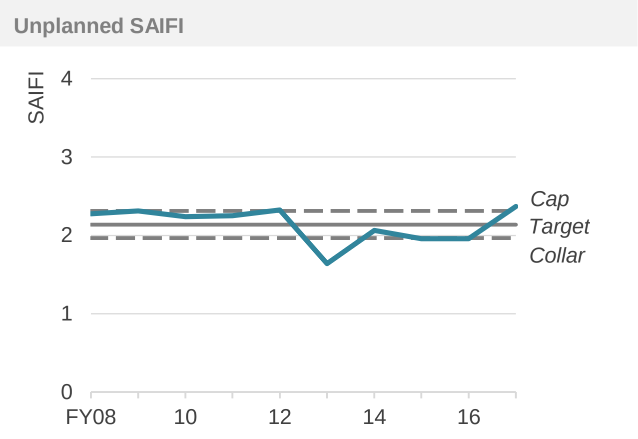
Based on the above, our proposed CPP Period quality-path parameters are set out in Table 17.4 and illustrated in Figure 17.6.

Table 17.4: Our proposed quality path parameters

PARAMETER	SAIDI	SAIFI
Cap / limit	195.9	2.31
Target	173.3	2.14
Collar	150.6	1.97
Unplanned boundary value	11.7	0.064

Figure 17.6: Proposed quality path





The above charts show:

- historical SAIDI and SAIFI based on normalised, unplanned outages only
- the proposed SAIDI and SAIFI targets superimposed on our historical performance
- the proposed cap and collars.

The proposed CPP SAIDI target is essentially marginally higher than the historical target level, while the SAIFI target will be lower than the historical value. This reflects the improvement seen in network SAIFI over the last ten years.

17.5 Why our proposed quality path is appropriate

An unavoidable consequence of increasing our work programme is that the number of planned outages will increase. This is because we need to de-energise parts of the network in order to gain safe access to our assets to undertake the necessary investment.

Customers have told us that outages that are notified in advance, are efficiently executed, and kept to a minimum are preferable to unplanned supply interruptions, such as those caused by storm damage.

Box 17.2: Quality path justification

We are confident that our approach to the quality path for the CPP Period will deliver a prudent and efficient outcome because:

- by excluding planned outages, it will allow the flexibility required to efficiently deliver the proposed CPP work programme (and avoid perverse incentives to defer planned work)
- while a short-term increase in planned outages is inevitable as a result of the additional network activities required, the longer-term incentive (and sanction) to ensure that underlying network reliability does not deteriorate, is maintained
- the changes proposed from the existing DPP quality path are minimal, and straightforward to apply. The required calculations conform with those currently applied
- no perverse incentive will be introduced that would put pressure on or reward not delivering the proposed CPP work programme
- by publicly reporting annual performance against an extended range of service measures, stakeholders will gain visibility of our broader performance and can use this information as a basis for further engagement as required.

To ensure the long-term stable performance of our network, it has become imperative that we materially lift maintenance and construction work on the network, which will lead to increased planned outages.

Avoiding further deterioration of the network is the basis of the CPP proposal and the associated quality path. In the longer term it will greatly enhance customers' experience compared with a counterfactual of an accelerating number of unplanned outages.

Revenue requirement and price implications

This section sets out the revenue required to fund our proposed investments and the potential implications for customer prices.

CONTENTS

18 REVENUE REQUIREMENT AND PRICE IMPLICATIONS

We have taken our proposed expenditure, outlined in Chapters 11 to 16, and used an independently audited financial model compliant with the IMs to calculate a revenue requirement over the CPP Period.

- our proposed expenditure results in a 5.7% increase in our revenue requirement
- the revenue requirement calculation is based on the building blocks approach, which provides revenue allowances for a return on our investment, return of our investment, operating expenditure, tax, and other allowances
- consistent with the regulatory requirements we have smoothed our revenue over the CPP Period to remove fluctuations between years. The revenue smoothing we have applied assumes CPI increases during the regulatory period and a 5.7% one-off revenue increase (P_0) at the beginning of the period
- we estimate that as a result of our CPP an illustrative household's total electricity bill will increase by 1.6%.[113]

This chapter outlines how we have determined our revenue requirement from our proposed operational and capital expenditure.

The revenue requirement is derived from the building blocks calculation and after applying revenue smoothing assumptions consistent with the applicable regulatory requirements.

This chapter:

- outlines how the revenue requirement is derived
- describes the drivers of the 5.7% increase in P_0
- summarises how the revenue requirement is derived from the building blocks approach and what revenue smoothing assumptions are applied
- illustrates the impact of the proposed revenue increase on the electricity bill of an illustrative household.

Supporting material

The Financial and Modelling Information document (FAMI), included as part of our submission, provides a detailed explanation of how the revenue requirement is derived and the assumptions used to derive it. The CPP financial model, also included as part of our submission, is the model we used to calculate the revenue requirement.

18.1 How is our revenue requirement derived

Our revenue requirement is determined consistent with the IMs. The IMs require us to:

- determine our proposed operational and capital expenditure
- calculate our revenue requirement in accordance with the prescribed building blocks approach
- apply revenue smoothing assumptions.

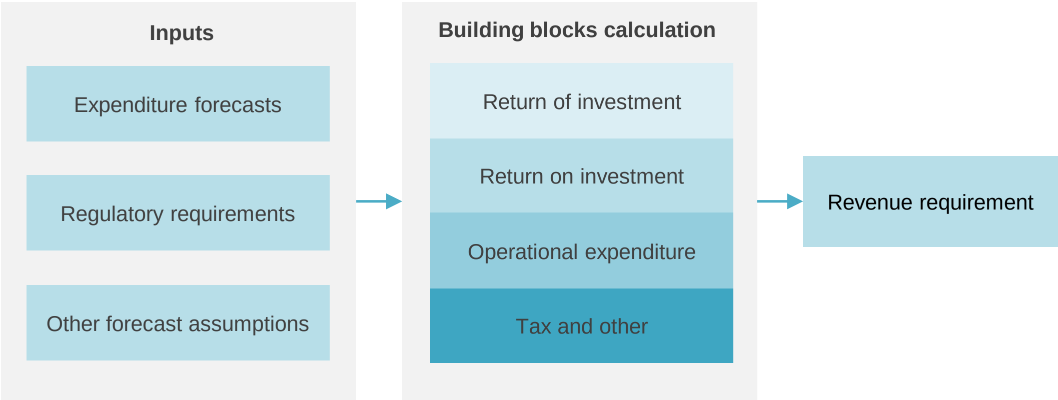
The building blocks calculate our required revenue for the regulatory period by providing us with allowances for the expenditure we incur in running our regulated business and to allow us to earn a return on and of our investment.

[113] Any actual increase will depend on how retailers choose to pass on the increased cost.

Figure 18.1 illustrates the approach used to derive our CPP revenue requirement, including:

- the inputs into our revenue requirement calculation
- the building blocks approach used to derive our revenue requirement
- the resulting smoothed revenue requirement.

Figure 18.1: Approach to deriving our CPP revenue requirement



18.2 What affects our revenue requirement

Our revenue requirement is derived based on our expenditure forecasts, regulatory requirements, and other non-expenditure forecast assumptions. This section outlines how each of these input assumption groups affect our revenue requirement and provides further information on each of them.

18.2.1 Regulatory requirements

We are regulated under Part 4 of the Commerce Act 1986. The Commission promotes the long-term interest of electricity consumers by assessing our proposed expenditure and determining the amount of revenue we can recover.

The IMs set out how our revenue requirement is to be derived from our expenditure forecasts, specifying that we apply a building blocks approach. They also specify input assumptions to be applied in the revenue requirement calculation and the methodologies for determining them.

Section 18.3 provides an overview of how the revenue requirement is derived. The FAMI sets out, in detail, how our revenue requirement is calculated consistent with the regulatory requirements.

18.2.2 Expenditure forecasts

Our expenditure forecasts make up a large portion of our revenue requirement. As the cost to manage, maintain and grow our network increases so does the revenue we need to recover.

Operating expenditure has a direct impact on our revenue requirement during the regulatory period in which it is incurred. Further information on why we are forecasting an increase in Opex is outlined in Chapters 15 and 16.

Costs incurred on replacing or creating new assets (capital expenditure) is recoverable over the life of the assets. Accordingly, the Capex proposed in Chapters 11 to 14 has an effect on the required revenue during the regulatory period and also future regulatory periods.

The FAMI steps through how our revenue requirement is derived from our expenditure forecasts.

18.2.3 Other forecast assumptions

Other forecast assumptions are those applied in the revenue requirement calculation in addition to the Capex and Opex forecasts.

Where the regulatory requirements do not specify an input assumption they will, in most instances, specify how the forecast assumption is derived.

The most significant input assumption is the cost of capital, which directly impacts the return we can earn on our investment. It also has an impact on the revenue smoothing and building block allowance calculations. Section 18.3.3 outlines the cost of capital assumption applied in our revenue requirement calculation.

The majority of the input assumptions are specified in the regulatory requirements. Where inputs are not specified the FAMI outlines how they have been determined. Significant input assumptions are discussed in the building blocks calculation section below.

18.3 Building blocks allowable revenue

The expenditure needed to provide regulated services determine our revenue requirement. The regulatory requirements specify what level of revenue we can earn to recoup the cost we incur. It applies a ‘building block’ approach that includes the allowances outlined in the below table.

Table 18.1 shows the building block allowable revenue (BBAR) after applying timing and tax effect assumptions.

Table 18.1: Building blocks allowable revenue

NOMINAL $M	FY19	FY20	FY21	FY22	FY23	TOTAL PV[114]
Return on investment (funding costs)	165.7	183.0	184.1	196.7	209.5	788.5
Return of investment (depreciation)	61.7	65.8	70.7	75.5	80.1	296.6
Return of investment (revaluations)	-47.5	-51.2	-54.7	-57.9	-61.7	-228.9
Operating expenditure	94.1	99.8	102.2	101.4	101.1	420.8
Other revenue allowances	3.0	3.2	3.4	3.7	4.0	14.5
Tax adjustments	-10.6	-12.0	-11.5	-12.3	-13.2	-50.2
Revenue requirement pre-smoothing (BBAR before tax)	266.4	288.6	294.2	307.0	319.8	1,241.3

The building blocks allowances are determined before tax. Tax adjustments are included in the revenue requirement to allow for the tax effect of differences between regulatory and taxable profit.

The remainder of this section outlines the purpose of each building block allowance and discusses how they are affected by key input assumptions. They represent information prior to the application of timing assumptions. We are required to apply timing factors within the BBAR calculation to reflect the time use of money for when revenues are received or expenses are incurred throughout the year.

114 Means present value, being the current worth of a future sum of money or stream of cash flows given a specified rate of return.

18.3.1 Return on investment

The return on investment allowance provides us the ability to earn a return on our investment in the regulated business. The regulatory regime specifies that the regulatory asset base (RAB), deferred tax balance and a portion of assets commissioned in each year represent the value we have invested.

The regulatory regime allows us to earn a reasonable rate of return on our investment. The Commission specifies this as the cost of capital for each regulatory period.

Table 18.2 outlines the key components of the return on investment allowance. We then discuss in further detail the RAB investment and cost of capital assumptions.

Table 18.2: Return on investment assumptions

$M	FY19	FY20	FY21	FY22	FY23
Opening RAB	1,679.0	1,865.2	2,000.3	2,139.7	2,310.1
Deferred tax	-63.7	-70.4	-81.6	-95.5	-113.0
RIV	1,615.3	1,794.8	1,918.7	2,044.1	2,197.1
Assets commissioned	226.5	179.1	186.9	221.1	226.4
Cost of capital	7.19%	7.19%	6.78%	6.78%	6.78%

Our return on investment allowance represents 64% of our revenue requirement. It is higher than what would have been allowed under the DPP mainly due to the higher capital expenditure in the lead up to and during the CPP Period. This is partially offset by a reduction in the cost of capital assumption.

18.3.2 RAB investment

The RAB value represents the value our regulated assets, which in simplified terms is the cost of our regulated assets less any amount we have recovered in previous years through the return of investment allowance.

The RAB investment value is rolled forward each year based on strict regulatory requirements. The components of the RAB investment value are outlined in Table 18.3.

Table 18.3: RAB roll-forward

$M	FY17	18	19	20	21	22	23
Opening RAB	1,528.0	1,600.3	1,679.0	1,865.2	2,000.3	2,139.7	2,310.1
Assets commissioned	110.9	116.0	226.5	179.1	186.9	221.1	226.4
Depreciation	- 61.2	- 62.2	- 64.5	- 69.0	- 74.0	79.2	- 84.0
Revaluation	32.0	34.4	35.1	37.8	40.3	42.7	45.5
Disposals	- 9.4	- 9.5	- 11.0	- 12.9	- 13.8	- 14.3	- 14.6
Closing RAB	1,600.3	1,679.0	1,865.2	2,000.3	2,139.7	2,310.1	2,483.4

The value of our RAB investment is forecast to increase in the years that lead into and during the CPP Period. The increase in the value of our regulated assets is a result of our proposed increase in Capex as outlined in Chapters 11-14.

The forecast value of assets commissioned is derived from our capital expenditure forecasts after taking into account cost escalation, cost of finance and commissioning assumptions.

The Capex forecasts outlined in Chapters 11-14 are in real 2016 dollars. The capital expenditure used to determine the value of commissioned assets is in nominal dollars which takes into account our forecast assumptions of price increases in the resources required to deliver our capital expenditure program (cost escalation).

The value of commissioned assets also takes into account the cost of financing assets during the construction period. The cost of finance is determined in accordance with generally accepted accounting practices.

Assets are only commissioned (included in the RAB value) once they are used and useful. Accordingly, the value of assets commissioned reflects the difference between when Capex is incurred and when it enters the RAB (based on our commissioning assumptions).

The depreciation and revaluation components of the RAB roll-forward are discussed below.

18.3.3 Cost of capital

The cost of capital assumption is the return we expect to earn on our investment in our regulated services. The regulatory requirements define it as the weighted average cost of capital (WACC) and it is either specified by the Commission or how it is to derived is prescribed in the IMs.

In accordance with the regulatory requirements, the cost of capital assumption applied in our revenue requirement for the FY19 and FY20 years is the WACC used in setting revenue under the current DPP.[115] The WACC assumption for the FY21-23 years is our forecast of the WACC using the methodology prescribed in the regulatory requirements.

Section 18.3.7 outlines our reasoning for applying an alternative WACC during the FY21-23 years.

18.3.4 Return of investment - depreciation and revaluations

The return of investment allowance provides for the return of our past expenditure on regulated assets. It is more commonly referred to as depreciation.

The regulatory requirements also provide for the revaluation of assets during the period. Revaluations reflect the increase in the value of assets from which the regulated entity can earn a return on and, a return of, in future periods.

Our return of investment allowance, net of revaluations, represents 5% of our revenue requirement. It is lower than what would have been allowed under the DPP requirements due to the CPP regulatory requirements specifying more detailed depreciation assumptions. This is partially offset by the increase in the RAB value as a result of our increased capital expenditure forecast.

Depreciation

Depreciation reflects the return of our past investments in our regulated assets. It decreases the value of the RAB and increases our revenue requirement during the CPP Period.

Depreciation is derived from the value of each asset and the asset life assumptions specified in the regulatory requirements.

Revaluations

The revaluation amount is derived from the RAB value and a forecast revaluation rate.

The regulatory regime specifies the revaluation rate as the forecast rate of CPI. Revaluations increase the value of our regulated assets and therefore increase our potential to earn a return on and return of our investment in future periods. The revaluations amount also reduces our revenue requirement during the CPP Period to reflect the fact that we will be allowed to recover the revalued amount through the return of investment allowance in later periods.

In accordance with the regulatory requirements the forecast CPI is sourced from Statistics New Zealand publications. Table 18.4 outlines the revaluation rates applied.

115 Commerce Commission, Cost of capital determination for electricity distribution businesses' default price-quality paths and Transpower's individual price-quality path [2014] NZCC 28, 31 October 2014.

Table 18.4: Forecast revaluation rate

	FY17	18	19	20	21	22	23
Forecast revaluation rate (%)	2.11	2.17	2.11	2.06	2.05	2.02	2.00

18.3.5 Operational expenditure

The Opex allowance provides for the return of our forecast operating costs incurred. Opex includes the cost of operating and maintaining our assets and to administer and manage our business.

Opex is derived from the forecast expenditure as outlined in Chapters 15 and 16. The Opex allowance is based on nominal dollars which takes into account our forecast assumptions of price increases in the resources required to deliver our operating expenditure plans (cost escalation).

Our Opex allowance contributes 34% of our revenue requirement. It is higher than what would have been allowed under the DPP. The need for our operating expenditure is outlined in Chapters 15 and 16.

18.3.6 Regulatory tax adjustments and other allowances

Our revenue requirement less operating costs and total depreciation equals our regulatory profit/(loss) before tax. However, the notional tax we are assumed to pay is based on regulatory taxable income which excludes tax differences such as permanent and timing differences between regulatory and tax accounting rules. The tax adjustments building block makes an adjustment to allow for these differences.

The tax adjustments building block reduces our revenue requirement. It is equivalent to 4% of our revenue requirement. It is higher than what would have been allowed under the DPP due to the effect of our higher Capex on revaluations and notional deductable interest.

The regulatory regime also provides for a term credit spread differential allowance (TCSD). This allowance provides for the costs we will incur through having debt securities that are for longer than the 5 years assumed in the cost of capital assumption. The TCSD allowance represents 1% of our revenue requirement.

18.3.7 Revenue requirement reflects expected allowable revenues

Our revenue requirement reflects the impact of a WACC change reopener in FY21. This approach deviates from the IMs (explained below) and therefore how the Commission may choose to approve our revenue requirement. However, we believe that our approach better meets the purpose of Part 4 of the Act as we present our revenue requirement and calculate our revenue based on what we expect the average revenue requirement will be over the regulated period.

Clause 5.3.22 of the IMs notes that the Commission will apply the DPP WACC for the whole of the regulatory period when making a CPP determination. However, clause 5.6.7 also provides for the revenue allowance CPP to be reset when a WACC change occurs.

We know a WACC change will occur part way through the regulatory period due the Commission being required to determine a DPP for price regulated suppliers prior to the start of the FY21 financial year. This raises a question about what should be assumed for our CPP application where it extends beyond FY21. Our approach uses a forecast of WACC, revaluation rate and cost of debt from FY21-23, rather than the assumptions included in the current DPP WACC.

We have presented our revenue requirement and associated information in our proposal consistent with what the regulatory requirements prescribe to occur.[116] The FAMI provides more detail on our forecast WACC.

Table 18.5 outlines the affect the applied cost of capital, revaluation rate and cost of debt assumptions has on our revenue requirement relative to the current DPP assumptions.

116 As a point of reference, Appendix A of the FAMI presents all revenue requirement information consistent with the application of the DPP cost of capital for the whole regulatory period.

Table 18.5: Impact of applied cost of capital

	FY19	20	21	22	23
Applied cost of capital (%)	7.19%	7.19%	6.78%	6.78%	6.78%
Revenue requirement based on applied cost of capital ($m)	282.3	288.4	294.4	300.4	306.4
DPP cost of capital (%)	7.19%	7.19%	7.19%	7.19%	7.19%
Revenue requirement based on DPP cost of capital ($m)	288.0	294.2	300.4	306.5	312.6

The DPP WACC is higher than our applied cost of capital and therefore results in a higher revenue requirement.

The WACC that will apply to FY21–23 will be determined by the Commission when it sets the DPP for the next DPP period.

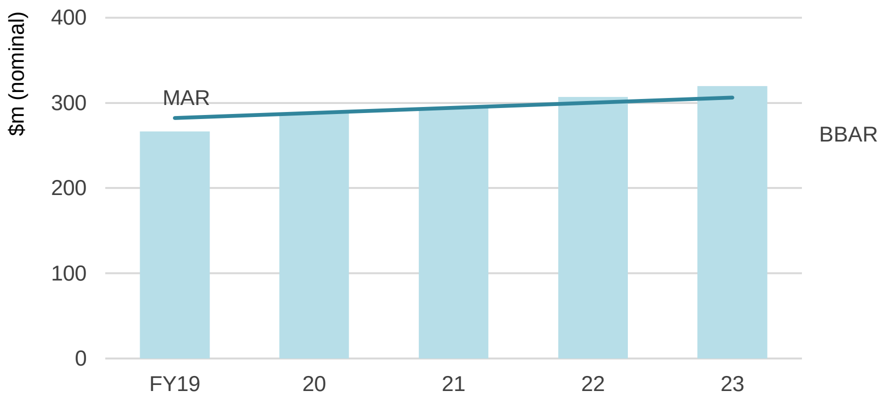
18.4 Why we smooth our revenue requirement

Our revenue requirement, or maximum allowable revenue (MAR) is our revenue requirement after applying revenue smoothing assumptions. The MAR, as defined by the IMs, is equivalent to the BBAR allowable revenues in present value terms.

Revenue smoothing removes year-on-year fluctuations in the building blocks derived revenue requirement.

Figure 18.2 outlines the revenue requirement pre-smoothing (BBAR) and after smoothing (MAR). The revenue requirement after smoothing is the same in present value terms as the revenue requirement before smoothing.

Figure 18.2: Smoothing of the revenue requirement



Revenue smoothing also allows us to assess whether revenue increases are better reflected as a one-off increase at the beginning of the regulatory period or as gradual increases during the regulatory period.

Our proposal is for the revenue requirement to reflect a one-off increase at the beginning of the regulatory period of 5.7% and CPI increases during the period. Reflecting the required uplift in revenue as a one-off increase, rather than gradual increases during the regulatory period over and above CPI, is consistent with how the Commission has previously set revenues and consistent with expectations implied in the regulatory requirements. We have also considered the expected impact on a typical customers' overall electricity bill in making our decision (see Section 18.5).

Feedback from our stakeholder engagement identified that retailers leaned towards a single initial increase on the grounds that it would facilitate better coordination and communication with end-consumers. Feedback from customers did not strongly support either option.

As an alternative, we could smooth the increase over the whole of the CPP Period, which would equate to an annual increase of about 1.9% per year, plus inflation.

We welcome any feedback from the Commission's consultation on how our revenue requirement increase could be reflected.

18.5 Illustrative price implications

The Commission will determine the amount of expenditure we are allowed to recover through revenue from electricity distribution charges. The revenue requirements will have implications for the total price consumers pay for electricity.

After the Commission determines our allowed revenue, we will update our pricing to retailers. Retailers choose how these prices are reflected in retail tariffs to consumers.[117]

As an illustration, Table 18.6 shows how a household with an electricity bill of $2,500 per year could be impacted by a 5.7% increase in our revenue. Under the assumptions made, the increased revenue requirement translates into a 1.6% increase in total electricity cost.

Table 18.6: Illustrative electricity bill impact for a typical household

	$ PER YEAR
Annual electricity bill today	2,500
Powerco portion of bill (total x 30%)	717
Increase due to CPP (Powerco portion x 5.7%)	41
Annual electricity bill after price increase	2,541

The typical household's bill in this worked example would increase by $41 per year or 1.6%. This increase corresponds to an average monthly increase of $3.42 and an average weekly increase of $0.79. As noted above, any actual increase will depend on how retailers choose to pass on the increased cost.

117 For further information refer to the Electricity Authority's website www.ea.govt.nz/consumers/my-electricity-bill/

Appendix

CONTENTS

APPENDIX A FORECAST DETAILS

$2016 REAL $	FY12	13	14	15	16	17	18	19	20	21	22	23	CPP TOTAL	CPP AVERAGE
Renewals Capex														
Overhead structures	13,785	14,460	22,457	18,774	22,872	23,275	23,345	29,668	35,577	37,702	37,800	36,855	177,602	35,520
Overhead conductors	1,294	2,174	4,015	2,604	3,230	4,090	4,327	6,809	8,431	11,310	13,821	14,877	55,248	11,050
Cables	4,906	8,275	4,117	7,661	5,371	11,455	6,699	6,639	7,441	6,832	6,367	5,730	33,010	6,602
Zone substations	3,234	3,215	5,674	5,009	6,359	7,574	11,515	14,392	14,996	15,078	14,019	13,241	71,726	14,345
Distribution transformers	7,102	5,690	7,255	8,049	9,743	6,476	6,462	8,239	8,328	8,284	8,068	8,013	40,931	8,186
Distribution switchgear	6,959	6,997	7,504	7,793	9,847	7,695	8,186	9,218	9,097	9,008	8,950	7,348	43,620	8,724
Secondary systems	1,815	780	1,648	1,767	1,538	2,935	2,982	8,698	8,651	6,214	2,462	2,256	28,280	5,656
Total renewals Capex	39,095	41,590	52,670	51,657	58,959	63,500	63,517	83,663	92,521	94,428	91,486	88,320	450,417	90,083
Growth and security Capex														
Papamoa	931	82	237	285	-	7,347	6,102	243	-	-	-	-	243	
Palmerston North	-	-	168	1,790	456	3,013	7,153	1,399	-	-	3,873	9,543	14,815	
Putaruru	193	626	480	244	446	341	338	334	5,258	8,465	8,139	-	22,196	
Whangamata	186	59	58	-	-	60	762	6,100	1,119	59	57	321	7,656	
Omokoroa	-	-	-	-	-	-	-	1,306	6,444	3,648	880	-	12,278	
Kopu-Tairua	-	-	-	-	-	-	435	3,791	3,188	1,592	-	-	8,571	
Kopu-Kauaeranga	289	144	274	136	710	-	220	2,955	297	297	1,446	1,129	6,124	
Moturoa - NPL GXP	-	-	-	-	-	-	3,534	5,232	-	-	-	-	5,232	
Kerepehi-Paeroa	-	-	-	-	-	162	161	-	-	1,592	4,289	-	5,881	
Whenuakite	-	-	-	-	-	-	190	237	238	238	1,487	4,764	6,963	
Matarangi	-	-	-	-	-	-	-	83	83	1,441	4,025	2,533	8,165	
Putararu-Tirau	-	-	-	-	-	-	-	-	2,288	4,437	-	-	6,725	
Kaimarama-Whitianga	-	-	-	-	-	-	-	165	165	1,398	2,122	2,215	6,066	
Kereone-Walton	-	-	-	-	-	-	-	-	-	1,193	3,662	1,452	6,307	
Feilding-Sanson-Bulls	-	-	-	-	-	-	-	231	-	-	2,407	3,367	6,006	
Pyes Pa	-	-	-	-	-	384	2,135	2,785	-	-	-	-	2,785	
Inglewood	-	-	-	-	-	-	-	2,287	2,889	751	-	-	5,928	
Pre CPP major projects	9,460	3,349	1,928	6,758	462	-	-	-	-	-	-	-	-	
Major projects	11,059	4,260	3,145	9,213	2,074	11,307	21,028	27,148	21,970	25,112	32,386	25,325	131,942	26,388
Minor growth & security works	14,983	24,768	26,264	22,356	23,178	24,890	26,094	29,719	27,895	27,444	21,603	25,973	132,634	26,527
Reliability	2,056	1,979	2,284	3,683	5,034	2,860	2,662	3,184	4,591	4,720	4,529	4,322	21,345	4,269
Total growth and security Capex	28,099	31,007	31,693	35,252	30,287	39,057	49,784	60,051	54,456	57,276	58,518	55,620	285,921	**57,184**

Other network Capex													
Consumer connection	5,148	5,601	5,089	9,681	13,879	14,286	12,523	10,989	10,756	10,516	9,160	9,814	51,235	10,247
Asset relocations	335	847	553	1,038	1,000	1,034	806	777	787	784	778	771	3,897	779
Network evolution	227	150	801	304	80	-	2,672	2,852	2,867	3,568	4,428	4,412	18,126	3,625
Total other network Capex	5,710	6,598	6,443	11,023	14,959	15,320	16,001	14,617	14,409	14,868	14,366	14,997	73,258	14,652
Non-network Capex														
ICT Capex	4,789	4,928	5,663	3,992	5,071	5,204	14,277	17,902	8,457	13,225	6,860	6,627	53,072	10,614
Facilities Capex	1,470	1,571	471	367	737	123	4,925	2,872	1,307	1,707	2,353	2,069	10,309	2,062
Total non-network Capex	6,259	6,499	6,135	4,359	5,808	5,327	19,202	20,774	9,765	14,932	9,213	8,696	63,381	12,676
Total Capex (excl. cost of financing)	**79,163**	**85,694**	**96,940**	**102,290**	**110,013**	**123,204**	**148,504**	**179,106**	**171,151**	**181,504**	**173,583**	**167,633**	**872,977**	**174,595**

Opex

$2016 REAL $	FY12	13	14	15	16	17	18	19	20	21	22	23	CPP TOTAL	CPP AVERAGE
Network Opex														
Corrective maintenance	9,770	7,952	11,528	10,349	9,031	12,096	11,979	12,585	13,818	13,829	12,894	12,457	65,584	13,117
Preventive maintenance and inspection	8,469	10,261	8,429	6,496	7,479	7,294	8,396	11,261	12,134	12,409	11,408	11,328	58,539	11,708
Reactive maintenance	6,530	5,492	6,518	7,030	6,732	6,733	7,081	7,214	7,311	7,409	7,348	7,288	36,570	7,314
System operations and network support	7,019	7,795	8,609	9,770	10,751	12,034	13,913	15,463	16,479	17,057	16,786	16,701	82,486	16,497
Vegetation management	6,613	5,686	4,808	5,025	6,026	5,750	5,500	9,939	9,237	8,957	9,231	8,677	46,041	9,208
Total network Opex	38,401	37,187	39,893	38,670	40,019	43,907	46,869	56,462	58,979	59,661	57,667	56,451	289,220	57,844
Non-network Opex														
Corporate	17,651	18,652	18,240	19,794	22,017	25,355	23,571	23,572	23,871	23,402	23,056	22,433	116,333	23,267
ICT Opex	2,891	3,411	3,414	3,224	3,397	3,709	4,467	5,274	5,890	5,788	5,663	5,530	28,146	5,629
Insurance and governance	1,846	2,043	2,012	2,097	2,048	1,984	2,062	2,146	2,188	2,227	2,218	2,207	10,986	2,197
Facilities	1,778	1,824	1,791	1,688	1,885	1,856	1,938	1,975	1,897	2,042	2,001	1,968	9,883	1,977
Total non-network Opex	24,166	25,930	25,456	26,803	29,346	32,903	32,037	32,966	33,845	33,460	32,939	32,139	165,349	33,070
Opex	**62,567**	**63,116**	**65,349**	**65,473**	**69,365**	**76,810**	**78,906**	**89,428**	**92,825**	**93,121**	**90,605**	**88,589**	**454,569**	**90,914**