Powerco's Customised Price Path Application

Final verification report for Powerco

7 June 2017

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1. Introduction and summary

1.1 Purpose of this report – to assist the Commission's determination

This verification report concerns Powerco's application to the Commerce Commission (the Commission) for a Customised Price Path (CPP) for the five-year period from 1 April 2018 to 31 March 2023 (CPP period).

It has been prepared by Farrier Swier Consulting (FSC) with input from WSP Australia (WSP, formerly known as Parsons Brinckerhoff) in accordance with the Electricity Distribution Services Input Methodologies Amendments 2016 Determination (IM) and in the expectation that the report will be used by the Commission to inform its own analysis and decisions around Powerco's CPP, particularly in relation to the proposed capital expenditure (capex) and operating expenditure (opex) over the CPP period.[1] This verification report is based on information provided as at 31 May by Powerco in the form of data and documents uploaded to the data room (Ansarada) and responses to questions.

The report has been structured and drafted to assist the Commission's considerations:

- It explicitly provides opinions and advice on the matters set out in the IM.
- Given the inherent subjectivity involved in assessing forecasts, it highlights where we have drawn on professional experience and judgement and explains the reasons for our views.
- It explains the overall approach to the verification, the extent of information and analysis prepared and provided by Powerco, and the iterative process used to verify the CPP.
- It highlights matters that we suggest be consciously considered or investigated by the Commission as part of its deliberations because, for example, judgement about the specific activities and costs depends on the Commission's philosophy and policy position; we have assessed that the costs do not meet the expenditure objective; or the costs were unable to be fully verified in the time available based on the information provided.
- While our opinions and advice do not extend to providing alternative forecasts or proposing modifications, where possible, we indicate the approximate

[1] The source for the IM is: Commerce Commission, *Electricity Distribution Services Input Methodologies Determination 2012*, This consolidated determination consolidates the principal determination and all amendments as of 28 February 2017, 28 February 2017.

relative magnitude of any issues in the context of the total forecast capex and opex.

The verification process and report does not extend to a holistic assessment of the CPP or address other objectives which may be relevant to the Commission's determination, such as rate of return and price outcomes.

1.2 Verification context – Reasons for Powerco's CPP application

Powerco has been subject to default/customised price-quality regulation and information disclosure under Part 4 of the Commerce Act 1986 (the Act) since 2010, but, like most electricity distribution businesses, it has managed the business within the bounds of the default price path (DPP) revenue and has not pursued the option of proposing a CPP until now.

Powerco's public consultation documents explain that the results of analysis of network performance, planning, and work on its asset management strategy show that it needs to increase investment to prevent deterioration in performance and ensure that the network can meet future needs. The uplift in investment cannot be accommodated within the DPP constraints; this has prompted Powerco to apply for a CPP.

We note that the trigger for Powerco's CPP is markedly different to Orion's CPP proposal which was in response to the Canterbury earthquakes in 2011 and following. In Powerco's case the CPP reflects significant work, analysis and ongoing refinement in a business as usual context and is designed to support the transition to and achieve good asset management practice.

1.3 Powerco's CPP proposal

The CPP covers the five-year period from 1 April 2018 and includes approximately $1,327.5 million ($2016) of capital and operating expenditures, compared to $936.9 million ($2016) for the previous five years.[2]

Powerco's consultation explains that the increased CPP investment is associated with:

1. **Providing safe, secure and resilient networks**. This requires Powerco to focus on the underlying health of its networks, rather than focussing on average measures of reliability.

[2] For presentation purposes, all values are reported in real $2016 unless otherwise stated – which means that they exclude cost escalation. This aligns with how Powerco presents its expenditure forecasts in most of the information that it provided to us, including in Powerco's descriptions of the expenditure programs. We consider the impact of cost escalation separately in section 5.4.

2. **Investing in Powerco's communities**. This requires Powerco to facilitate economic growth by providing network capacity that its customers need.
3. **Understanding and leveraging new technology**. This requires Powerco to gain practical experience of new technology through trials and pilot schemes.

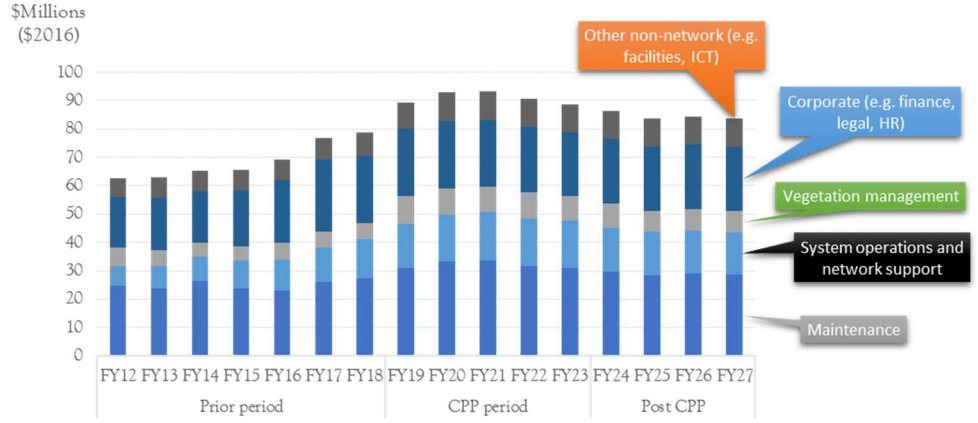
The CPP includes the costs of capital and operating works to address a backlog of defects, meet vegetation management requirements, address deteriorating asset condition, stabilise network performance and equip the network for the future, among other requirements.

Figure 1 shows the profile of the proposed capital and operating expenditures and indicates the contribution of key cost categories and drivers.

Figure 1 – Expenditure forecasts

A: Proposed capex

B: Proposed opex



We understand that the CPP proposal (as consulted on with customers) would give rise to an average price increase of 5.5% one off real price increase which means an average increase of approximately $0.74 per week for customers.[3]

1.4 The verifier's role and focus

The verifier's role, purpose and obligations are set out in the IM (see Box 1 below) and focus on capex and opex forecasts with reference to the **expenditure objective**:

> *The objective that capital expenditure and operating expenditure reflect the efficient costs that a prudent non-exempt EDB[4] would require to-*
>
> *(a) meet or manage the expected demand for electricity distribution services, at appropriate service standards, during the CPP regulatory period and over the longer term; and*
>
> *(b) comply with applicable regulatory obligations associated with those services.*

The expenditure objective is similar to objectives in other regulatory frameworks, and inevitably relies on judgement in interpreting the attributes and approach associated with a *prudent* business. We do not equate prudent practice with *best practice*, which means that a range of approaches and costs can potentially achieve the expenditure objective.

[3] Powerco, *Summary table consideration of customer feedback*, May 2017, Ansarada document number 02.20.

[4] Electricity distribution business.

Box 1 – Verifier's role, purpose and obligations[5]

Schedule G2 of the IM:

The **verifier's** role, purpose and obligations include-

(a) engaging with the **CPP applicant** in an **independent** manner in accordance with this Terms of Reference;

(b) assessing the extent to which the **CPP applicant's policies** allow the **CPP applicant** to meet the **expenditure objective**;

(c) assessing the extent to which the **CPP applicant's policies** have been implemented;

(d) prior to the **Commission's** assessment of the **CPP proposal**, assessing whether the **CPP applicant** has provided the **verifier** with the information specified in clause 5.5.2(3);

(e) prior to the **Commission's** assessment of the **CPP proposal**, providing an opinion to the **CPP applicant** on whether the **CPP applicant's capex forecasts**, **opex forecasts** and **key assumptions** meet the **expenditure objective**;

(f) prior to the **Commission's** assessment of the **CPP proposal**, assessing the extent to which the **CPP applicant** is able to deliver its **capex forecast** and **opex forecast** during the **CPP regulatory period**;

(g) prior to the **Commission's** assessment of the **CPP proposal**, providing an opinion on the extent and effectiveness of the **CPP applicant's** consultation with its **consumers**; and

(h) providing a list of the key issues which it considers the **Commission** should focus on when assessing the **CPP proposal**.

1.5 Approach and process for verifying Powerco's CPP

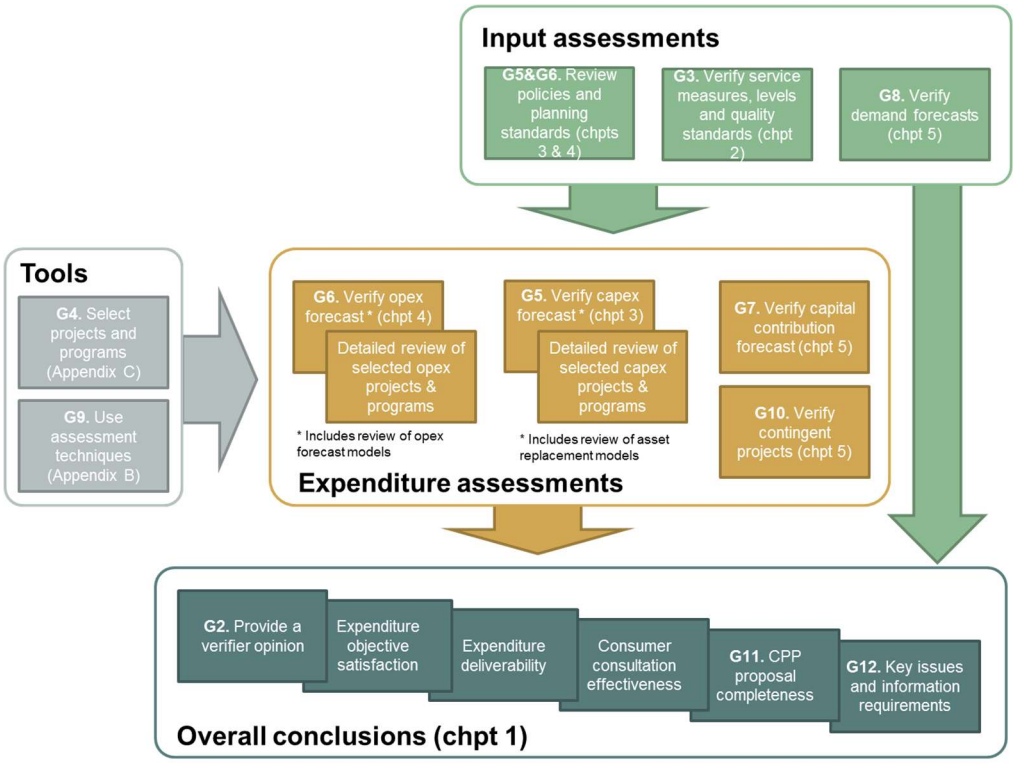
The opinions and advice set out in this report draw on a five-month period of information review and iterative analysis. To a large part, the verification process has occurred in parallel with Powerco's work to develop and refine its CPP application before this is submitted to the Commission. At the time of writing this report, Powerco continues to finalise that application.

Our involvement commenced on 16 December 2016 when FSC, and WSP (sub-contractors to FSC) attended a tripartite workshop with Powerco and the Commission. A data room was established on 24 January 2017, and since then we have been provided with a significant number of documents, including plans, policies, spreadsheets and expert reports. We conducted a site visit to Powerco's Wellington and New Plymouth offices over the week beginning 6 February 2017. We also hosted separate visits from Powerco staff in Melbourne in December 2016, and January and April 2017. In addition, in accordance with the communication protocols, we have formally directed many questions and information requests to Powerco, which resulted in over 350 responses from Powerco.

[5] In this box – and other boxes throughout the report – bolded text represents defined terms included within the IM.

We provided Powerco with a draft verification report on 6 April 2017. Following that report Powerco provided further information and analysis. Powerco also moderated its forecasts in response to our draft report (discussed in section 1.6).

Figure 2 – Overall approach to verification (references in bold are to IM clauses, and chapter references are to this report)



Our approach to verification is shown in Figure 2 and was specifically designed to meet the IM requirements. This included nominating up to 20 selected projects and programs for detailed review and applying a range of assessment techniques to assess the CPP proposal, including benchmarking, trend analysis, desktop reviews, interviews, and model critiques.

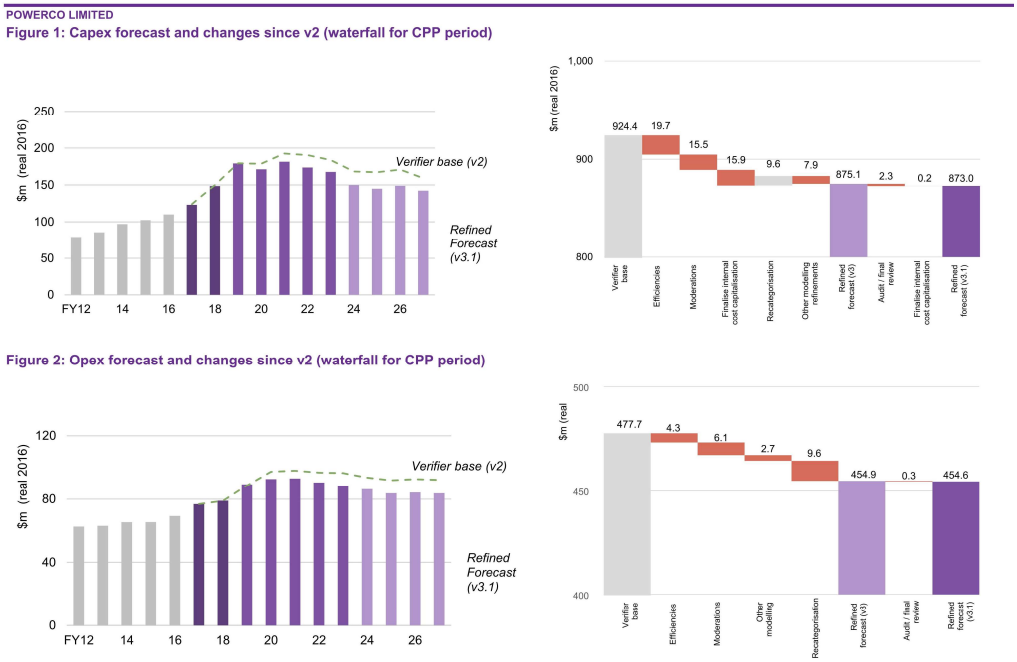
1.6 Impact of verification process on expenditure forecasts

The IM contemplates that the verification process may give rise to adjustments to the CPP because of matters raised and further analysed.

Powerco has actively considered feedback provided by us throughout the process. As a result, Powerco has made changes to models to reduce modelling uncertainty and correct errors, updated and expanded documentation, reconsidered strategies (e.g. vegetation management), and moderated the forecasts to reflect forecast efficiencies and interdependencies between components of the expenditure forecasts.

In response to our draft verification report and feedback Powerco reduced its capex forecasts by $51.4 million (a 5.6% reduction) and opex by $21.3 million (a 4.8% reduction) over the CPP period (see Figure 3).

Figure 3 – Powerco changes to expenditure forecasts



Source: Powerco. Note values exclude the impact of inflation and cost escalation.

1.7 Verification findings

We have presented our findings as follows:

- To provide context and perspective for the detailed verification findings, our introductory comments focus on our overall finding in terms of the quantum of expenditure verified, and the key reasons for unverified expenditure.
- Table 1 summarises our overall assessment against the Schedule G IM requirements which includes a range of matters. The reasons for our overall assessment are set out in detail throughout the body of our report.
- Subsequent subsections provide more detail around key Schedule G IM matters.

1.7.1 Overall findings – introductory commentary

Powerco is addressing specific network needs, is on an asset management journey, and is considering the future evolution of its network. This means that:

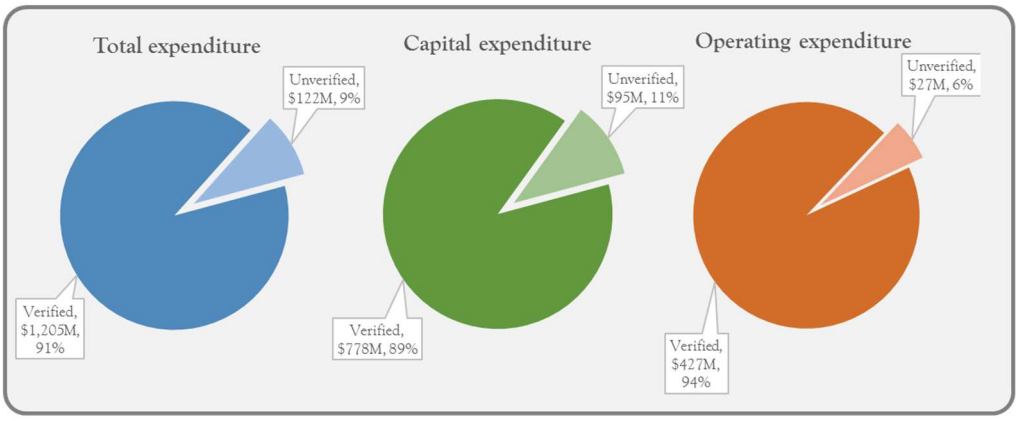
- increased capex and opex spend is required to stabilise asset performance through addressing a rising number of asset defects as assets wear out and to support good

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

- while Powerco intends to implement good asset management practices, in the immediate term its expenditure forecasts reflect, at least in part, current practices and information
- 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.

Figure 4 shows that the review team has been able to verify most of the forecast expenditures proposed by Powerco in its CPP. The figure shows the amounts that we were unable to verify against the expenditure objective, and which we recommend that the Commission focus its review on – we refer to these as 'unverified'. With further information and analysis, the Commission may satisfy itself that some or all of these amounts meet that objective. We have suggested additional information or lines of inquiry that may assist the Commission (see section 1.7.9).

Figure 4 – Overall findings



Note: The figure identifies the share of Powerco's proposed expenditure over the CPP period that we have been unable to verify against the expenditure objective, in real 2016 dollars. Cost escalation is not reflected in the figure. We consider cost escalation separately in Table 2 and section 5.4 below.

In relation to the unverified amounts, part of the unverified proposed expenditure broadly relates to the direct and indirect costs of Powerco's asset management journey. Another part of the unverified amounts relates to the costs of Powerco's future network strategy, the benefits of which are mainly expected beyond the CPP period. We do not believe that the costs associated with these two parts necessarily meet the expenditure objective. Other parts of the unverified proposed expenditure may also require further consideration by the Commission.

We have suggested that the Commission focus on all unverified costs (see 1.7.9).

1.7.2 Overall assessment against the Schedule G IM requirements

A summary of our overall findings is provided in Table 1.

Table 1 – Overall assessment

IM requirement	Description	Our finding
Adequacy of policies G2(b)	Assessing the extent to which the CPP applicant's policies allow the CPP applicant to meet the expenditure objective	Powerco has a comprehensive set of policies, the bulk of which appear to be of the nature and quality required to meet the expenditure objective. However, we have identified some areas where policies may not lead to an efficient level of expenditure (substation security standards and timber pole inspections) which are set out in sections 3.2 and 4.2 of this report.
Implementation of policies G2(c)	Assessing the extent to which the CPP applicant's policies have been implemented	On the whole, we believe that Powerco's capex and opex forecasts are consistent with its policies with one exception (substation security standards) as set out in sections 1.7.4 and 3.2 of this report.
Expenditure objective G2(e) and equivalent clauses in G5 and G6	Providing an opinion to the CPP applicant on whether the CPP applicant's capex forecasts, opex forecasts and key assumptions meet the expenditure objective	There are many aspects of Powerco's capex and opex forecasts and supporting assumptions that support the expenditure objective. However, it is not possible to conclude that the total proposed expenditure over the CPP period fully meets the expenditure objective. We have identified in sections 1.7.3 and 1.7.4 areas in the expenditure forecast where we believe the capex and opex forecasts do not meet the expenditure objective.
Deliverability G2(f) and equivalent clauses in G5 and G6	Assessing the extent to which the CPP applicant is able to deliver its capex forecast and opex forecast during the CPP regulatory period	Powerco's approach to deliverability appears well considered, and discussions with service providers are well advanced. We note there are risks associated with its deliverability plan but we expect that Powerco will manage them.
Consumer consultation G2(g)	Providing an opinion on the extent and effectiveness of the CPP applicant's consultation with its consumers	Powerco has undertaken substantial consumer consultation to date, and has prepared and made available a significant amount of material, consistent with requirements of the IM.
CPP proposal completeness G11 and G2(d)	Assessing whether the CPP applicant has provided the verifier with the information specified in clause 5.5.2(3)	The core material and models which Powerco has provided are of an appropriate standard. Powerco has responded to over 350 questions and requests for information and supporting models and uploaded over 400 documents and spreadsheets to the data room.
Key issues and information requirements G12 and G2(h)	Providing a list of the key issues which it considers the Commission should focus on when assessing the CPP proposal	We have set out in section 1.7.9 the focus areas that the Commission may wish to consider.

1.7.3 Expenditure objective

There are many aspects of Powerco's capex and opex forecasts and supporting assumptions that support the expenditure objective. However, it is not possible to conclude, in terms of the IM requirements, that the total proposed expenditure over the CPP period fully meets the expenditure objectives.

Based on the analysis that we have performed, information reviewed, matters considered and the assessment techniques that we have applied, Powerco's capex and opex forecasts and supporting assumptions for the CPP period do not fully meet the expenditure objective because it is in excess of what is a reasonable forecast to:

- meet or manage expected demand at appropriate service standards; and
- comply with applicable regulatory obligations.

Our reasons for this opinion are set out below.

1.7.4 Capital expenditure

Whilst we note that components of Powerco's capex forecasts support the expenditure objective, we have formed the view that Powerco's capex forecast and supporting assumptions for the CPP period do not fully meet the expenditure objective because:

- Application of the current security standard would result in the application of an N-1 level of redundancy with no load at risk.[6] 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. Powerco maintains that this will not have a material impact on the CPP forecast.[7] We have not been able to put a value on this uncertainty.
- 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; a key example being the target fault level adopted which directly leads to the volume of conductor replacements forecast, also driving around half of expenditure in the overhead structures renewal program. The portion unverified across the conductor and poles renewal programs is $58 million ($2016).

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[6] 'N-1' refers to Normal Minus one, where no consumer load would be placed at risk for the loss of a single item of network infrastructure.

[7] Powerco, *Summary Of Powerco Feedback On The Draft Verification Report*, Appendix 1, p.4

- 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. The portion unverified is approximately $9 million ($2016).
- 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. The portion unverified is approximately $5 million ($2016).
- 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. The portion unverified is approximately $15 million ($2016).
- The level of proposed expenditure within the network evolution category appears higher than appropriate given the uncertainty in achieving the benefits. The portion unverified is approximately $8.1 million ($2016).

In aggregate, these issues are likely to result in an overstatement of expenditure of up to approximately $95 million ($2016) over the CPP period, or approximately 11% of Powerco's forecast capex – as shown in Figure 4. This value does not include uncertainty relating to the growth and security (major projects and minor works) programs, so it could be higher.

Our detailed analysis and reasons for our findings on capex are set out in chapter 3 and in appendix D.

1.7.5 Operating expenditure

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. Some of the maintenance and SONS step changes (above Powerco's FY16 opex) proposed by Powerco we characterise as base year expenditure that a prudent operator would likely incur.

We also consider that most of Powerco's opex forecast does not appear inconsistent with the expenditure objective. However, we have formed the view that Powerco's opex forecast and supporting assumptions for the CPP period do not *fully* meet the expenditure objective because:

- 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 and that these outweighed the $8.9 million ($2016) cost of the step change.

- 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. These new FTEs contribute most of the $18.4 million ($2016) in corporate step changes.

These issues are likely to result in an overstatement of expenditure, up to approximately $27.3 million ($2016) over the CPP period, or approximately 6% of Powerco's forecast opex. This value is shown in Figure 4.

We note that some of the expected benefits resulting from the proposed SONS step changes are reflected in assumed efficiencies built into Powerco's expenditure forecasts for FY22 and FY23. If this step change did not occur, then we would expect these efficiencies to reduce.

We also note that there are interdependencies between the various maintenance expenditure programs. Although Powerco has not necessarily modelled these directly, it has applied a general cost efficiency over the forecasts for FY22 (half year efficiency) and FY23 (full year efficiency). We could not validate that the assumed efficiencies adequately address the interdependencies; however, we do not think that it is unreasonable in the circumstances.

Our detailed analysis and reasons are set out in chapter 4.

1.7.6 Deliverability

In our opinion, the work proposed in the capex and opex forecasts over the CPP period does not appear undeliverable, notwithstanding some risks which are discussed below. Powerco has identified these risks and has an appropriately advanced delivery plan across the capex and opex program. We consider that Powerco will be able to source the required resources.

Delivery risks result from:

- management bandwidth and the timeframe to mobilise projects and programs given the significant step up in proposed activity at the start of the CPP period
- specific assets requiring renewal not yet being identified – this is not unreasonable at this point of time, and is a challenge that has been successfully managed by other networks
- the interplay between the capital and operating program – for example, if the SONS FTE increases are not attainable in time we expect this could delay delivery of externally resourced capex and opex
- the lack of internal resourcing to give effect to the delivery plan – Powerco is planning a significant increase in internal resources for some expenditure

categories; based on our experience, significant internal restructures tend to take longer to complete than expected, with key roles often left vacant for some time

- Powerco awaiting the Commission's final determination before undertaking recruitment in full – this may result in a risk that the recruitment and training required to support the volume driven increase in SONS FTEs, for instance, may not occur fast enough.

1.7.7 Consumer consultation

Powerco has undertaken substantial consumer consultation[8] 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. Whilst 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.

1.7.8 CPP proposal completeness

In assessing Powerco's capex and opex forecasts, methods, models, and supporting policies, key assumptions and drivers, we have reviewed a significant amount of information prepared by Powerco, including responses to over 100 questions from us.

On the whole, we consider Powerco's CPP proposal is complete. However, in our detailed findings set out in chapters 2 to 6 we have specified where we consider the information provided by Powerco was incomplete or where information was omitted.

1.7.9 Key issues and information requirements

Box 2 sets out the IM requirements for key issues and information requirements.

[8] We note that more than 200 people representing electricity retailers, major customers, councils and stakeholder groups attended Powerco meetings and forums; Powerco published various consultation documents targeting different audiences, supported by an online survey and video on a dedicated website, which was viewed more than 4,000 times; through social media advertising (Facebook and Twitter), Powerco achieved a total reach of 92,000 users in its distribution areas, with the video viewed more than 60,000 times; Powerco run print advertising, as inserts in newspapers and rural publications in its areas, with a circulation of 159,400.

Box 2 – IM requirements for key issues and information requirements

Schedule G2(h) of the IM:

Verifier's role, purpose and obligations include-

(h) providing a list of the key issues which it considers the **Commission** should focus on when assessing the **CPP proposal**.

Schedule G12 of the IM:

Based on its assessment, the **verifier** must, in the **verification report**-

(a) provide a list of the key issues that it considers the **Commission** should focus on when undertaking its own assessment of the information to which the assessment related;

(b) specify information identified in the **CPP proposal** that, were it to be provided, would assist the **Commission's** assessment of the **CPP proposal**; and

(c) identify any other information it reasonably believes would-

(i) be held by the **CPP applicant**; and

(ii) assist the **Commission's** assessment of the **CPP proposal**.

We have set out in Table 2 below the components of the capex and opex forecasts over the CPP period that we suggest the Commission should focus on in assessing and making its determination on Powerco's CPP proposal:

Table 2 – Key issues for the Commission

Forecast component	Why should the Commission investigate it?	Suggested additional information or line of inquiry
Overhead conductors renewals capex	Powerco has not proven that the risk associated with the current level of faults is unacceptable and needs to be reduced.	Undertake suitable investigation/analysis to assess the risks posed by distribution conductors failing, and hence the number of faults that can be expected on the network of a prudent EDB.
Overhead structures renewals capex	Powerco has not proven that the current fault rate is unacceptable and needs to be reduced. Additionally, Powerco's overhead structures survivor curves include 'green defects' which may overstate levels of expenditure required.	Construct new survivor curves excluding green defects. Revise the overhead structures forecast to reflect any changes to the overhead conductor renewals capex.
Zone substation renewal capex	With the information provided, we have identified five transformer replacements that could be deferred beyond of the CPP period, although Powerco has not yet had the opportunity to respond to this finding.	Confirm with Powerco that its proposed replacement of transformers is prudent in light of our findings.

Forecast component	Why should the Commission investigate it?	Suggested additional information or line of inquiry
Growth and renewals capex	Powerco does not currently have a probabilistic planning standard, which may lead to greater levels of expenditure necessary.	Assess the value of lost load associated with each of the major projects and a sample of the minor works.
Reliability capex	The level of expenditure proposed does not appear justified as the significant uplift in other capex appears sufficient to meet Powerco's aim to maintain unplanned reliability without the inclusion of a large reliability program.	Evaluate forecast reliability performance with the reliability program included to determine the level of expenditure required on reliability specific programs.
Network evolution capex	Information provided does not provide sufficient justification to verify the level of expenditure proposed.	Engage with Powerco on its business cases for its network evolution initiatives, including on whether the expected benefits of each initiative are likely to outweigh the costs and the alternative options available.
System operation and network support (SONS) opex	Information provided does not provide sufficient basis to verify the proposed strategy-driven step changes.	Engage with Powerco on its business case for its strategy-driven step changes or initiatives, including on whether the expected benefits of each initiative are likely to outweigh the costs and the alternative options available.
Corporate opex	Although some increase in headcount (i.e. FTEs) is expected above that in the FY16 base year, the information provided is not sufficient to verify the material increase proposed.	Engage with Powerco on the business cases for the FTE increases, including on the expected benefits from and proposed salaries for the extra staff.
Cost escalators	Powerco's expenditure forecasts are sensitive to the cost escalator forecasts used and these are inherently unstable, especially for material escalation.	The Commission may wish to procure its own cost escalator forecasts from a sufficiently qualified and independent third party to compare to those proposed by Powerco.
Quality standard variation	Although Powerco's proposed increase in planned system average interruption frequency index (SAIDI) and system average interruption frequency index (SAIFI) appear reasonable given the proposed increase in planned works during the CPP period, its proposed targets for unplanned SAIDI and SAIFI do not appear to fully incorporate the likely improvement resulting from its proposed expenditure.	The Commission may wish to undertake its own analysis of the likely reliability benefits arising from the proposed capex and opex programs, or engage with Powerco to have its models refined.

Forecast component	Why should the Commission investigate it?	Suggested additional information or line of inquiry
Customer engagement	Powerco consulted with its customers on the impact of its CPP at an aggregated level based on average customer impact. The actual price outcomes may have greater impact on certain customers.	The Commission may wish to investigate the price impact of the CPP application on Powerco's customers at a more granular level to identify whether any customers are likely to receive unpalatable price increases.

1.8 Structure of our report

Our report is structured as follows:

Heading	Sets out
Chapter 2	Findings on services measures, service levels, consumer engagement and quality standard variations
Chapter 3	Findings on Powerco's forecast capex
Chapter 4	Findings on Powerco's forecast opex
Chapter 5	Findings on other matters that we are required to consider including demand, contingent projects and cost escalation
Chapter 6	Findings on completeness of the CPP proposal
Appendices	Supporting analysis and information, including on benchmarking, and our detailed review of projects and programs and the reliability modelling. Our nomination of selected projects and programs (G4 IM) and the assessment techniques (G9 IM) that we used and the information that we relied on as part of our verification

2. Service measures, levels and quality standards

Powerco is proposing two service measures – SAIDI and SAIFI. These are the same measures that apply currently under Powerco's DPP.

Powerco is also proposing a quality standard variation to place 0% weight on the *planned* component of the SAIDI and SAIFI measures and to update the *unplanned* (normalised) component of those measures to reflect more recent historical data.

This chapter assesses these proposals against the IM requirements, including by assessing how Powerco has consulted with its consumers about its proposal.

This chapter is structured as follows:

Heading	Sets out
Section 2.1	Findings on Powerco's service measures
Section 2.2	Findings on Powerco's service levels
Section 2.3	Findings on Powerco's consumer engagement
Section 2.4	Findings on Powerco's proposed quality standard variation

2.1 Service measures

2.1.1 Powerco proposal and our general observations

Powerco's current DPP includes SAIDI and SAIFI targets that it must meet. These targets themselves are split into planned and unplanned components, recognising that interruptions may be caused by a planned activity – such as replacing a power line or undertaking vegetation management – or an unplanned event – such as from a tree falling on a power line during a storm. Both components are important.

Powerco proposes to retain the same measures as part of its CPP and the weight applied to the unplanned component (100%) when measuring aggregate performance. These measures are important to Powerco's proposal to stabilise deteriorating network condition and performance as its network ages, and the outcomes that follow from this, such as reliability. Powerco also proposes to apply no weight (0%) to the planned component over the CPP period given the need to increase planned outages to deliver the expenditure outcomes proposed.

Powerco has also actively consulted with its consumers and other stakeholders on the service attributes that they find important and meaningful. Reliability is one of these service attributes. Although other service attributes were also identified as important and meaningful by consumers, Powerco is not proposing additional service measures to

address these in its CPP due to lack of long-term, audited data deemed necessary to support the introduction of further measures.

2.1.2 IM requirements and our approach to assessment

This section aims to address Schedule G3(1)(a) and (b) of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

Box 3 – IM requirements for service measures

Schedule G3 of the IM:

(1) The **verifier** must review, assess and report on-

(a) whether the **CPP applicant** has proposed **service measures** relevant to a complete range of key service attributes that are meaningful and important to **consumers**;

(b) whether the **CPP applicant** has undertaken an appropriate process to determine the **service measures** and **service levels**, such as consultation with relevant **consumers**;

Our approach to assessment was:

- identify a complete range of key service attributes that are meaningful and important to consumers, including by looking at consumer feedback received by Powerco
- compare Powerco's proposed service measures against these service attributes to identify whether all attributes are covered
- review the process that Powerco undertook to determine its proposed service measures.

Relevant information provided by Powerco is set out in Table 3.

Table 3 – Information provided – service measures

Title	Reference	Date
Planned quality model v2 [Read-Only].pdf	04.01.06	1 Feb 2017
Quality Note v2.docx	04.01.07	1 Feb 2017
Planned SAIDI Model.xlsx	04.02.03.01	2 Mar 2017
Verifier Question and Answer Initial Summary Response_Q0016 Service Measures Levels and Quality Standard Variation	Ansarada Question ID 016	2 Mar 2017

2.1.3 Our findings

The proposed service measures are relevant to key service attributes that appear meaningful and important to Powerco's consumers. This is evidenced by consumer feedback that reliability is important and that current levels should be maintained.[9]

However, it does not appear that the proposed service measures cover a complete range of key service attributes that are meaningful and important to consumers. This is because consumers have also said that they consider other service attributes are important to them, including safety, environmental responsibility, legislative compliance, customer engagement, fault response and power quality, further reliability, networks of the future, asset utilisation and asset failure rates.

The process undertaken by Powerco to determine the proposed service measures appears appropriate in the circumstances because:

- Powerco started with the service measures approved by the Commission in the DPP – which was itself subject to public consultation and is consistent with previous regulatory determinations.
- Powerco engaged with consumers about what service attributes they consider important – and reliable electricity supply was consistently identified.
- Powerco also considered other potential service measures, but did not have data of sufficient quality to determine targets for these – which appears reasonable given that the targets, once set, are designed to incentivise efficient EDB behaviour and that targets estimated using inaccurate data could undermine those incentives and lead to poor consumer outcomes.
- Powerco has noted that it annually measures and reports – in its publicly available asset management plan – on performance against a further set of quality measures and targets, and will continue to do so.[10] Customers therefore can assess Powerco's performance against a broader range of service measures than merely those used for incentive regulation purposes.

2.1.4 Completeness and key issues for the Commission

The information provided by Powerco on its proposed service measures was sufficient for us to undertake our verification. We are not aware of any information that we consider was omitted by Powerco.

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[9] For example, see PwC, *Full results from consumer survey, Summary findings*, February 2017 and Powerco, *Investing to ensure safety, security and resilience, 2018-2023 Investment Proposal, Have your say*.

[10] Powerco response to CPP verification question set ID016, response to question 1, dated 2 March 2017.

We also have not identified any key issues relating to the proposed service measures that we consider the Commission should focus on when undertaking its own assessment of the information.

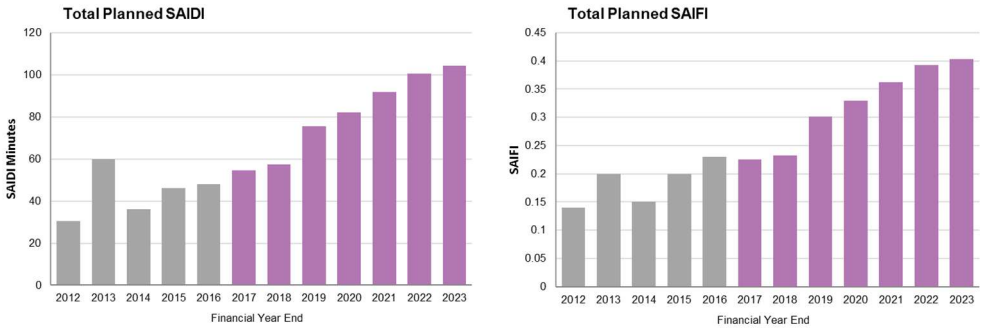
2.2 Service levels

2.2.1 Powerco proposal and our general observations

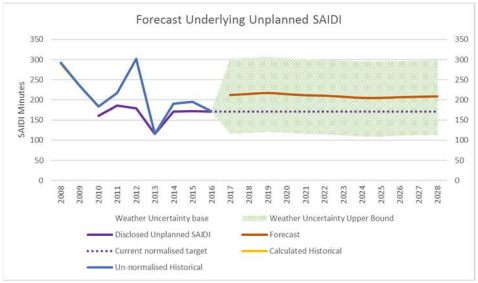
Powerco proposes that planned SAIDI and SAIFI increase over the CPP period and forecasts that unplanned SAIDI and SAIFI will remain at historical levels – as shown in Figure 5.

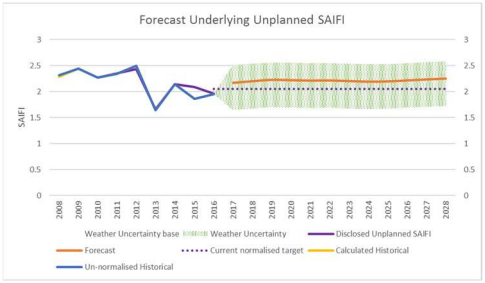
Although Powerco intends to engage further with the Commission on the unplanned SAIDI and SAIFI targets as part of the CPP determination process,[11] we have considered both Powerco's planned and unplanned SAIDI and SAIFI forecasts as part of our verification given their link to Powerco's proposed expenditure forecasts. We note that Powerco has forecast un-normalised unplanned reliability, rather than the normalised unplanned reliability that is used to set and apply the quality standard. Powerco have not modelled normalised unplanned reliability and while a close relationship is expected, we are not able to directly assess this using the information provided.

Figure 5 – Powerco planned SAIDI and SAIFI (FY12–FY23) and unplanned normalised SAIDI and SAIFI (FY18–FY28)



[11] Powerco response to CPP verification question set ID016, question 1, dated 24 February 2017.





Source: Powerco, Ansarada document numbers 04.02.03.10 (for the planned reliability figures) and 04.02.03.11.01 (for the unplanned reliability figures). The forecasts in the bottom two graphs show the *un-normalised* unplanned SAIDI and SAIFI outcomes from Powerco's unplanned reliability forecast model (Ansarada document number 04.02.03.11.02). These are compared to Powerco's current *normalised* targets.

Powerco's proposed increases in **planned** SAIDI and SAIFI levels are material and reflect the significant increase in asset renewal, maintenance and vegetation management activity proposed for the CPP period (discussed in chapters 3 and 4). Powerco determined the increase by using current estimates of planned SAIDI and SAIFI per activity type and multiplying these by the forecast volume of renewal, maintenance and vegetation management activity, with some adjustment.

This method and the assumptions that underpin it do not appear inappropriate in the circumstances. The model appears to appropriately allocate SAIDI and SAIFI contributions to assets and to reasonably reflect efficiencies from larger scale projects (compared to smaller scale projects). This view is subject to noting that the proposed service levels are calculated using current connection numbers rather than forecast connection numbers (as would be expected) – however, any overstatement of levels because of this are likely to be immaterial.

Powerco forecasts that normalised **unplanned** SAIDI and SAIFI will remain at current levels over the CPP period. We would, however, expect the significant increase in capex and opex would have a positive impact on normalised unplanned SAIDI and SAIFI.

Powerco consulted with consumers on its proposed service measures and levels. Customers stated that Powerco's current reliability should be maintained and did not support improvement or reduction to existing service levels.

2.2.2 IM requirements and our approach to assessment

This section aims to address Schedule G3(1)(b) and (c) of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

Box 4 – IM requirements for service levels

Schedule G3 of the IM:

(1) The **verifier** must review, assess and report on-

(b) whether the **CPP applicant** has undertaken an appropriate process to determine the **service measures** and **service levels**, such as consultation with relevant **consumers**;

(c) whether any step change in any **service level** is explained and justified;

Our approach to assessment was to:

- identify what service levels are proposed by Powerco for the CPP period, including any step changes
- review the explanation and justification for any step changes
- consider whether there should be a step change where none was proposed
- review the method and model used to forecast the planned SAIDI and SAIFI service levels
- review the method and model used to forecast the unplanned SAIDI and SAIFI service levels
- consider what, if any, impact the proposed expenditure for the CPP period may have on planned and unplanned SAIDI and SAIFI over that period
- review the process that Powerco undertook to determine its proposed service measures.

Relevant information provided by Powerco is set out in Table 4.

Table 4 – Information provided – service levels

Title	Reference	Date
Planned quality model v2 [Read-Only].pdf	04.01.06	1 Feb 2017
Quality Note v2.docx	04.01.07	1 Feb 2017
Planned SAIDI Model.xlsx	04.02.03.01	2 Mar 2017
NAPA FY 15-16 SAIDI SAIFI per asset analysis.xlsx	04.02.03.02	2 Mar 2017
Outdef 04-14 SAIDI SAIFI per asset analysis.xlsx	04.02.03.03	2 Mar 2017
SAIDI per asset workbook.xlsx	04.02.03.04	2 Mar 2017
Verifier Question and Answer Initial Summary Response_Q0016 Service Measures Levels and Quality Standard Variation	Ansarada Question ID 016	2 Mar 2017
Influence of Weather on Network Performance V3.pdf	04.02.03.05	6 Mar 2017
Verification that Western Distribution Overhead Network Health is Declining.pdf	04.02.03.06	6 Mar 2017
Report on Weather Influence 061016.pdf	04.02.03.07	6 Mar 2017
SAIDI per asset workbook - Update 07032017.xlsx	04.02.03.09	8 Mar 2017
Planned SAIDI Model - Update 07032017 v2.xlsx	04.02.03.10	8 Mar 2017
Information provided since draft report		
NPV and Unplanned model update note.pdf	04.01.14	28 Mar 2017

Title	Reference	Date
Unplanned Regional Model Note -CPP - 21-04-17 - final draft.docx	04.02.03.11.01	21 Apr 2017
Unplanned Regional Model 17-4-17 - CPP - final draft.xlsx	04.02.03.11.02	21 Apr 2017
ageModelling (Crossarms) 170417 (CPP inputs).xlsx	04.02.03.11.03	21 Apr 2017
ageModelling (Fuses) 170417 (CPP inputs).xlsx	04.02.03.11.04	21 Apr 2017
ageModelling (Poles) 1170417 (CPP inputs).xlsx	04.02.03.11.05	21 Apr 2017
ageModelling (Trans - Ground Mount - w totals) 170417 (CPP inputs).xlsx	04.02.03.11.06	21 Apr 2017
ageModelling (Transformers - Pole Mount) 170417 (CPP inputs).xlsx	04.02.03.11.07	21 Apr 2017
Fault Rate Analysis - 170417.xlsx	04.02.03.11.08	21 Apr 2017

2.2.3 Our findings – planned SAIDI and SAIFI

The proposed step changes to planned SAIDI and SAIFI service levels are well explained in the documents provided to us and appear justified, provided that the increase in renewal, maintenance and vegetation management activity is also justified and the increase is temporary to align with the increase in activity. It is reasonable to assume that a material step up in this type of activity will lead to more planned outages.

The method, models and assumptions used to quantify these step changes do not appear unreasonable or inadequate and appear to reflect the forecast change in the volumes of work. If the volumes of work are adjusted in the final CPP, then the planned SAIDI and SAIFI forecasts should also be adjusted to reflect the revised volumes.

The process used to determine the planned SAIDI and SAIFI step changes also does not appear inappropriate.

Appendix E provides our further analysis of Powerco's forecast planned SAIDI and SAIFI.

2.2.4 Our findings – unplanned SAIDI and SAIFI

Based on the information assessed, it is not clear to us that Powerco's proposed unplanned un-normalised SAIDI and SAIFI service levels are appropriate. We expect that the net effect of the proposed capex and opex may reduce unplanned un-normalised SAIDI and SAIFI, including because the operating initiatives are moving Powerco to a more proactive than reactive approach to managing faults and risk.

Our view on the unplanned SAIDI and SAIFI service levels is based on the following observations:

- With the absence of a growth driver, most capital projects and programs are expected to improve service measures and levels, including reliability. Powerco's

modelling suggests that these projects and programs will not improve reliability, although we are not convinced by this modelling (see appendix E for further discussion). Therefore, it is not clear whether the net effect will be to maintain or improve reliability.

- The information provided for several projects[12] states that reliability benefits will not be realised during the CPP period. In our experience, this is unlikely as reliability benefits should be realised as work programs are rolled out.
- Powerco's proposed maintenance approach is moving to focus on corrective and preventative maintenance and should also result in reliability benefits. These benefits have not been quantified in the information provided so far. Powerco has noted (response to questions 1 and 2, information request 2070) that identifying and rectifying defects when they are green and yellow rather than red will avoid them becoming reliability issues. In our view, this should then lead to improved reliability.
- Powerco's proposed vegetation management approach should reduce the number of unplanned outages due to vegetation – which should reduce unplanned SAIDI and SAIFI.

Appendix E provides our further analysis of Powerco's forecast unplanned un-normalised SAIDI and SAIFI.

2.2.5 Completeness and key issues for the Commission

The information provided by Powerco on its proposed service measures was sufficient for us to undertake our verification. We are not aware of any information that we consider was omitted by Powerco.

We do, however, consider that the Commission should focus on the relationship between Powerco's proposed expenditure forecasts and the impact on reliability when undertaking its own assessment of the information. Customers have clearly said that they do not want to pay for improved reliability[13]; yet, it is unclear to us whether Powerco's proposed expenditure will lead to reliability improvements or not because:

- modelling unplanned SAIDI and SAIFI is inherently difficult – and we have some concerns with how this was done by Powerco with respect to forecast un-normalised reliability (see appendix E for further detail)
- Powerco is proposing some significant expenditure over the CPP period that should impact reliability, including overhead conductor renewal capex, improved vegetation management opex and a reliability capex program.

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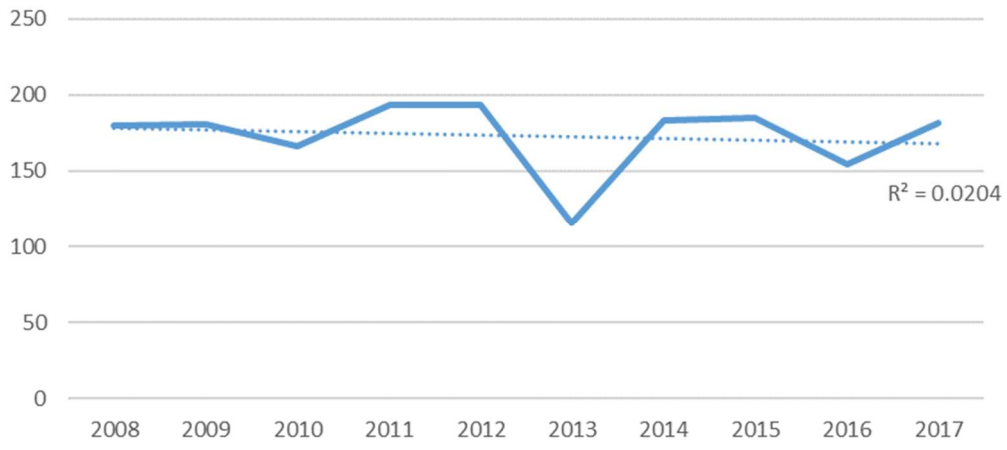
[12] For example, overhead conductor renewal capex - response to question Ansarada document number 014; vegetation management opex - response to question Ansarada document number 011.

[13] Powerco, Summary table consideration of customer feedback, May 17.

The Commission may wish to consider the following when undertaking its own assessment of reliability:

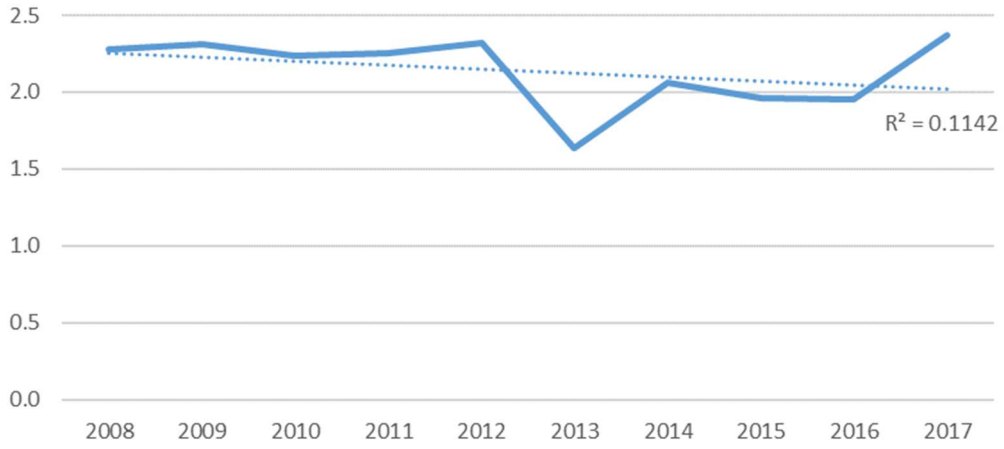
- whether the reliability program, preventative maintenance and corrective maintenance have been incorporated into the unplanned un-normalised reliability model adequately
- how the forecast for un-normalised reliability might relate to future normalised reliability, given that many assets that are in poor condition might fail on a major event day, i.e. during a major storm when stresses are higher, rather than on non-major event days
- Powerco's reliability performance over recent years, noting that:
  - due to the increasing asset replacement expenditure and inclusion of a reliability improvement program since 2008, we would expect that the more recent years are likely to provide a better indication of future performance due to the cumulative impact of the recent and forecast expenditure
  - the normalised reliability performance over the last 5 years, however, is distorted by the good performance in 2013, which results in a declining performance trend – without this year, current reliability performance appears similar to previous performance
  - the normalised reliability data over the longer term 2008 to 2017 does not indicate a sustained deterioration in performance (see Figure 6 and Figure 7 below) – although there is year on year volatility, this is largely explained by potential outliers in 2013 (with relatively good SAIDI and SAIFI performance) and 2017 (with poorer SAIFI performance).

Figure 6 – Total unplanned SAIDI (minutes, normalised)



Source: Powerco data, see Ansarada document number 04.02.03.13.

Figure 7 – Total unplanned SAIFI (frequency, normalised)



Source: Powerco data, see Ansarada document number 04.02.03.13.

2.3 Consumer consultation

2.3.1 Our general observations

Powerco has undertaken substantial consumer consultation, and has prepared and made available significant material, consistent with clause 5.5.1 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 (NZ).

Table 5 presents the information that has been provided by Powerco in relation to consumer consultation.

Table 5 – Information provided – consumer consultation

Title	Reference	Date
2015 snapshot_Powerco Consumer Research Overview.pdf	02.01	24 Feb 2017
2009-2011 Powerco Consultation Report.pdf	02.02	24 Feb 2017
2014_2015 research on preferences around interruptions.pdf	02.03	24 Feb 2017
2013_Key Research_Consumer Engagement-Price-Quality Report.pdf	02.04	24 Feb 2017
2013 Wairarapa Electricity Survey.pdf	02.05	24 Feb 2017
2014_Stakeholder Report_Engagement on Future Investment Plan_AMP 2013.pdf	02.06	24 Feb 2017
2016_Preliminary Findings from the Willingness to Pay consumer survey.pdf	02.07	24 Feb 2017
2015 PWC_Quantitative Consumer Research Results - Willingness to Pay and General Findings.pdf	02.08	24 Feb 2017

Title	Reference	Date
2015 PWC_Quantitative Consumer Research Results_VOLL.pdf	02.09	24 Feb 2017
2017 PWC Full Results from consumer survey.pdf	02.10	24 Feb 2017
2017 PWC Further analysis of customer survey.pdf	02.11	24 Feb 2017
2016_Key Research_Stakeholder Preferred Engagement.pdf	02.12	24 Feb 2017
2015 Board Paper_1186_Customer Engagement Programme.pdf	02.13	24 Feb 2017
2015 BAU+Consultation with Councils.pdf	02.15	24 Feb 2017
2015 PWC_Colmar Brunton Presentation to the Powerco Board_Survey Approach and Scope.pdf	02.16	24 Feb 2017
2015_Colmar Brunton - Qualitative Survey - Understanding Consumers' (and SMEs) Willingness to Pay.pdf	02.17	24 Feb 2017
Schedule of Pco Consultation Docs_230217.pdf	02.18	24 Feb 2017
Overview-document-Investing-in-your-energy-future.pdf	02.19.01	28 Feb 2017
Powerco_Have-Your-Say_24JAN17.pdf	02.19.02	28 Feb 2017
Example - CPP Rural advert 18.5x26.2cm.pdf	02.19.03	28 Feb 2017
Example Newspaper Insert - Powerco_Insert_BOP_Version 2.pdf	02.19.04	28 Feb 2017
Example Newspaper Ad - Powerco Manawatu Standard Tues 21 Feb 2017.pdf	02.19.05	28 Feb 2017
Example - Invitation to Powerco's 'Investing in Your Energy Future' Forum.msg	02.19.06	28 Feb 2017
Example Forum Slides - Wellington retailers forum.pdf	02.19.08	28 Feb 2017
Example CEO letter_Contact - Dennis Barnes.pdf	02.19.09	28 Feb 2017
Verifier Question and Answer Initial Summary Response_Q0016 Service Measures Levels and Quality Standard Variation	Ansarada Question ID 016	2 Mar 2017
2015 CPP Consultation Strategy based on a May 2016 submission.pdf	02.14	3 Mar 2017
Information provided since draft report		
Summary table_consideration of customer feedback.pdf	02.20	31 May 2017
CPP Core Consultation Database - Summary to CC_May 2017.xlsx	02.21	31 May 2017

2.3.2 IM requirements and our approach to assessment

This section aims to address the IM requirements for consumer consultation set out in Schedule G2(g) and G3 of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements. Schedule G3(d) requires verification of the extent and effectiveness of a CPP applicant's consultation with its consumers, as specified in clause 5.5.1 of the IM.

Box 5 – IM requirements for consumer consultation

Schedule G2(g) and G3, and clause 5.5.1 of the IM

Schedule G2:

The **verifier's** role, purpose and obligations include-

(g) prior to the **Commission's** assessment of the **CPP proposal**, providing an opinion on the extent and effectiveness of the **CPP applicant's** consultation with its **consumers**.

Schedule G3:

(1) The **verifier** to review, assess and report on:

...

(d) the extent and effectiveness of a **CPP applicant's** consultation with its consumers, as specified in clause 5.5.1 of the IM.

Clause 5.5.1(1):

By no later than 40 **working days** prior to submission of the CPP **proposal**, the **CPP applicant** must have adequately notified its **consumers**-

(a) that it intends to make a **CPP proposal**;

(b) of the expected effect on the revenue and quality of its electricity distribution services were the **Commission** to determine a **CPP** entirely in accordance with the intended **CPP proposal**;

(c) of the price versus quality trade-offs made in the expenditure alternatives considered in the intended **CPP proposal**, where these are directly associated with the rationale for seeking the **CPP proposal**, which are required to be disclosed under clause 5.4.2[14];

(d) if it intends to propose to include a **quality standard variation** under clause 5.4.5, why the proposed **quality standard variation** has been chosen over alternative quality standards;

(e) where and how further information in respect of the intended **CPP proposal** may be obtained;

(f) of the process for making submissions to the **EDB** in respect of the intended **CPP proposal**; and

(g) of their opportunity to participate in the consultation process required of the Commission by s 53T of the Act after any **CPP proposal** is received and considered compliant by the **Commission**.

Clause 5.5.1(2):

For the purpose of subclause (1)(e), where further information is available in hard copy only, the applicant must have ensured that any further information was readily available for inspection at the stated location.

Clause 5.5.1(3):

For the purpose of subclause (1), the **CPP applicant** must-

[14] A CPP proposal must contain a (a) detailed description of the CPP applicant's rationale for seeking a CPP; and (b) summary of the key evidence in the proposal supporting that rationale.

(a) provide all relevant information;

(b) provide information in a manner that promotes **consumer** engagement;

(c) make best endeavours to express information clearly, including by use of plain language and the avoidance of jargon; and

(d) provide **consumers** with (or notified them where to obtain) the information through a medium or media appropriate to the natures of the **consumer** base.

Compliance with clause 5.5.1(1)(d) is discussed in section 2.4.

Given the nature of consumer consultation, we have applied the following assessment techniques in analysing and considering the effectiveness of Powerco's consumer engagement:

- high level governance and process reviews, and
- desktop review.

We consider that the other assessment techniques are inappropriate for our verification of Powerco's consumer engagement obligations.

We met with Powerco on Friday 10 February 2017 to discuss its consultation program and have reviewed the consultation material prepared by Powerco including glossy brochures, web-based video vignettes, advertisements, and material prepared following various consultation forums summarising findings. We reviewed material made available by Powerco in hard and soft copy and digital format.

2.3.3 Our findings

Powerco's consultation program is supported by fit for purpose printed and electronic material, advertising and various consumer forums (including one-on-one, group, mass market consumer survey (willingness to pay), online surveys, targeted letters, and videos). The first step of its consultation program was to reach out to consumers on its CPP proposal and what it meant for them. Powerco has considered how consumer feedback will impact its CPP proposal.

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.

We think that Powerco has complied with the IM clause 5.5.1 requirements but note that the following areas could have been improved upon:

- A stronger link could have been made by Powerco between the CPP forecast expenditure and the service measures:
  - Questions put to consumers on price and quality trade-offs by Powerco are quite abstract and may lead to insufficient feedback being provided to assess customer preferences. For example, Powerco provided information against its four investment options to consumers for the key rationale[15] supporting the CPP by five key expenditure areas. Other than for the CPP option, the link to the level of costs and price impact is not clear for the expenditure areas (it is inferred through the impact on revenue), and for two of the key expenditure areas (net opex and vegetation management) the quality trade-offs have not been quantified for the alternatives.
  - It is noted that Powerco did test at an abstract level price-quality trade off (for example, through consumer surveys). We note that some other network businesses have provided more detailed information on the trade-offs being considered (e.g. $ reductions/ increases with the impact on service outcomes), and how the proposed expenditure requirements may impact individual consumers[16] (such as more granular price impact analysis).
- 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.

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

[15] That is providing safe, secure and resilient networks; investing in Powerco's communities and understanding and leveraging new technology.

[16] In presenting the price impact of its CPP, Powerco has shown a very simple illustrative impact on a typical residential electricity bill (consuming 8,000 kWh per year). We believe that more detailed customer analysis showing the impact by tariff classes and consumption bands within each tariff class would be more meaningful and provide consumers with a better understanding of the likely impact to them.

whilst some individual consumers or groups of consumers may have different views, Powerco's overall findings would remain materially the same.

2.3.4 Completeness and key issues for the Commission

The Commission may wish to investigate the price impact of the CPP on Powerco's customers at a more granular level to identify whether any customers are likely to receive unpalatable price increases.

2.4 Quality standard variations

2.4.1 Powerco proposal and our general observations

The Commission assesses each year the actual performance of EDBs against quality standards. Powerco is currently – under its DPP – subject to quality standards for both planned and unplanned SAIDI and SAIFI, with 50% weight applied to planned and 100% to unplanned. Major event days are excluded from the measures of SAIDI and SAIFI. If the Powerco's performance exceeds the specified levels in two out of three years then there is investigation by the Commission.

Powerco is proposing to vary its quality standard to:[17]

- revise the unplanned SAIDI and SAIFI targets, cap and collar for more recent performance data, while otherwise retaining the calculation method used by the Commission to set the DPP targets
- reducing the weight applied to planned SAIDI and SAIFI targets to 0%, which means that the planned SAIDI and SAIFI *forecasts* provided by Powerco are not intended to be used to set *targets* for these measures.

Powerco explain this is to support 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'.[18]

2.4.2 IM requirements and our approach to assessment

This section aims to address Schedule G3(2) of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

[17] Powerco, *Our proposed quality path*, 17 May 2017, Ansarada document number 04.02.03.12.

[18] Powerco, *Our proposed quality path*, 17 May 2017, Ansarada document number 04.02.03.12.

Box 6 – IM requirements for any quality standard variations

Schedule G3(2) of the IM:

Where the **CPP applicant** intends to propose a **quality standard variation** in the **CPP proposal** under clause 5.4.5, the **verifier** must review, assess and report on the extent to which the **quality standard variation** better reflects the realistically achievable performance of the **EDB** over the **CPP regulatory period**.

Our approach to assessment was:

- identify what, if any, quality standard variations Powerco proposes, including any proposed changes to service measures or levels
- consider the extent to which any proposed variations better reflect the realistically achievable performance of Powerco over the CPP period.

Table 6 presents the information that has been provided by Powerco in relation to the quality standard variation. We also relied on some information listed in Table 4 above to assess the realism of the proposed targets.

Table 6 – Information provided – quality standard variation

Title	Reference	Date
Planned quality model v2 [Read-Only].pdf	04.01.06	1 Feb 2017
Quality Note v2.docx	04.01.07	1 Feb 2017
Verifier Question and Answer Initial Summary Response_Q0016 Service Measures Levels and Quality Standard Variation	Ansarada Question ID 016	2 Mar 2017
Information provided since draft report		
Our Proposed Quality Path	04.02.03.12	17 May 2017
CPP SAIDI and SAIFI targets.xlsx	04.02.03.13	19 May 2017
CPP quality path - reference dataset - create.xlsx	04.02.03.14	19 May 2017

2.4.3 Our findings

We have interpreted the IM requirements as relating to the targets proposed by Powerco, rather than any proposed changes to the design of the incentive mechanism – such as placing 0% weight on planned SAIDI and SAIFI. Given that Powerco does not propose any targets for planned SAIDI and SAIFI, we focus our findings only on unplanned SAIDI and SAIFI.

In our view, Powerco's proposed unplanned SAIDI and SAIFI targets, normalised to remove major event days, are realistically achievable – in that it is realistic to assume that Powerco can deliver superior performance to them – because:

- as noted above, we consider that it is likely that Powerco's unplanned SAIDI and / or SAIFI performance will improve over the CPP period due to the proposed maintenance, vegetation management and asset renewal programs
- normalised SAIDI and SAIFI appears stable over the last five to ten years, in part due to reliability initiatives and asset renewals undertaken during that time.

We note that the method and data used to calculate the unplanned SAIDI and SAIFI targets appears appropriate. Powerco appears to have used the same method as applied by the Commission to set the DPP targets, with the only update to include more recent performance data.

We also note that in consulting with consumers on its proposed quality standard variation, Powerco did not explicitly consult on its proposal to place 0% weight on the planned SAIDI and SAIFI components. However, Powerco provided consumers with relatable information on quality to enable them to form a view on Powerco's plan to maintain current unplanned reliability over the proposed CPP period and into the future was acceptable if it meant a short-term increase in planned outages.[19]

No concern was expressed by consumers about the proposed increase in planned outages to accommodate the increased work, nor on any aspect related to SAIDI or SAIFI (planned or unplanned).

2.4.4 Completeness and key issues for the Commission

The information provided by Powerco on its proposed service measures was sufficient for us to undertake our verification. We are not aware of any information that we consider was omitted by Powerco.

We also have not identified any key issues relating to the proposed quality standard variation that we consider the Commission should focus on when undertaking its own assessment of the information. We note, however, that:

- if the expenditure forecasts change due to this assessment, then this may affect whether the proposed unplanned SAIDI and SAIFI targets remain realistically achievable
- if the Commission is concerned that the proposed expenditure initiatives are likely to improve unplanned SAIDI and SAIFI over the CPP period, then it may wish to consider using a forward-looking method – that picks up these improvements – to determine these targets.

[19] For example, see pages 13-14 and 25-26 of Powerco's consultation document titled "*Investing to ensure safety, security and resilience; 2018-2023 Investment Proposal; Have your say*".

3. Capital expenditure

In this chapter, we assess Powerco's forecast capex against the expenditure objective and the schedule G IM requirements. This required us to:

- form a view on Powerco's policies and planning approaches, assumptions, and forecast models
- summarise our conclusions from a detailed review of identified capex programs and projects.

This chapter is structured as follows:

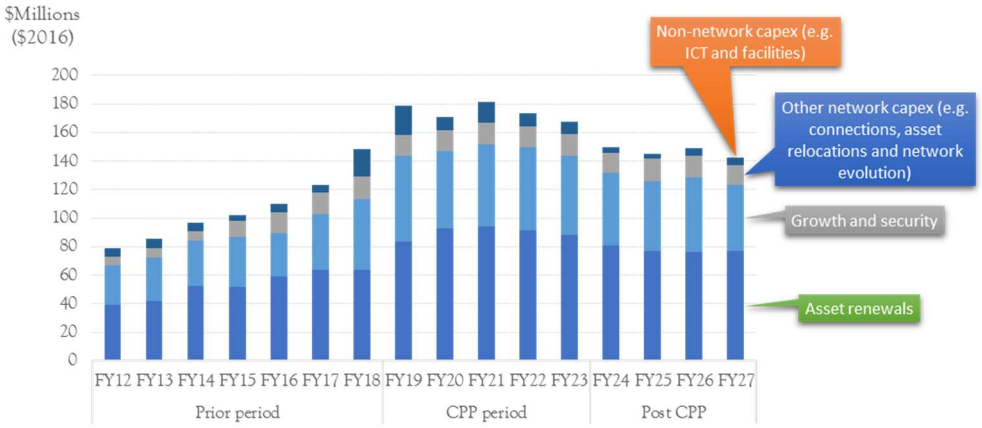
Heading	Sets out
Section 3.1	Findings on Powerco's forecast capex against the expenditure objective
Section 3.2	Findings on Powerco's policies and planning standards as they relate to its forecast capex
Section 3.3	Findings on key assumptions underpinning Powerco's forecast capex
Section 3.4	Conclusions from our review of identified capex programs and projects
Section 3.5	Findings on the deliverability of Powerco's forecast capex
Section 3.6	Findings on the asset replacement models used by Powerco to develop its forecast capex

3.1 Expenditure objective

3.1.1 Powerco proposal and our general observations

Powerco proposes capex over the CPP period of $873.0 million ($2016), as summarised in Figure 8. This compares to $581.0 million expected over the 2014 – 2018 period – an increase of $292.0 million ($2016), or 50%. Powerco initially proposed capex of $924.4 million ($2016) as indicated – which was an increase of $343.5 million ($2016), or 59.1%, and revised its forecast downwards following the draft verification report. The difference between its initial and revised forecasts is $51.5 million, 5.6%.

Figure 8 – Capex forecast



Source: Data from Powerco, graph prepared by us.

The increase in expenditure over the CPP period compared to the 2014-18 period is attributed by Powerco principally due to:

- increased levels of replacement of the overhead network, particularly overhead conductors, poles and cross arms
- increased replacement of zone substation transformers and indoor switchboards
- increased augmentation of zone substations to address energy at risk
- other network expenditure which is driven by the new network evolution program.

3.1.2 IM requirements and our approach to assessment

This section aims to address Schedule G5(2) of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

Box 7 – IM requirements for capex forecasts

Schedule G5(2):

Based on its analysis under this clause the **verifier** must provide its opinion on whether the applicant's forecast of total **capex** meets the **expenditure objective** and, if not identify-

(a) whether the provision of further information is required to enable assessment against the **expenditure objective** to be undertaken and, if so, the type of information required;

(b) which of the **CPP applicant's forecast capex programmes** for each **capex category** might warrant further assessment by the **Commission**; and

(c) what type of assessment would be the most effective.

We assessed Powerco's proposed capex against the requirements set out in Schedule G of the IM, which we detail further below. This involves assessing:

- Powerco's policies and planning standards and how these applied in developing the forecast expenditure
- the key assumptions and drivers that underpin the forecast expenditure and the models used to derive those forecasts
- selected capital projects and programs
- the deliverability of the forecast expenditure.

3.1.3 Our findings

The forecasts represent a significant uplift in expenditure in most capex categories, except for consumer connections and asset relocations. We acknowledge that Powerco is on a path of improvement with its asset management practices and recognise there is a need to manage deteriorating network condition, energy at risk and future network growth and that this need may warrant an increase in expenditure from current levels.

There are many components of Powerco's capex forecasts that support the expenditure objective such as:

- Powerco has, and appears to apply, a comprehensive range of policies and planning standards
- generally the forecasting methodologies applied, the models developed and the quality and robustness of those models do not appear inappropriate
- most assumptions applied by the development of the forecast do not appear to be unreasonable.

However, several components of Powerco's capex forecasts do not support the expenditure objective. These are:

- 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.
- Application of the current security standard would result in the application of an N-1 level of redundancy with no load at risk.[20] 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. Powerco maintains

[20] 'N-1' refers to Normal Minus one, where no consumer load would be placed at risk for the loss of a single item of network infrastructure.

that this will not have a material impact on the CPP forecast.[21] We have not been able to put a value on this uncertainty.

- 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; a key example being the target fault level adopted which directly leads to the volume of conductor replacements forecast, also driving around half of expenditure in the overhead structures renewal program. The portion unverified across the conductor and poles renewal programs is $58 million ($2016); allocated approximately 50% in each category.
- 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 result in an overstated volume of replacements required. The portion unverified is approximately $9 million ($2016).
- 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. The portion unverified is approximately $5 million ($2016).
- 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. The portion unverified is approximately $15 million ($2016).
- The level of proposed expenditure within the network evolution category appears higher than appropriate given the uncertainty in achieving the benefits. The portion unverified is approximately $8.1 million ($2016).

These issues are likely to result in an overstatement of expenditure, to an upper limit of $95 million ($2016) over the CPP period, approximately 11% of Powerco's forecast capex. This figure does not include uncertainty relating to the growth and security (major projects and minor works) programs.

The reasons for our view and findings are discussed in the following sub-sections, and are informed by our detailed review of capex projects and programs contained in appendix D. We also separately consider Powerco's proposed cost escalation of its capex and opex forecasts in section 5.4.

[21] Powerco, *Summary Of Powerco Feedback On The Draft Verification Report*, Appendix 1, p.4.

3.1.4 Completeness and key issues for the Commission

The information provided by Powerco on its proposed capex forecasts was largely sufficient for us to undertake our verification. We are not aware of any information that we consider was omitted by Powerco.

As noted above, we have identified several concerns with key aspects of Powerco's capex forecasts. When undertaking its own assessment of the information, we recommend that the Commission focus on:

- **Overhead conductors renewals** – undertake suitable investigation/analysis to assess the risks posed by distribution conductors failing, and hence the number of faults that can be expected on the network of a prudent EDB. Note this also applies to overhead structures renewals.
- **Overhead structures renewals** – recalculate Powerco's survivor curves based on asset replacements dates or, if unavailable, the defect data excluding green defects and the output of Powerco's expenditure forecast with the revised curves applied; and reflect any further assessment undertaken in the overhead conductors renewal program.
- **Zone substation renewal capex** – confirm with Powerco that its proposed replacement of transformers is prudent, given our findings (noted in section 3.4) that some proposed transformer replacements could be deferred beyond the CPP period.
- **Growth and renewals capex** – assess the value of lost load associated with each of the major projects and a sample of the minor works.
- **Reliability capex** – evaluate forecast reliability performance with the reliability program included to determine the level of expenditure required on reliability specific programs.
- **Network evolution** – engage with Powerco on its business cases for its network evolution initiatives, including on whether the expected benefits of each initiative are likely to outweigh the costs and the alternative options available.
- **Cost escalators** – the Commission may wish to procure its own cost escalator forecasts from a sufficiently qualified and independent third party to compare to those proposed by Powerco.

3.2 Policies and planning standards

3.2.1 IM requirements and our approach to assessment

This section aims to address Schedule G5(1) of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

Box 8 – IM requirements for capex policies and planning standards

Schedule G5 (1) of the IM:

The **verifier** must:

(a) Provide an opinion as to whether the-

(i) **policies**;

(ii) **planning standards**; and

(iii) ...,

relied upon by the **CPP applicant** in determining the **capex forecast** are of the nature and quality required for that **capex forecast** to meet the **expenditure objective**;

(b) provide an opinion as to whether the **capex forecast** has been prepared in accordance with the **policies** and **planning standards** at both the aggregate system level and for each of the **capex categories**;

Our approach to assessment is to obtain a list of relevant documents and to select a sample for review including those likely to be significant drivers of forecast expenditures. Documents are examined for:

- version control to show the status of the document and the appropriateness of approval levels
- clarity of content to show reliability in application and that clear and appropriate guidance is delivered
- key guidance is consistent with industry practice.

The application of the key policies and procedures is also tested at the project/program level, particularly to assess whether the application of the policy/procedure is correctly implemented and that this supports the achievement of the expenditure objectives. The results of these reviews are contained in appendix D.

3.2.2 Our findings

Powerco has a comprehensive set of policy and planning documents. In our opinion, based on our assessment in relation to this CPP proposal, the bulk of these documents appear of the nature and quality required for the capex forecast to meet the expenditure objective.

However, we believe that some of these documents and the practices that follow from them do not appear to be of that nature and quality. These are discussed below.

Planning/ZSS Growth & Security

Document 01.02.24 310S001 Security of Supply Classification - Zone Substations sets out the security standard for zone substations. It specifies a target for the duration of an outage. To achieve the target duration, most substations would require an N-1

deterministic standard to be adopted. Under this system, no load would be placed at risk for the loss of a single item of network infrastructure. This appears to be common practice in NZ, but is inconsistent with many overseas jurisdictions that adopt a probabilistic standard that seeks to minimise the costs of supply loss plus the cost of remediation.

The N-1 deterministic standard leads to earlier augmentation and hence higher remediation costs than if the standard allowed some energy to be placed at risk of loss. The approach leads to higher economic costs for consumers and is therefore inconsistent with the expenditure objectives. (We note that Powerco in practice does accept some load at risk. See our discussion in appendix D on programs C5, C6 and C7).

Renewals – Overhead structures

Asset management practices as related to overhead asset inspections are not adequate to meet the expenditure objectives for efficiency. This predominantly relates to the inspection of overhead structures.

For example, document 01.02.40 393S049 Overhead Network Inspections Standard - Maintenance - 4OH DOH SOH sets out the standard for pole inspections. Inspectors are required to assess whether a pole will remain serviceable for a period of five years, which is likely to lead to conservative assessment. Powerco has included all defected poles in its forecast, whereas in practice the poles are re-inspected during the project design phase. Powerco notes that replacement is often deferred as a result of re-inspection. We note that the initial defect date is also included in the defect data that is used to calculate the survivor curves and may lead to an over statement of replacement volumes.

Additionally, the prime test for determining the condition of a wood pole is a hammer and sound test, with drilling of poles not undertaken and more accurate testing equipment, such as ultrasound equipment, not yet widely used. This introduces uncertainty in the test results, leading to conservative assessments and earlier than needed replacement in some cases.

In our view, Powerco's inspection and assessment practices have resulted in an overestimate of replacement needs.

Renewals – Overhead conductors

Document 01.02.40 393S049 Overhead Network Inspections Standard - Maintenance - 4OH DOH SOH sets out the standard for inspection of overhead conductors. Inspectors are required to undertake a visual inspection, including looking for mechanical damage and corrosion.

Powerco acknowledges the limitations in assigning a condition score using visual inspection techniques and intend to develop a more robust inspection technique.[22] The inspection techniques mean that the condition of conductors cannot be accurately assigned and hence the level of conductor replacements may not be optimal. We note that Powerco has addressed this issue and moderated its forecast based on findings from our draft verification report.

Application to forecast expenditure

In our opinion, based on our assessment in relation to this CPP proposal, Powerco has prepared the capex forecast in accordance with the policies and planning standards available at the time, except for the following:

- Planning/ZSS Growth & Security: The security standard for zone substations specify a N-1 deterministic standard for most substations, whereas Powerco in practice does accept some load at risk and have undertaken a risk evaluation process to establish the appropriate level of forecast expenditures. Powerco states that it intends to review the standard and adopt a new approach that will apply during the CPP period, leading to forecasts being made on a different basis to actual future expenditures. This leads to uncertainty in the forecasts, with potential for over-forecasting.
- Powerco could demonstrate the prudency of its forecast expenditure by undertaking, for the largest and a sample of the smaller projects, an assessment of the value of energy at risk and the potential deferral of expenditures to achieve lowest cost to consumers.

3.3 Key assumptions

3.3.1 Our general observations

In our opinion, most of the assumptions used by Powerco to develop its capex forecast are appropriate and no evidence has been provided to suggest that they would not result in an expenditure forecast that meets the expenditure objective.

Some of Powerco's key assumptions relevant to the capex forecast, however, do not appear to be reasonable and are likely to result in an overstatement of expenditure. These are summarised in section 3.3.3 and explained in detail within the project and program reviews set out in appendix D.

[22] Powerco, *Overhead conductor fleet management plan*, December 2016, Ansarada document number 04.01.04.04.

3.3.2 IM requirements and our approach to assessment

This section aims to address Schedule G5(1) of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

Box 9 – IM requirements for capex key assumptions

Schedule G5(1) of the IM:

The **verifier** must:

(a) provide an opinion as to whether the-

...

(iii) **key assumptions**,

relied upon by the **CPP applicant** in determining the **capex forecast** are of the nature and quality required for that **capex forecast** to meet the **expenditure objective**;

...

(c) provide an opinion on the reasonableness of the **key assumptions** relevant to capex relied upon the **CPP applicant** including-

(i) the method and information used to develop them;

(ii) how they were applied; and

(iii) their effect or impact on the **capex forecast** by comparison to their effect or impact on **actual capex**;

Our approach to assessment was to:

- identify the assumptions relied upon by Powerco to develop its capex forecast
- review these assumptions against what we would expect to see for a prudent non-exempt EDB, in terms of both nature and quality
- review the method and information used to develop those assumptions, including any supporting models, business cases or strategy documents
- review how these assumptions were applied, including in the relevant capex forecast models
- consider the effect or impact of the assumptions on the proposed capex forecasts, including by considering their effect or impact on actual capex (where relevant).

3.3.3 Our findings

In our view, most of the assumptions made by Powerco in the development of its capex forecast are appropriate, and no evidence has been provided to suggest that these assumptions would not result in an expenditure forecast that meets the expenditure objective.

However, several of Powerco's key assumptions relevant to the capex forecast do not appear to be reasonable and are likely to result in an overstatement of expenditure. These are explained below:

- A network performance threshold (number of faults assumed to be reasonable) is a key driver of the conductor replacement forecast. The choice of threshold directly drives the volumes of conductor that needs to be replaced. The threshold assumed in the model[23] has not been adequately justified from an ALARP perspective for the safety driver or network performance perspective for the reliability driver. The forecast is very sensitive to this assumption as it also has an impact on the overhead structure forecast. We have recommended this warrants further assessment by the Commission.
- Defect dates are used rather than replacement dates for calculation of the survivor curves for poles and cross arms. Additionally, the inclusion of green defects for which replacement is often deferred adds further uncertainty to the forecast. Since green defects are likely to occur on younger assets, inclusion of the defect date in the survivor curve calculation will change the characteristic of the curve to have a higher failure rate at younger ages, not just result in a fixed shift in timing of replacement. Hence, inclusion of all green defected assets in the survivor curves is likely to result in an early replacement bias.
- Powerco plans to implement a new criticality framework in FY18 that will apply a risk based approach to prioritising asset replacements based on safety consequence. The framework will also form part of its defect management system. This change has potential to affect the replacement volumes required, with the likely outcome a reduction in volumes. Powerco has included factors in its models to account for efficiencies gained during the CPP period from a variety of changes to current practices, but have not clearly separated out the benefits due to this framework and other efficiencies they are expecting.
- Powerco assumed that the proposed capex works will result in unplanned reliability being maintained without any material improvement during the CPP period and supported this by modelling the impact of these works on forecast unplanned SAIDI and SAIFI. However, in our view, the modelling did not adequately account for proposed reliability improvement initiatives – and therefore the assumption that reliability will be maintained (and not improved) has not been demonstrated through the modelling provided. We consider that it is likely that the proposed capex works (in aggregate) will lead to some improvement in the unplanned SAIDI and SAIFI measures.

Key assumptions are discussed in detail below as part of our review of the selected capex projects and programs.

[23] Powerco, *2.2a Distribution Overhead Conductor Expenditure Fault Rate Model (Urban)*, Ansarada document number 04.02.01.04.

Our view on the key assumptions is also subject to the following limitation:

- The capex by program is adjusted for real input cost escalation based on escalators independently forecast by New Zealand Institute for Economic Research (NZIER) – although we consider that the labour and materials escalators determined by NZIER for Powerco do not appear unreasonable, we recommend that the Commission consider procuring its own forecasts from a suitably qualified third party as a cross check (see section 5.4 for further discussion).

3.4 Review of identified programs

3.4.1 Powerco proposal and our general observations

Although parts of the forecast do not appear unreasonable based on the information provided by Powerco, there are asset categories where we have identified the following general key issues:

- inclusion of data in models that is not appropriate or will likely result in a bias in the outcome of the model
- forecasting methodologies applied to some assets that are not considered good practice
- conservative assumptions or use of data.

These issues are likely to result in an overstatement of expenditure.

The following sections set out a summary of our findings for each of the identified projects and programs. Full details of our review are provided in appendix D.

3.4.2 IM requirements and our approach to assessment

This section aims to address the relevant requirements set out in Schedule G5 of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

Box 10 – IM requirements for G5(1) and (2)

Schedule G5(1) and (2) of the IM:

(1) The **verifier** must-

.....

(d) report conclusions of a detailed review of **identified programmes** that are **capex projects** or **capex programmes** including, but not limited to assessment of-

(i) whether relevant **policies** and **planning standards** were applied appropriately;

(ii) whether **policies** regarding the need for, and prioritisation of, the **project** or **programme** are reasonable and have been applied appropriately;

(iii) the process undertaken by the **CPP applicant** to determine the reasonableness and cost-effectiveness of the chosen solution, including the use of cost-benefit analyses to target efficient solutions;

(iv) the approach used to prioritise **capex projects** over time including the application of that approach for the **next period**;

(v) the **project** capital costing methodology and formulation, including unit rate sources, the method used to test the efficiency of unit rates and the level of contingencies included for **projects**;

(vi) the impact on other cost categories including the relationship with **opex**;

(vii) links with other **projects**;

(viii) cost control and delivery performance for **actual capex**;

(ix) the efficiency of the proposed approach to procurement; and

(x) whether it should be included as a **contingent project** or part of a **contingent project**;

(e) ...

(f) ...

(2) Based on its analysis under this clause the **verifier** must provide its opinion on whether the applicant's forecast of total **capex** meets the **expenditure objective** and, if not identify-

(a) whether the provision of further information is required to enable assessment against the **expenditure objective** to be undertaken and, if so, the type of information required;

(b) which of the **CPP applicant's forecast capex programmes** for each **capex category** might warrant further assessment by the **Commission**; and

(c) what type of assessment would be the most effective.

Our approach to assessment of the projects and programs was:

- identify and review the documentation including models used to justify each of the key projects or programs and alignment with business policies and standards
- assess the information provided against common industry practice, appropriateness of forecasting methodologies, models and inputs
- undertake staff interviews to clarify any concerns and submit any questions through the data room submission process that was established
- where available, consider benchmarking with other EDBs

- consider any relationships between project and programs with in the capex forecast and relationships with the opex forecasts and how these have been incorporated into the method or methods, or not
- review any methods used by Powerco to check the reasonableness of its capex.

We reviewed the following identified capital projects and programs:

- asset renewals
  - overhead structures
  - overhead conductors
  - zone substations
  - secondary systems
- growth and security
  - major projects
  - minor growth and security works
  - reliability
- other network capex
  - network evolution
  - ICT/IS capex.

3.4.3 Our conclusions

Our conclusions from this review are set out below. These conclusions inform our overall findings on capex, and our findings on other clauses within schedule G5 of the IM.

Renewals – overhead structures

The overhead structures replacement program aims to replace poles and cross arms that have deteriorated in condition or require replacement as a result of other drivers. Powerco proposes total expenditure of $177.6 million ($2016), 60.4% higher than the prior period. The primary objective identified by Powerco is to maintain the safety of the network.

Based on our assessment of the CPP proposal, the overall approach taken by Powerco to forecast replacements is appropriate and in-line with common industry practice. However, we consider that the overhead structure replacement program appears to be overstated because:

- the date of defects being used in the modelling rather than the date of replacement, the inclusion of green defects, and an inspection process that is likely to lead to conservative practices in the field (as evidenced by replacement of green defect poles being deferred) – which will lead to an overstatement of the replacement volumes

- the model does not explicitly track the reduction of backlog for poles or cross arms so the final level of backlog being held is not clear and may differ from the targets set out in the Fleet Management Plan – resulting in an overstatement of replacement volumes.

The portion unverified is up to $38 million ($2016), $29 million of this attributed to the conductor program, and the remainder due to the survivor curve issue. We note that any changes to the overhead conductor replacement program will have a direct impact on the volume of poles and cross arms forecast for replacement.

Renewals – overhead conductors

The overhead conductor replacement program aims to replace conductors with type issues, and to meet the expected future growth in the need for asset replacement due to deterioration of asset condition. Powerco proposes total expenditure of $55.2 million ($2016), 202.5% higher than the prior period. The primary objective identified by Powerco is to maintain the safety of the network and the secondary objective is to improve network reliability performance.

Based on our assessment of the CPP proposal, the forecast for the sub transmission conductor replacement and low voltage conductor replacement is reasonable because:

- the sub transmission conductor replacement forecast is based on known type issues and the estimated component is not material
- the low voltage conductors forecast is reasonable is based on common industry practice and uses reasonable assumptions.

However, in our view the program for replacement of distribution conductors is likely overstated as the need for the proposed step increase to the replacement program has not be clearly demonstrated because:

- although the need to have a safe network and the dangers of conductors falling to the ground are clear, Powerco has not proven that the expenditure meets the principle of as low as reasonably practicable (ALARP) and that the increased expenditure and planned SAIDI are prudent for the expected reduction in conductor fault rates
- there is uncertainty in the forecast model due to the unknown type and age of approximately 10% of distribution conductors. Subsequent to the draft verification report, Powerco moderated the forecast in recognition of this issue[24]; however a small uncertainty remains
- the data set used to calculate the aging curve includes conductor faults due to type issues – this curve is then applied to all conductor types and is likely to result in

[24] Powerco, *Final moderations to Verifier Base (v2) expenditure forecast*, 8th May 2017, p.3.

more rapid aging of the conductor fleet and therefore result in an overstatement of replacement

- total network reliability has not been considered in setting the target fault rate for conductors and therefore is likely to overstate the replacement required.

The portion unverified is up to $29 million ($2016).

Renewals – zone substations

The renewals – zone substations program aims to replace deteriorated assets that are located within a zone substation. Powerco proposes total expenditure of $71.7 million ($2016), 98.5% higher than the prior period. The increase in this category is driven by the increase in power transformer and indoor switchgear replacements. The primary objective identified by Powerco is to maintain the safety of the network.

Based on our assessment of the CPP proposal, the overall approach taken by Powerco to forecast replacements is appropriate and in-line with common industry practice.

In our view, the replacement of five transformers within the zone substation renewals category do not appear to be justified based on the outputs of the Asset Health Index (AHI) model and consideration of the energy at risk at the substations:

- the replacement year forecast by the AHI model for three transformers are in excess of five years beyond the end of the CPP period
- two transformers are located in substations with demand less than the substation N-1 rating meaning there is no load at risk and therefore an opportunity to defer expenditure.

We note that the forecast replacement of indoor switchgear is based on a prudent assumption for safety and that the forecasts for replacement load injection control plant and other zone substation assets appear reasonable. The portion unverified is up to $5 million ($2016).

Renewals – secondary systems

The renewals – secondary systems program aims to replace deteriorated assets. Powerco proposes total expenditure of $28.3 million ($2016), 160.2% higher than the prior period. The increase in this category is driven by the increase in power transformer and indoor switchgear replacements. The primary objective identified by Powerco is to maintain the safety of the network.

In our view, Powerco's proposed preventative maintenance and inspection expenditure does not appear unreasonable.

Our view is based on the following observations:

- the extend reserves scheme – an external driver is behind the program to comply with new requirements

- the forecast expenditure appears reasonable to meet the expenditure objective, except for part of the relay replacement program
- appropriate modelling has been undertaken to determine the forecast expenditures.

We note that Powerco has included allowance for a 10% contingency for a major expenditure item which may result in an overstatement of expenditure in the order of $926,900 ($2016, including capitalisation).

Growth and security – major and minor projects

The growth and security - major projects and minor growth and security program of works are necessary to ensure that the capacity of the network is adequate to meet the peak demand of customers at appropriate levels of reliability. Powerco proposes total expenditure of $264.6 million ($2016), 56% higher than the prior period.

The driver behind most of Powerco's proposed expenditure is security of supply. In most cases, the proposed increase from historical expenditure is due to Powerco not meeting its required security standard at present. Powerco developed the program to essentially deal with existing load at risk resulting from past growth. A minority of the expenditure is to meet new growth.

From the information made available it is not possible to make a definitive finding on the prudency of the expenditure proposed. It is clear that expenditure at levels greater than historical averages are required in order to meet the need to provide adequate security of supply and to meet ongoing ICP growth; however, we cannot be certain the prudent level of expenditure has yet been arrived at.

We note that the forecast expenditure returns the load at risk of interruption at a zone substation to a similar level to that existing in 2012, which does not appear unreasonable.

The prudency of the forecast for major projects and minor growth and security works could be demonstrated by further assessment of the value of lost load associated with each of the major projects and a sample of the minor works. The assessment would be to model unplanned reliability of each project or type of project based on an assumed value of consumer reliability. The aim would be to determine the optimal timing for a project based on minimising net costs to customers. Powerco has performed this calculation for some projects in the forecast period.

We have not been able to put a value on the uncertainty.

Growth and security – reliability

The growth and security – reliability program is generally related to improving the resilience of the network by introducing more automation and segmentation of feeders. Powerco proposes total expenditure of $21.3 million ($2016), 29.2% higher than the prior period. The primary objective identified by Powerco is to maintain the reliability

of the network to offset an expected decline in reliability as the network ages. A minor part of the program is to install Earth Fault Neutralisers.

Modelling of unplanned reliability supplied by Powerco to show the impact of renewals expenditures indicates that unplanned reliability would be maintained without the reliability program.[25] Hence, the inclusion of the reliability program could be expected to improve unplanned reliability. Given Powerco's intention to maintain rather than improve unplanned reliability, it is not clear that the majority of the reliability program is required.

It does appear that the types of expenditure carried out in the past and proposed for the future deliver cost effective outcomes; however, in the absence of a cost benefit analysis the appropriate level of expenditure cannot be verified. The portion unverified is up to $15 million ($2016).

Network evolution

The network evolution program is aimed at establishing a smart network and moving Powerco towards being a distribution system integrator over the next five to ten years, including providing for two way flows of electricity, allowing unfettered connection of localised generation and allowing customers to conduct energy transactions over the network. Powerco proposes total expenditure of $18.2 million ($2016), an increase of $14.3 million ($2016), or 370%. This increase is from a small base, with expenditure proposed to increase significantly from negligible amounts from 2014–2017 and $2.7 million in 2018. Individual projects range from developing battery storage and electric vehicle charging systems to investigating self-healing networks.

Based on our assessment of the CPP proposal, it appears reasonable for some research and development expenditures to be included in the CPP period.

However, we have not been able to determine the appropriate level of expenditures. Powerco has stated elsewhere that 'uptake rates of solar PV, energy storage devices and EVs on the network is extremely low and, at current growth rates, will not have a material impact within the next ten years'.[26] Although this statement is somewhat at odds with the plan to invest considerable capex during the CPP in this area Powerco maintain that 'R&D' work is required[27]:

> *The practical reality is that uptake rates for EV and PV are difficult to predict. Based on the experience in other jurisdictions we consider it prudent to invest in understanding and proving technology application to moderate the impact of future*

[25] Powerco, *Unplanned Regional Model 2017-4-17 - CPP - final draft*, Ansarada document number 04.02.03.11.01.

[26] Powerco, Response to item 6 of question ID 007, February 2017 .

[27] Powerco, Response to draft report, April 2017.

> *uptake, in advance of rapid update. This will enable us to phase in technology at a considered and appropriate rate as required.*

In our view capex of around $2 million ($2016) per annum would appear a more appropriate level of expenditure for this category. The portion unverified is therefore up to $8.1 million ($2016).

ICT

The ICT program is part of Powerco's non-network capex portfolio. Powerco proposes total expenditure of $53 million ($2016), an increase of $18.9 million ($2016), 55.1%. Approximately 70% of the expenditure is for maintaining existing capability while the remaining 30% is to provide new capability. The most significant item of expenditure ($23.2 million ($2016)) is for Powerco's project to implement a new ERP solution.

Based on our assessment of the documentation provided, the overall approach taken by Powerco to forecast the ICT program is appropriate and in-line with common industry practice, and appears to meet the expenditure objective because:

- the ERP project – while a significant component of the proposed increase in expenditure – has undergone a planning process in line with good industry practice, with:
  - business requirements documented and a process followed to determine the appropriate scope to meet these requirements
  - the project progressing along a path that would appear to lead to efficient expenditure based on the approach to market
- stripping out the costs for the new ERP, Powerco's proposed expenditure during and post the CPP period is in line with historical expenditure
- the need for expenditure on replacement of ICT assets is reasonable given that life of such assets is generally quite short.

3.5 Deliverability

3.5.1 Powerco proposal and our general observations

Powerco's field resource capability is delivered solely by external contractors, with no field staff employed by Powerco. Most of this capability is delivered by one contractor under two field services agreements (currently Downer), while many other contractors also provide field services to deliver capex or opex. Internal resources to support the field work are provided primarily from within the SONS opex function.

Powerco has recognised that the forecast increase in expenditure during the CPP period requires a delivery strategy that identifies the augmentation of capability and capacity required to ensure that the work can be delivered as planned. Powerco proposes to continue with its outsourced delivery model and has undertaken market sounding with

incumbent providers, obtaining commitments in principle to support the plans should proposed expenditure as currently planned proceed.

Powerco is also proposing to establish more formal agreements with the next tier of contractors, as well as increasing the volume of work delivered by the primary provider (currently Downer). Powerco's consideration of external resourcing requirements in detail – even to the extent of engaging with key suppliers and mapping resourcing requirements to regions, considering depot locations and recruitment lag times – is a reasonable approach.

Finally, Powerco also recognises that an uplift in internal capacity is required to support the increased work volume delivered by external contractors, and deliver other internally resourced projects, with some restructuring including addition of new capability, and appears to have considered internal resourcing requirements in quantum. However, it is less certain at this stage whether the logistics of procuring, training and integrating the significant step up in internal resources is achievable in the timeframes proposed, particularly for the uplift in capacity required within the SONS expenditure program.

3.5.2 IM requirements and our approach to assessment

This section aims to address Schedule G5(1)(e) of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

Box 11 – IM requirements for capex deliverability

Schedule G5(1) of the IM:

The **verifier** must-

(e) provide an opinion as to overall **deliverability** of work covered by the **capex categories** in the **next period**;

Our approach to assessment was to examine at an aggregate level along with a review of sampled projects/programs Powerco's planning with regards to delivery. At an aggregate level, this involved a review of Powerco's deliverability plan, proposed uplift in externally driven expenditure and the capacity of the market to provide the services required and be managed by Powerco, and the extent that internal resources need to be augmented.

The review of sampled projects/programs identified any unique or highly skilled resources required that may have some execution risks.

3.5.3 Our findings

In our view, the work proposed in the capex forecast over the CPP period does not appear undeliverable, with some limitations.

While the on-the ground deliverability plans are well advanced, there are risks around management bandwidth and the challenging timeframe assumed in the forecasts to mobilise projects and programs given the significant step up in proposed activity at the start of the CPP period.

We note that delivery risks result from:

- specific assets requiring renewal not yet being identified – having said that, this is not unreasonable at this point of time, and is a challenge that has been successfully managed by other networks
- the interplay between the capital and operating program – for example, if the SONS FTE increases are not attainable in time we expected there would be delay delivery of externally resourced capex and opex
- the lack of required internal resourcing to give effect to the delivery plan – Powerco is planning a significant increase in internal resources for some expenditure categories; based on our experience, significant internal restructures tend to take longer to complete than expected, with key roles often left vacant for some time.

We believe that Powerco can manage the above risks and therefore we do not envisage that Powerco will not be able to source the required resources based on the information that we have seen.

3.6 Asset replacement models

3.6.1 Powerco proposal and our general observations

Powerco developed several different approaches to model its assets and forecast replacement volumes and expenditure. The general methodologies applied in the models are:

- **Probabilistic** models using historical data to develop survivor curves then forecasting replacement based on asset population. These are generally considered good industry practice when applied appropriately.
- **Trending** models were used to forecast future performance, volumes or expenditure based on the continuation of historical trends or on a per unit basis to provide a relationship to changing work practices in the future. These are generally considered good industry practice when applied appropriately.
- **Condition based** models using actual condition inputs to determine individual asset health and forecast replacement date. These are generally considered good industry practice when applied appropriately and provided the input data is accurate and reliable with a known correlation to asset failures.
- **Age based** models used age as the key determinant for asset replacement. This was implemented both as a deterministic approach and as the basis for modelling asset performance. These are generally not considered good industry practice but are

acceptable when no other data is available and consideration is given to historical trends.

- **Discounted cash flow** models to compare project options on a financial basis.
- **Consolidation models** that were used to bring together forecasts from multiple related assets, adjust timing to address asset specific issues and calculate the final volumes and expenditure.

The models for each project and program reviewed were assessed in detail and the specific outcomes are set out in appendix D. Section 3.6.3 sets out our findings.

3.6.2 IM requirements and our approach to assessment

This section aims to address Schedule G5(1) of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

Box 12 – IM requirements for asset replacement models

Schedule G5 of the IM:

The **verifier** must-

(f) provide an opinion as to the reasonableness and adequacy of any asset replacement models used to prepare the **capex forecast** including an assessment of-

(i) the inputs used within the model; and

(ii) the methods the **CPP applicant** used to check the reasonableness of the forecasts and related expenditure.

Our approach to assessment of the models is:

- identify the models used to justify each of the key projects or programs and / or to support overall network performance
- review the appropriateness of the methodology utilised in each of these models against good practice, appropriateness for the asset type, and those likely to promote the expenditure objective
- identify the inputs to the model, investigate if the data source was appropriate, and how the inputs relate to key assumptions
- consider any relationships between the opex and capex forecasts and how these have been incorporated into the method or methods, or not
- review any methods used by Powerco to check the reasonableness of its capex forecasts.

3.6.3 Our findings

In our view, based on our assessment in relation to the CPP proposal, the overall approaches to asset replacement modelling do not appear unreasonable given the maturity of Powerco's management systems and availability of data.

However, in some cases, the methods do not appear to align with common industry practice for the assets that they are applied to and some inputs are not demonstrated to be appropriate or prudent to use. In our view, this is likely to result in an overstatement in forecast replacement expenditure. The amount of expenditure we were unable to verify based on the forecasting models was up to $72 million.[28] Hence, the models used to forecast the renewal capex have not been demonstrated to determine total expenditure that fully meets the expenditure objective.

We have separated our findings in the following sub-sections into an assessment of the methodology applied, how the model was implemented and the inputs used.

Forecasting method

The forecasting method is the approach taken to model the assets and can include any of the types listed above in section 3.6.1.

Key aspects of the methods applied that support the expenditure objectives are:

- a probabilistic approach to pole, cross arm and LV conductor replacements has been undertaken and is in line with common industry practice
- application of an asset health model to forecast replacement year of high value assets (power transformers) has been implemented
- known asset condition has been used to identify specific replacement requirements relating to overhead conductor and zone substation assets
- forecasts for major projects and other growth and security projects has been based on identified network constraint and technical analysis of the network.

Key aspects of the methods applied that do not support the expenditure objectives are:

- The deterministic model for overhead conductor replacement using age as the basis for trending the rate of failure – this is an age based replacement model and all conductor types were 'aged' at the same rate, a simplification which we consider inappropriate.

[28] Refer to section **Error! Reference source not found.**. The $72 million is made up of $58 million related to the overhead conductor renewal capex program (as per Powerco response to question Ansarada document number 014), $9 million related to the overhead structures renewal capex program (estimated by review team at up to $9 million e.g. approximately 5% of the overall program) and $5 million related to the zone substation replacement program (deferral of transformers beyond CPP).

- By applying the same aging curve for all conductor types, when the data underlying the aging curve includes type issue assets with higher fault rates, is likely to increase the forecast increase in failure rate and therefore volumes requiring replacement – we note that proximity to the coast was appropriately considered.

Forecasting model

The forecasting model is how the forecasting method described above is applied, and includes the software tool used (typically MS Excel), the structure of the model and formulae applied.

Key aspects of models that support the expenditure objectives are:

1. most models were well constructed and included cover pages, explanation and separation of inputs, calculations and outputs – this resulted in a reliable and consistent suite of models and provided confidence in their robustness
2. use of a standard template for discounted cash flow analysis to assess the options for growth and major projects – this provided consistency and robustness in the assessment of options between all staff and facilitated review.

Key aspects of models applied that do not support the expenditure objectives are:

1. limited validation of volume or expenditure forecasts. Sensitivity analyses were only undertaken upon our request – no other validation was provided with the original analysis and development of the expenditure forecast
2. some models did not follow good practice, specifically, there were often hard coded variables contained within equations and equations that changed between years – this increases the difficulty of review to ensure all equations are understood, implemented correctly and limits the ability to test the model.

Model inputs

The inputs are the data used by the model to calculate the forecast volume and expenditure. This can include network data extracted from databases, outputs from other models and assumptions.

Key aspects of the inputs use that support the expenditure objectives are that, in general:

1. historical or market unit rates have been used to calculate the expenditure forecast
2. actual network data was used, where available, to identify trends or calculate input values rather than making assumptions.

Key aspects of the inputs use that do not support the expenditure objectives are:

1. some data has not been proven to be appropriate for inclusion in the models, particularly the inclusion of green defects[29] in the calculation of survivor curves for poles and cross arms. It is likely that including this data will result in a curve with higher probability of asset failure at young ages than would be expected in practice and therefore may result in an overstatement of renewal expenditure
2. several inputs to the unplanned reliability model had adjustments made to the raw data using hard coded values. [30] The reason and value of the adjustment were not justified.

[29] A green defect is a condition assessment of an asset that requires replacement within three years.

[30] Such as the 'SAIDI per asset workbook'; refer Appendix E for further detail.

4. Operating expenditure

In this chapter, we assess Powerco's forecast opex against the expenditure objective and the schedule G IM requirements. This required us to:

- form a view on Powerco's policies and planning approaches, assumptions, drivers, forecasting methodologies, and forecast models
- summarise our conclusions from a detailed review of identified opex programs and projects.

This chapter is structured as follows:

Heading	Sets out
Section 4.1	Findings on Powerco's forecast opex against the expenditure objective
Section 4.2	Findings on Powerco's policies and planning standards as they relate to its forecast opex
Section 4.3	Findings on key assumptions underpinning Powerco's forecast opex
Section 4.4	Findings on drivers underpinning Powerco's forecast opex
Section 4.5	Conclusions from our review of identified opex programs and projects
Section 4.6	Findings on any opex reduction initiatives proposed by Powerco
Section 4.7	Findings on the deliverability of Powerco's forecast opex
Section 4.8	Findings on the models and forecasting methods used by Powerco to develop its forecast opex

4.1 Expenditure objective

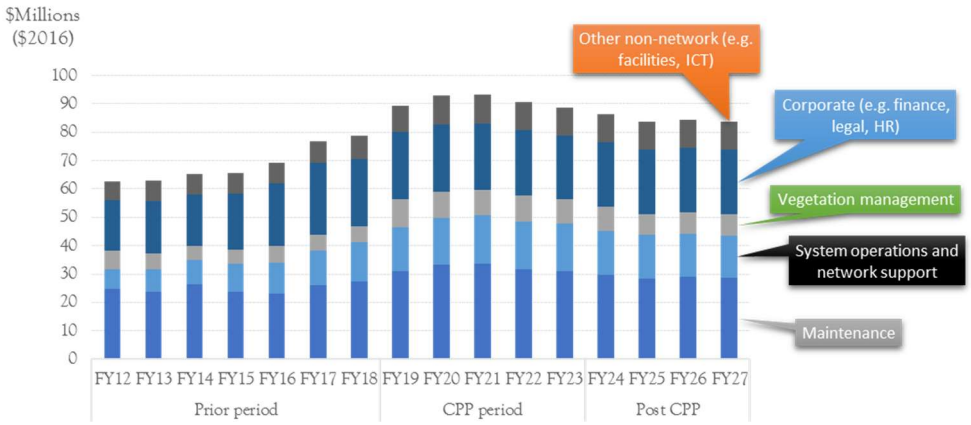
4.1.1 Powerco proposal and our general observations

Powerco proposes opex over the CPP period of $454.6 million ($2016), as summarised in Figure 9.[31] This compares to $355.9 million expected over the FY14 to FY18 period – an increase of $98.7 million ($2016), or 27.7% per cent. Powerco initially proposed opex of $477.7 million ($2016) as indicated which was an increase of $121.8 million ($2016), or 34.2%, and revised its forecast downwards following the draft verification report. The difference between the initial and revised forecasts is $23.1 million, 4.8%.

[31] All values in this report are in real $2016, unless otherwise stated. These values are often identified as '$2016' for short. All values exclude cost escalation, unless otherwise stated.

As with capex, the forecasts represent a significant uplift in expenditure in all opex categories, except reactive maintenance, facilities, and insurance and governance. We acknowledge that Powerco is on a path of improvement with its asset management practices and recognise there is a need to manage deteriorating network condition and a backlog of faults, and that this need may warrant an increase in expenditure from current levels.

Figure 9 – Opex forecast



Source: Data from Powerco, graph prepared by us.

The proposed increase in expenditure is principally due to:

- a drive to reduce the number of defects on the network by increasing expenditure on preventative maintenance and inspection, and corrective maintenance
- increased activity required to support the proposed increase in capex, including by corporate business units
- a change in approach to vegetation management, including additional corporate staff
- additional capability and capacity added to Powerco's system operations and network support activities.

4.1.2 IM requirements and our approach to assessment

This section aims to address Schedule G6(2) of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

Box 13 – IM requirements for opex overall

Schedule G6(2) of the IM:

Based on analysis in accordance with this clause, the **verifier** must provide an opinion on whether the **CPP applicant's** forecast of **total opex** meets the **expenditure objective** and, if not, identify-

(a) whether the provision of further information is required to enable assessment against the **expenditure objective** to be undertaken and, if so, the type of information required;

(b) which of the **CPP applicant's** forecast **opex programmes** for each **opex category** might warrant further assessment by the **Commission**; and

(c) what type of assessment would be the most effective.

We assessed Powerco's proposed opex against the requirements set out in Schedule G of the IM, which we detail further below. This involves assessing:

- Powerco's policies and planning standards and how these applied in developing the forecast expenditure
- the key assumptions and drivers that underpin the forecast expenditure and the models used to derive those forecasts
- selected operating programs
- any proposed expenditure reduction initiatives
- the deliverability of the forecast expenditure.

4.1.3 Our findings

Powerco has used the AER's 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. Some of the maintenance and SONS step changes (above Powerco's FY16 opex) proposed by Powerco we characterise as base year expenditure that a prudent operator would likely incur.

We also consider that most of Powerco's opex forecast does not appear inconsistent with the expenditure objective. However, we have formed the view that Powerco's opex forecast and supporting assumptions for the CPP period do not *fully* meet the expenditure objective because:

- 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 and that these outweighed the $8.9 million ($2016) cost of the step change.
- 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. These new FTEs contribute most of the $18.4 million ($2016) in corporate step changes.

These issues are likely to result in an overstatement of expenditure, up to approximately $27.3 million ($2016) over the CPP period, or approximately 6% of Powerco's forecast opex.

We note that some of the expected benefits resulting from the proposed SONS step changes are reflected in assumed efficiencies built into Powerco's expenditure forecasts for FY22 and FY23. If this step change did not occur, then we would expect these efficiencies to reduce.

We also note that there are interdependencies between the various maintenance expenditure programs. Although Powerco has not necessarily modelled these directly, it has applied a general cost efficiency over the forecasts for FY22 (half year efficiency) and FY23 (full year efficiency). We could not validate that the assumed efficiencies adequately address the interdependencies; however, we do not think that it is unreasonable in the circumstances.

The reasons for our view and findings are discussed in the following sub-sections, and are informed by our detailed review of opex projects and programs contained in appendix D. We also separately consider Powerco's proposed cost escalation of its capex and opex forecasts in section 5.4.

4.1.4 Completeness and key issues for the Commission

The information provided by Powerco on its proposed opex forecasts was largely sufficient for us to undertake our verification. We are not aware of any information that we consider was omitted by Powerco.

As noted above, we have identified several concerns with key aspects of Powerco's opex forecasts. When undertaking its own assessment of the information, we recommend that the Commission focus on:

- **System operations and network support** – engage with Powerco on its business cases for its strategy-driven step changes or initiatives, including on whether the expected benefits of each initiative are likely to outweigh the costs and the alternative options available. This may include demonstrating the ongoing opex is justified by benefits – whether financial or non-financial – on an NPV basis.
- **Corporate services** – engage with Powerco on the business cases for the FTE increases, including on the expected benefits from and proposed salaries for the extra staff.
- **Cost escalators** – the Commission may wish to procure its own cost escalator forecasts from a sufficiently qualified and independent third party to compare to those proposed by Powerco.

4.2 Policies and planning standards

4.2.1 Powerco proposal and our general observations

Powerco has a comprehensive set of policy and planning documents covering all the core aspects of the business that we would expect in other large organisations. Powerco provided us with a list of these policies and planning standards and any specific policies and planning standards that we sought to review.

Powerco is developing new strategies for delivery of several of its network opex functions, including vegetation management and maintenance, which have led to higher than historical expenditures forecast for the CPP period.

4.2.2 IM requirements and our approach to assessment

This section aims to address Schedule G6(1)(a) and (b) of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

Box 14 – IM requirements for policies and planning standards relevant to the opex forecasts

Schedule G6(1)(a) and (b) of the IM:

The **verifier** must-

(a) provide an opinion as to whether the–

(i) **policies**,

(ii) **planning standards**; and

(iii) **key assumptions**,

relied upon by the **CPP applicant** in determining the **opex forecast** are of the nature and quality required for that **opex forecast** to meet the **expenditure objective**;

(b) provide an opinion as to whether the **opex forecast** has been prepared in accordance with the **policies** and **planning standards**, at both the aggregate system level and for each of the **opex categories**;

Our approach to assessment was to:

- review the list of policies and planning standards that Powerco has and identify those considered most relevant to developing the opex forecasts
- review the identified policies and planning standards against what we would expect to see for a prudent non-exempt EDB, in terms of both nature and quality
- as part of our review of selected opex projects and programs, review how the policies and planning standards were applied when developing the opex forecasts.

4.2.3 Our findings

Nature and quality

In our view, based on our assessment in relation to this CPP proposal, the bulk of these documents appear of the nature and quality required for the opex forecast to meet the expenditure objective.

However, in our view some of these documents and the practices that follow from them do not appear to be of that nature and quality. Specifically,

- Asset management practices in some cases do not appear adequate to meet the expenditure objectives for efficiency – for instance, when inspecting wooden poles inspectors are required to assess whether a pole will remain serviceable for a period of five years. However, no further inspections are scheduled for such green defected assets, other than during the design phase, which means that the assessment is conservative by its nature, likely leading to earlier than needed replacement in some cases. Network businesses in Australia typically program additional inspections on a yearly basis by exception to reassess a pole's condition and only replace when required.
- Additionally, the prime test for determining the condition of a wood pole is crude (i.e. a hammer and sound test, with drilling of poles not being undertaken and more certain testing by ultrasound equipment still to be widely used). This leads to some uncertainty in the test results, any may further lead to conservative assessments and earlier than needed replacement in some cases, though we view the impact on the forecast as immaterial due to the proportion of timber poles being replaced in the program being quite low.

For completeness, we note that Powerco's capitalisation policy also appears of the nature and quality required for the opex forecast to meet the expenditure objective. We are, however, not aware of any policies that relate directly to cost allocation and so cannot provide an opinion on whether these are of the nature and quality required for the opex forecast. We also note that cost allocation was explicitly removed from Schedule G of the IM in the amendments made in December 2016.

Application to forecast expenditure

In our view, based on our assessment in relation to this CPP proposal, Powerco has generally prepared the opex forecast in accordance with the policies and planning standards available at the time.

4.3 Key assumptions

4.3.1 Powerco proposal and our general observations

Powerco's opex forecast is based on several key assumptions, including that:

- there is a need to adopt a new strategy for vegetation management across its network (include a three-year cutting cycle)
- there is a need to ensure compliance, safety, support for proposed network capex work, and planned asset management – and that the proposed opex (when combined for the proposed capex) will achieve this
- it is reasonable to rectify the existing backlog of amber defects over the CPP period
- current corporate opex is not sufficient to deliver the corporate services needed to support the network over the CPP period
- the asset management capability requires enhancement, leading to ISO 55000 certification enabled, which coupled with an increased network investment and analysis focus will lead to network capex and opex investment efficiency at least cost to consumers over time
- substantially more work is required to improve the extent and accuracy of asset performance and condition data, to support improved analysis and optimal future investment decision making
- provision of new functions within the SONS portfolio will have a net benefit for consumers.

These are explained within the documents provided by Powerco – including in response to questions that we raised – and reflected in the underlying opex forecast models.

4.3.2 IM requirements and our approach to assessment

This section aims to address Schedule G6(1)(a) and (c) of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

Box 15 – IM requirements for key assumptions

Schedule G6(1)(a) and (c) of the IM:

The **verifier** must

(a) provide an opinion as to whether the–

(i) **policies**,

(ii) **planning standards**; and

(iii) **key assumptions**,

relied upon by the **CPP applicant** in determining the **opex forecast** are of the nature and quality required for that **opex forecast** to meet the **expenditure objective**;

(c) provide an opinion on the reasonableness of the **key assumptions** relevant to **opex** relied upon by the **CPP applicant** including-

(i) the method and information used to develop them;

(ii) how they have been applied; and

(iii) their effect or impact on the **opex forecast** by comparison to their effect or impact on **actual opex**;

Our approach to assessment was to:

- identify the assumptions relied upon by Powerco to develop its opex forecast
- review these assumptions against what we would expect to see for a prudent non-exempt EDB, in terms of both nature and quality – this included review of the practices that we see other EDBs undertake in relation to pole extensions, vegetation management, and conductor replacement
- review the method and information used to develop those assumptions, including any supporting models, business cases or strategy documents
- review how these assumptions were applied, including in the relevant opex forecast model
- consider the effect or impact of the assumptions on the proposed opex forecasts, including by considering their effect or impact on actual opex (where relevant).

4.3.3 Our findings

In our view, Powerco's key assumptions relevant to the opex forecast are not unreasonable, except for the following:

- the level of uplift in expenditure within the SONS category has not been fully demonstrated to us
- although Powerco has built some cost savings into its opex forecasts to reflect proposed asset renewal expenditures – e.g. a 5% moderation of corrective maintenance forecasts and a 1% moderation of reactive maintenance forecasts, both starting in part from the fourth year of the CPP period – we consider that:
  - the assumption that no cost savings would occur before the fourth year is unsupported and we would expect some savings as the asset renewal program was rolled out earlier in the CPP period
  - the assumption that replacement of some older assets with modern equivalents, for example replacement of a large portion of electromechanical and static protection relays with numerical relays under the secondary systems capex program, will not result in cost savings for any maintenance opex categories is not supported and we would expect that reduced asset failures

should result in a reduction in corrective and reactive maintenance for all asset categories,

although the impact of these cost savings on forecast expenditures is likely to be immaterial during the CPP period.

Each exception is discussed further below as part of our review of the selected opex projects and programs.

Our view is also subject to the following limitations:

- The opex by program is adjusted for real input cost escalation based on escalators independently forecast by New Zealand Institute for Economic Research (NZIER) – although we consider that the labour and materials escalators determined by NZIER for Powerco do not appear unreasonable, we recommend that the Commission consider procuring its own forecasts from a suitably qualified third party as a cross check (see section 5.4 for further discussion).
- No obvious forecast productivity improvement or economies of scale efficiencies are included within the rate of change of the base, step and trend method used to forecast opex – although Powerco did apply top down efficiency adjustments to its FY22 and FY23 opex forecasts, which may account for productivity or scale efficiencies.

Both limitations may warrant further consideration by the Commission in making its determination on Powerco's CPP.

4.4 Drivers

4.4.1 Powerco proposal and our general observations

As part of our review of the selected opex projects and programs, we identified the following key opex drivers that are not directly covered by the key assumptions noted above:

- the significant increase in the capital program will require a significant increase in the number of volume-driven FTEs within the system operations and network support program – this increases forecast opex over the CPP period by $8.1 million ($2016)
- a significant increase in the number of strategy-driven FTEs within the system operations and network support program is needed to support Powerco's corporate and asset management objectives, including:
  - a drive to improve asset management practice generally, achieve ISO55,000 certification, and move from reactive to proactive maintenance practices
  - a need to meet changing consumer expectations with respect to contact with Powerco staff during outages
- this increases forecast opex over the CPP period by $21.0 million ($2016)

- current corporate opex is insufficient to support the proposed increase in other expenditure over the CPP period
- a change in maintenance strategy required partially to rectify a growing pool of defects and rising risk – this increases forecast opex over the CPP period on a 'one off' basis by approximately $10.8 million ($2016, excluding capitalisation allowance).

4.4.2 IM requirements and our approach to assessment

This section aims to address Schedule G6(1)(d) of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

Box 16 – IM requirements for opex drivers

Schedule G6(1)(d) of the IM:

The **verifier** must-

(d) review, assess and report on any other **opex** drivers not covered by the **key assumptions** that have led to an increase in the **opex** forecast including whether the quantum of such an increase is required to meet the **expenditure objective**;

Our approach to assessment was to:

- identify other opex drivers not covered by the key assumptions that have led to an increase in the opex forecast
- review whether those drivers are appropriate, including by reference to our review of the selected opex projects or programs
- identify the impact of these drivers on the opex forecast and consider whether the increase is required to meet the expenditure objective.

4.4.3 Our findings

Our findings on the opex drivers are further discussed as part of our review of the selected opex projects and programs. In summary, in our view is that:

- it is not unreasonable to forecast an increase in FTEs required to support the proposed increase in capex, if the capital program itself is reasonable and the increase in the FTEs is forecast to decline in line with that program
- the significant step in strategy-driven FTEs does not appear required to meet the expenditure objective based on the information that we have seen (see section 4.5.3 below for further discussion)
- it is not unreasonable to increase corporate expenditure above that in the base year to cover the increase in activity expected over the CPP period – however, we have not seen sufficient evidence to support the size of the proposed increase (see section 4.5.3 below for further discussion)

- the change in maintenance strategy is not unreasonable given the demonstrated need to deal with a rising volume of defects and risk profile
- a change in approach to vegetation management is not unreasonable.

4.5 Review of identified programs

4.5.1 Powerco proposal and our general observations

Powerco proposes several opex programs covering a range of network and non-network activities. We selected five of these programs for detailed review and the outputs from this review are set out in appendix D. Our approach to selecting these programs is explained in appendix C.

4.5.2 IM requirements and our approach to assessment

This section aims to address Schedule G6(1)(g) of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

Box 17 – IM requirements for identified opex programs

Schedule G6(1)(g) of the IM:

The **verifier** must-

(g) report conclusions of a detailed review of **identified programmes** that are **opex projects** or **opex programmes**, but is not limited to, an assessment of-

(i) whether relevant **policies** and **planning standards** were applied appropriately;

(ii) whether **policies** regarding the need for, and prioritisation of, the **project** or **programme** are reasonable and have been applied appropriately;

(iii) the process undertaken by the **CPP applicant** to determine the reasonableness and cost-effectiveness of the chosen solution, including the use of cost-benefit analyses to target efficient solutions;

(iv) the approach used to prioritise **opex projects** over time including the application of that approach for the **next period**;

(v) the **project operating cost** methodology and formulation, including unit rate sources, the method used to test the efficiency of unit rates and the level of contingencies included for **projects**;

(vi) the impact on other cost categories including the relationship with **capex**;

(vii) links with other **projects**;

(viii) cost control and delivery performance for **actual opex**;

(ix) the efficiency of the proposed approach to procurement; and

(x) whether it should be included as a **contingent project** or part of a **contingent project**;

Our approach to assessment of the projects and programs was to:

- identify and review the documentation including models used to justify each of the key projects or programs and alignment with business policies and standards
- assess the information provided against common industry practice, appropriateness of forecasting methodologies, models and inputs
- undertake staff interviews to clarify any concerns and submit any questions through the data room submission process that was established
- where available, consider benchmarking with other EDBs
- consider any relationships between project and programs within the opex forecast and relationships with the capex forecasts and how these have been incorporated into the method or methods, or not
- review any methods used by Powerco to check the reasonableness of its opex.

We reviewed the following identified programs:

- maintenance:
  - preventative maintenance expenditure and inspections
  - corrective maintenance
  - reactive maintenance[32]
- vegetation management
- system operations and network support
- corporate services.

4.5.3 Our conclusions

Our conclusions from this review are set out below. These conclusions inform our overall findings on opex, and our findings on other clauses within schedule G6 of the IM.

[32] Although we did not nominate reactive maintenance as a selected program under IM schedule G4, we did consider the program given its interdependence with the corrective maintenance and presentation maintenance and inspection programs that we did nominate.

Maintenance – overall

Powerco has three maintenance opex portfolios, which are shown below together with the broadly speaking Commission benchmarking categories (in brackets):

- preventive maintenance and inspection (routine maintenance and inspection)
- corrective maintenance (asset replacement and renewal)
- reactive maintenance (service interruptions and emergencies).

Preventive maintenance and inspection

Based on our assessment of the CPP proposal, the FY16 base year does not appear inefficient when total opex is compared to similar expenditure incurred by other NZ EDBs – and so appears to be a reasonable starting point for applying the base, step and trend method.

The change from a largely reactive to a more proactive maintenance approach is prudent.

Corrective maintenance

In our view, Powerco's proposed preventative maintenance and inspection expenditure does not appear unreasonable.

Our view is based on the following observations:

- the adjusted[33] FY16 base year is comparable to similar expenditure incurred by other NZ EDBs – and so appears to be a reasonable starting point for applying the base, step and trend method
- the change from a largely reactive to a more proactive maintenance approach is prudent
- appropriate modelling has been undertaken to determine the forecast expenditures
- the revised forecast has dealt with any issues we originally had with this category.

Although there is a limitation with the proposed forecast, we do not consider that these materially affect our view above. The limitation is not to do with corrective maintenance but reactive maintenance; there should be some benefits apparent towards the end of the CPP period as defects are rectified before they become 'red defects' requiring

[33] Powerco adjusts its FY16 base year corrective maintenance expenditure, in real terms, to reflect the average over FY12 to FY15. This adjustment adds over $4 million ($2016) to the expenditure forecast. Powerco state that this adjustment is needed because FY16 is not represent an efficient level of spend. See Powerco, *Corrective maintenance POD*, December 2016, pp. 7–8, Ansarada document number 04.01.05.03.

reactive or emergency work. In any case Powerco has made a cost efficiency adjustment somewhat mitigating this limitation.

Reactive maintenance

While not subject to a detailed review we note that expenditure forecast under this category is essentially flat with minor increases due to forecast minor growth in network scale. With a change in approach to a more proactive maintenance regime it is logical that reactive maintenance, that is responding to faults that have to be rectified on a reactive and sometimes emergency basis, would reduce by some degree.

Powerco has somewhat addressed this by incorporating a top-down cost efficiency reduction, however in our view there is a likelihood of greater cost savings available. We are also of the view these would be immaterial in the CPP period. The 'top down' cost savings incorporated were outlined in general terms in Powerco's document 'Asset Management Capability Enhancement Business Case' (Ansarada document number 04.01.11) and in exact dollar terms in the forecast cost model (Ansarada document number 03.09.45).

Vegetation management

Vegetation management is undertaken generally in accordance with Electricity (Hazards from Trees) Regulations 2003 (Tree Regulations), which state that Powerco is responsible for the first cut, while the tree owner is responsible for the second and subsequent cuts. The vegetation management program is to manage vegetation growing near the electricity network.

Powerco's historical costs are based on a largely reactive approach to vegetation management, where cutting or other vegetation management activities are undertaken only when Powerco becomes aware that a tree does not meet the clearance requirements set out in the tree regulations. Forecast costs are based on the introduction of cyclic cutting on a three-year cycle in all areas, an approach that appears to be prudent. Cyclic cutting was introduced into one planning region and the intent is to move the remaining regions to the same basis over a five-year period. In the CPP period, the forecast costs also include expenditure to address the tree site backlog. Powerco states that approximately $7.5 million ($2016) per year is needed to reflect a three-year cutting cycle with the remainder being associated with backlog.

In our view, Powerco's proposed vegetation management expenditure does not appear unreasonable.

Our view is based on the following observations:

- transitioning to a three-year cutting cycle is consistent with good industry practice and is appropriate to meet the regulatory requirements
- appropriate modelling has been undertaken to determine the forecast expenditures.

Although there are several limitations with the proposed forecast, we do not consider that these materially affect our view above. These limitations – which are acknowledged by Powerco[34] – include:

- estimates of work volumes are uncertain, but based on best information from trials
- assumptions about unit costs do not include any economies of scale, however, it is uncertain if these can be achieved
- the portion of costs to be borne by tree owners for second cuts could be increased more quickly than forecast.

System operations and network support (SONS)

SONS covers Powerco's internal costs to manage and operate the network, including management of all network capex and opex. The total increase from historical expenditure of $27.4 million ($2016) includes volume driven step changes of $5.3 million ($2016), strategy driven step changes of $12.9 million ($2016), data quality and asset management capability step changes of $6.6 million ($2016) and $1.5 million ($2016) relating to the ISO55000 compliance goal. Approximately $3.2 million ($2016) of the strategy driven step changes is attributed to 'Future Networks' operating expenditure.

Powerco has justified the volume-driven changes by demonstrating the link between outsourced capex and opex and required number of FTEs to manage the works. This includes contract delivery and network operations centre FTEs.

Strategy-driven changes have been justified as supporting Powerco's strategy, which supports improvements in asset management, investment decision making, a new customer contact centre among other activities not carried out now. Powerco provided preliminary business case documentation for the asset management strategy and the customer contact centre, along with estimates of the net benefits in the longer term including making downward adjustments during the CPP period for other expenditure categories. While this has undertaken some preliminary analysis of the longer term benefits we are unable to verify all the proposed expenditure; specifically relating to the additional FTEs referred to in Powerco's forecast model as for future networks, network analytics and investment optimisation.

Based on our assessment of the information made available, the volume driven step changes appear reasonable. We note that the forecast assumes an increase in headcount for service delivery – which includes capital program contract management. We would expect to see this reduce after the CPP period as the volume of activity proposed for that period reduces.

[34] Powerco response to question Ansarada ID 011.

Most of Powerco's proposed SONS expenditure does not appear unreasonable. However, in our view, Powerco has not sufficiently demonstrated that the proposed increase in SONS FTEs included within the strategy-driven step changes 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 and that these benefits outweighed the $8.9 million ($2016) cost of these step changes.

Our view is based on the following observations:

- the base year expenditure appears to be reasonable
- volume driven step changes appear reasonable
- strategy driven step changes appear reasonable, with exceptions noted above, benefits of which have been reflected in other expenditure categories by way of top-down cost reductions
- appropriate modelling has been undertaken to determine the forecast expenditures.

Corporate opex

Powerco is proposing a step up in corporate opex of almost $3.8 million ($2016) per year above the FY16 base year (or $19.0 million, $2016, over the CPP period), once the costs of undertaking the CPP are removed.

The sources for the step up are:

- adjustment to the FY16 base year expenditure to reflect a normalised version of Powerco's FY17 budget, which contributes about $11.3 million over the CPP period
- further specific step changes ($7.2 million), non-recurrent expenditure ($1.4 million) and output / or scale changes ($0.5 million) for several business units that form part of the corporate opex program, which contribute a further $9.1 million over the CPP period
- *less* assumed efficiencies over FY22 and FY23, which reduce the forecast by $1.4 million over the CPP period.

Based on our assessment of the CPP proposal, the FY16 base year does not appear inefficient when compared to similar expenditure incurred by other NZ EDBs – and so appears to be a reasonable starting point for applying the base, step and trend method. The proposed efficiencies in the last two years of the CPP period also appear appropriate, as it is realistic to assume that the corporate functions will benefit from improvements made across the business, including from the roll-out of a new ERP solution and an increase of scale over the period.

We also recognise that some step up from this start point is reasonable to align with the increase in capital and operating activity underpinning the CPP proposal, as the corporate business units are designed to support those activities. However, we have not

seen sufficient evidence to justify the quantum of that step up because it is not clear to us:

- that a normalised version of the FY17 budget reflects an efficient level of expenditure for Powerco's network in its current circumstances – this could be tested, for instance, by comparing Powerco's actual FY17 expenditure (when available) against that normalised budget
- how the increase in FTEs proposed to support the CPP proposal aligns to the increase in capital and operating activity underpinning that proposal.

We also note that it may be appropriate to include the forecast cost of preparing a subsequent CPP proposal, if this is expected to be necessary following the next CPP period to give effect to or realise the benefits from the initiatives proposed for that period.

4.6 Reduction initiatives

4.6.1 Powerco proposal and our general observations

Powerco does not appear to be proposing any opex reduction initiatives or to have reflected in its opex forecasts the outcomes undertaken during the current period. However, Powerco has recognised that some proposed expenditure may lead to reductions over the CPP period and intends to reflect these in its revised CPP proposal.[35]

4.6.2 IM requirements and our approach to assessment

This section aims to address Schedule G6(1)(f) of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

Box 18 – IM requirements for opex reduction initiatives

Schedule G6(1)(f) of the IM:

The **verifier** must:

(f) provide an opinion as to the reasonableness of any **opex** reduction initiatives undertaken or planned during the **current period** or the **next period**;

Our approach to assessment was to:

- identify any opex reduction initiatives undertaken or planned during the current period or the CPP period

[35] Powerco, *Investment Proposal Refinement Update*, version 1, 29 March 2017.

- review these for reasonableness against what we would expect for a prudent non-exempt EDB.

4.6.3 Our findings

Based on our assessment of the documents and models provided, we are not aware of any specific opex reduction initiatives undertaken or planned during the current period or the proposed CPP period. We are, therefore, unable to provide a view at this stage.

However, as noted above, we would expect some of the opex and capex initiatives proposed by Powerco for the CPP period to result in opex reductions over that period. We have seen some evidence of this being incorporated into the CPP proposal, e.g. efficiency reductions in capex and opex forecasts attributed to the asset management and future network initiatives.

4.7 Deliverability

4.7.1 Powerco proposal and our general observations

As noted in relation to capex deliverability, Powerco's field resource capability is delivered solely by external contractors, with no field staff employed by Powerco. Most of this capability is delivered by one contractor under two-field services agreements (currently Downer), while a number of other contractors also provide field services to deliver capex or opex. Internal resources to support the field work are provided primarily from within the SONS opex function.

Powerco has recognised that the forecast increase in expenditure during the CPP period requires a delivery strategy that identifies the augmentation of capability and capacity required to ensure that the work can be delivered as planned. Powerco proposes to continue with its outsourced delivery model and has undertaken market sounding with incumbent providers, obtaining commitments in principle to support the plans should proposed expenditure as currently planned proceed.

Powerco is also proposing to establish more formal agreements with the next tier of contractors, as well as increasing the volume of work delivered by the primary provider (currently Downer). Powerco's consideration of external resourcing requirements in detail – even to the extent of engaging with key suppliers and mapping resource requirements to regions, considering depot locations and recruitment lag times – is a reasonable approach.

Finally, Powerco also recognises that an uplift in internal capacity is required to support the increased work volume delivered by external contractors, and deliver other internally-resourced projects, with some restructuring including addition of new capability, and appears to have considered internal resourcing requirements in quantum. However, it is less certain at this stage whether the logistics of procuring, training and integrating the significant step up in internal resources is achievable in the

timeframes proposed, particularly for the uplift in capacity required within the SONS portfolio.

4.7.2 IM requirements and our approach to assessment

This section aims to address Schedule G6(1)(h) of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

Box 19 – IM requirements for opex deliverability

Schedule G6(1)(h) of the IM:
The **verifier** must-

(f) provide an opinion as to overall **deliverability** of work covered by the **opex categories** in the **next period**;

Our approach to assessment was to examine at an aggregate level along with a review of sampled projects/programs Powerco's planning with regards to delivery. At an aggregate level this involved a review of Powerco's deliverability plan, proposed uplift in externally driven expenditure and the capacity of the market to provide the services required and be managed by Powerco, and the extent that internal resources need to be augmented.

The review of sampled projects/programs identified any unique or highly skilled resources required that may have some execution risks.

4.7.3 Our findings

In our view, the work proposed in the opex forecasts over the CPP period does not appear undeliverable, with some limitations.

While the on-the ground deliverability plans are well advanced, there are risks around management bandwidth and the challenging timeframe assumed in the forecasts to mobilise projects and programs given the significant step up in proposed activity at the start of the CPP period.

We note that delivery risks result from:

1. the lack of required internal resourcing to give effect to the delivery plan – Powerco is planning a significant increase in internal resources for some expenditure categories; based on our experience, significant internal restructures tend to take longer to complete than expected, with key roles often left vacant for some time
2. Powerco awaiting the Commission's final determination before undertaking recruitment in full – this may result in a risk that the recruitment and training required to support the volume driven increase in SONS FTEs, for instance, may not occur fast enough.

However, Powerco can manage the above risks and therefore we do not envisage that Powerco will not be able to source the required resources based on the information that we have seen.

4.8 Models and forecasting methods

4.8.1 Powerco proposal and our general observations

Powerco uses two methods to forecast opex:

- a base, step and trend method is used for most categories of expenditure – the AER's use of this method supports the robustness of this approach
- volume or quantity driven forecasts are used for vegetation management and GEM scheduled maintenance expenditure – where forecast volume (e.g. tree sites or maintenance activities) are multiplied by current unit rates.

Powerco gives effect to these methods using over 20 models; separate base, step and trend models by expenditure program and, in the case of corporate opex, in separate models for each corporate business unit. There are also separate volume-based forecasts for vegetation management and GEM scheduled expenditure.

These models provide expenditure forecasts in real $2016, before forecast inflation and real input cost escalation is applied. This escalation is applied separately in the CPP financial model. We consider cost escalation further in section 5.4.

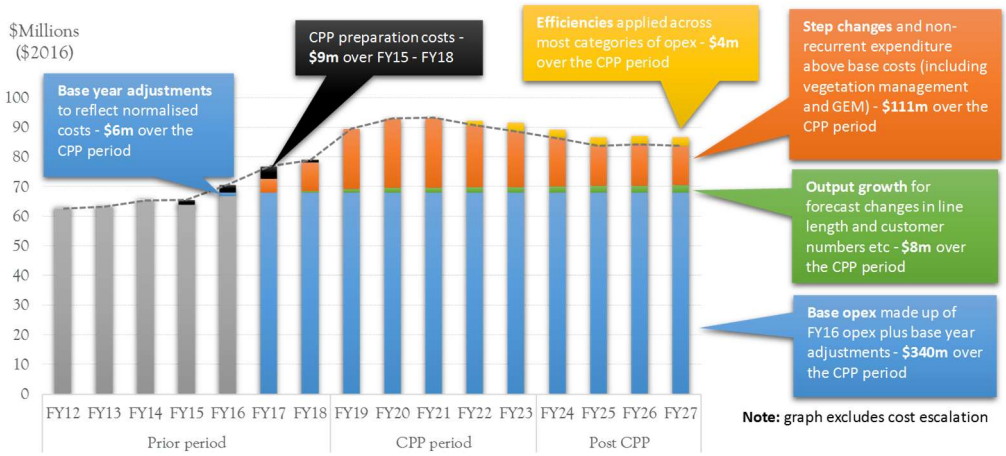
When applying the base, step and trend method, Powerco:

- uses a common base year (FY16) for all expenditure categories
- adjusts the base year higher – in two cases – to reflect:
  - the average *corrective* maintenance over FY12 to FY15, rather than FY16, and
  - *reactive* maintenance in FY15 rather than FY16
- applies scale escalation to select expenditure categories, namely IST, maintenance, and SONs
- does not apply a productivity adjustment as part of the rate of change
- adds forecast step changes and non-recurrent expenditure to reflect specific initiatives or expected increases in volumes (e.g. due to the increase in activity over the CPP period)
- applies an efficiency adjustment from FY22 onwards to all categories of opex (except for vegetation management) – in the case of non-network opex, this is applied across all forecast expenditure, while in the case of network opex, this efficiency is applied only to base expenditure (i.e. before step changes, non-recurrent expenditure, and output growth is applied).

Figure 10 shows the consolidated base, step and trend forecast for all categories of opex. For presentation purposes, this figure also includes the expenditure for vegetation

management and GEM scheduled maintenance – with the increase in opex above that in FY16 included in the 'step changes and non-recurrent expenditure' bar (in orange).

Figure 10 – Consolidated base, step and trend opex forecast



Source: Powerco opex forecast models for the data, analysed and re-cut by us.

As shown, Powerco's base year expenditure is broadly in line with its historical spend. However, Powerco considers that this spend is not sufficient to run its network efficiently.[36] We agree with this based on the information that we have seen, including because the network is currently experiencing:

- a growing backlog of defects on the network
- an increasing rate of asset failures on the network
- a growing backlog of tree pruning needs.

As a result, Powerco proposes a significant step up in opex above current levels to both address the backlog of issues over the CPP period, and to rebase its own going expenditure at an efficient level – as reflected in jump up over the CPP period and then the decline into the post CPP period (see the orange bars in Figure 10 above). Two key examples include:

- the corrective maintenance step change – of $10.5 million (net of assumed efficiencies) – to address the yellow defect backlog

[36] See, for instance, Powerco, *Asset management framework*, January 2017, Ansarada document number 01.01.02, p. 92 under the heading 'Getting on top of our defect work'; Powerco, *Maintenance strategy v1.1*, December 2016, Ansarada document number 04.01.01, sections 6.1 and 6.2, and figures 8 and 9; and Powerco, *Vegetation management strategy*, December 2016, Ansarada document number 04.01.02, p. 29.

- vegetation management catch up that Powerco proposes is needed to transition to a cyclical approach across its network.

Powerco appears to have undertaken internal review of its proposed opex forecasts and has consulted on these publicly.[37] Powerco also provided us with benchmarking of its current and proposed expenditure against other NZ EDBs, which generally shows that it is spending consistently with its peers.[38] We consider benchmarking further in appendix F.

4.8.2 IM requirements and our approach to assessment

This section aims to address Schedule G6(1)(e) and (f) of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

Box 20 – IM requirements for opex forecasting methods and models

Schedule G6(1)(e) and (i) of the IM:
The **verifier** must-

(e) provide an opinion as to the reasonableness of the methodology used in forecasting **opex** (such as cost benchmarking or internal historic cost trending), including the relationship between the **opex forecast** and **capex forecast**;

...

(i) provide an opinion as to the reasonableness and adequacy of any **opex** models used to prepare the **opex forecast** including an assessment of-

(i) the inputs used within the model; and

(ii) any methods the **CPP applicant** used to check the reasonableness of the forecasts and related expenditure.

Our approach to assessment was to:

- identify the forecast method or methods used by Powerco to develop its opex forecasts

[37] For instance, Powerco engaged experts to review and help develop its proposed expenditure for the CPP period and held sessions where its board could challenge management over that expenditure. We have seen copies of the material presented at board challenge sessions in October 2016, but do not reproduce it here given that it is confidential. See for instance Powerco, *Board committee top down challenge 1*, 6 October 2016, Ansarada document number 08.02; and Powerco, *Board committee top down challenge 2*, 27 October 2016, Ansarada document number 08.01.

[38] Powerco, Opex and capex benchmarking, 2 May 2017, Ansarada document number 04.02.07.

- review the method or methods against best practice and those likely to promote the expenditure objective
- consider any relationships between the opex and capex forecasts and how these have been incorporated into the method or methods, or not
- review the models and inputs used to apply the method or methods
- review any methods used by Powerco to check the reasonableness of its opex forecasts.

4.8.3 Our findings

Forecasting method

Nothing has come to our attention that causes us to believe that, in all material respects, Powerco's overall methodology for forecasting opex is unreasonable.

Our view is based on:

- the base, step and trend method being a well-accepted method for forecasting recurrent opex and is commonly used in rate setting processes like the CPP process
- using a volume or quantity driven forecast for high volume activities such as maintenance and tree pruning is also not unreasonable, especially where a significant step change in volumes is forecast
- the forecasting model used to forecast vegetation management aligns to the strategy proposed by Powerco, including by modelling the catch up spend and the impact of second cuts
- the output growth applied to the maintenance opex forecasts appears consistent with the method used by the Commission for the DPP – with the same elasticities being used, the historical line length data updated for the latest information disclosures, and forecast ICPs updated to reflect that underpinning the CPP connection capex forecast
- the opex forecast is adjusted to reflect interdependencies with the capex forecast, namely:
  - SONS opex is adjusted to reflect the increase in capital activity (e.g. renewals), a share of which is capitalised across the capital program as an 'AMG' overhead
  - SONS network running costs were scaled to reflect the forecast increase in zone substations resulting from the growth and security capital program
  - corporate opex is adjusted up to reflect the expected increase in recruitment, invoice processing, payroll and other corporate activities if the proposed CPP capital program goes ahead.

We are, however, not convinced that the proposed SONS and corporate opex step changes and non-recurrent expenditure satisfies the expenditure objective in full. We discuss these further in section 4.5 above, and in more detail in appendix D.

We note that Powerco adjusts up the base year opex for both corrective and reactive maintenance to better reflect efficient costs. This does not appear unreasonable given that current expenditure may be too low to operate the network efficiently given the growing backlog of defects and increasing rate of faults.

We also note that, although Powerco uses the base, step and trend method, Powerco's application of it differs in some respects from how it is described in some of the draft material that we have seen (e.g. in the draft corporate opex POD) and as applied by the AER. For instance, Powerco:

- does not apply a single base, step and trend across all opex – as the AER would do – but instead applies the method separately to each expenditure program and, in the case of corporate opex, separately for each corporate business unit
- does not apply a common rate of change for output growth, productivity, and cost escalation across base year opex – as the AER would do – and instead applies different output growth and cost escalation, and the models do not include any allowance for productivity (although they do include an overall efficiency adjustment from FY22 onwards).

Forecasting models

In our view, the models used by Powerco to develop its opex forecast are not unreasonable and do not appear inadequate for that purpose as they appear to give effect to the intended forecasting methods.

Our view is based on these findings:

- the models appear robust (although we have not undertaken a model audit)[39] and consistent with methods described
- the assumptions and inputs used within the models appear consistent with the proposed strategies as described in the information provided to us.

We note that not all inputs used in the models were fully described in the information provided to us, including as to their source – these are detailed in the program reviews in appendix D. For those inputs that we considered material to the overall opex forecast, we did seek and Powerco provided clarification.[40]

[39] We were advised that the final models that we reviewed had been audited by Deloitte.

[40] See, for instance, responses to our questions in Verifier Question and Answer Initial Summary Q001 through to Q024, dated February and March 2017.

Also, as described above in section 4.5, we are not convinced that the proposed FTE increases for the SONS strategy-driven step changes and corporate opex are sufficiently justified against the expenditure objective based on the information that we have seen. These FTE increases are inputs to the SONS and corporate base, step and trend models.

5. Other matters

In this chapter, we assess other matters required by schedule G of the IM that are not covered by our review of Powerco's forecast expenditure and service levels, measures and quality standard variations.

This chapter is structured as follows:

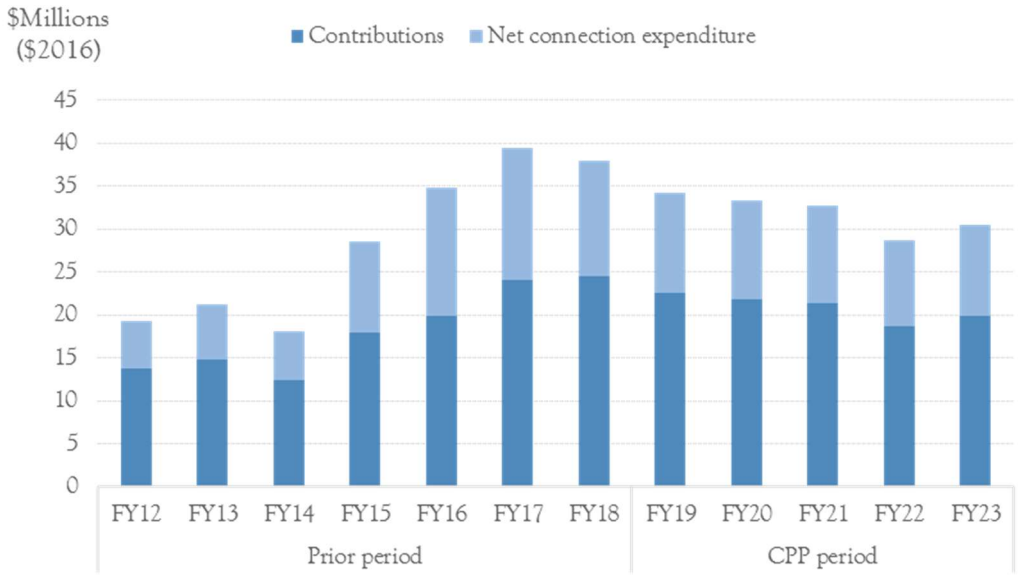
Heading	Sets out
Section 5.1	Findings on Powerco's forecast capital contributions
Section 5.2	Findings on Powerco's forecast demand
Section 5.3	Findings on Powerco's proposed contingent projects, if any
Section 5.4	Findings on Powerco's forecast cost escalation

5.1 Capital contributions

5.1.1 Powerco proposal and our general observations

Powerco proposes forecast capital contributions over the CPP period of $104.4 million ($2016), as summarised in Figure 11. This compares to $98.9 million ($2016) expected over the FY14–FY18 period – an increase of $5.5 million ($2016), or 5.5 per cent.

Figure 11 – Capital contributions



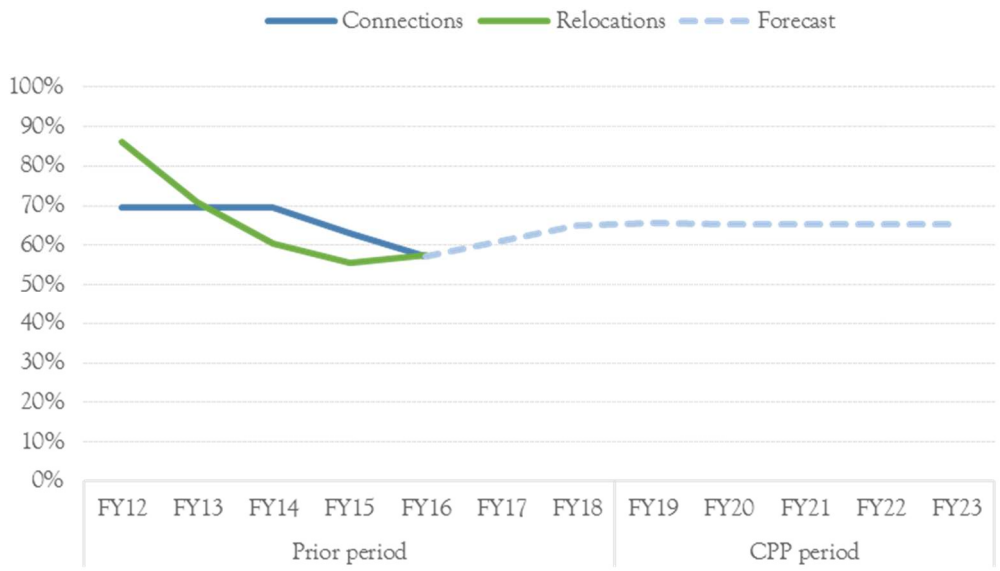
Source: Powerco data. Forecast expenditure does not include cost escalation.

Capital contributions over the CPP period were forecast by taking a percentage – or contribution rate – of gross connections and asset relocation capex for a given year. Powerco did not forecast any specific contributions for proposed projects.

The contribution rate ranged from 65.3% to 65.7% and was calculated by assuming a fixed split between major (23%) and minor (73%) works, a fixed rate of contribution per connection or asset relocation (56% of major works, 76% for minor works), and a variable adjustment (ranging from 7.6% to 8.3%) to reflect the forecast capitalisation of internal costs in each year (sourced from SONS opex forecast model).[41,42]

The resulting forecast contribution rates are close to the average rate of contribution experienced over the FY12 to FY16 period (of 65.9%) as shown in Figure 12.

Figure 12 – Contribution rate



Source: Powerco data. FSC and WSP analysis.

The **expenditure forecasts** were calculated for each year of the CPP period:

- *for gross connections*, by taking FY16 expenditure and multiplying this by the change in the number of connections (or ICPs) and the change in the rate of internal capitalisation between FY16 and the relevant year, ignoring any potential

[41] For instance, the 65.3% is calculated as: 65.3% = (23% x 56% + 76% x 73%) / (1 + 8.3%). Values may not add due to rounding.

[42] See Ansarada document 03.09.46, published 8 May 2017. The capitalisation rate of SONS costs is calculated on the 'Internal capitalisation rate' sheet at row 44.

disconnections – which effectively assumes a fixed expenditure per new connection before capitalisation of internal costs (of $8,732, in $2016)[43]

- *for asset relocations*, by holding expenditure before capitalisation of internal costs ($2.1 million, $2016) constant in real terms at the FY16 level.

5.1.2 IM requirements and our approach to assessment

This section aims to address Schedule G7 of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

Box 21 – IM requirements for capital contributions

Schedule G7 of the IM:

The **verifier** must provide an opinion as to whether the forecast of **capital contributions**–

(a) is reasonable; and

(b) consistent with other aspects of the **CPP proposal**, in particular–

(i) the **capex forecast**; and

(ii) forecast demand data provided in accordance with clause D6.

Our approach to assessment was:

- review the model, inputs and assumptions used to forecast capital contributions
- compare the ICP connections forecast used to forecast capital contributions to that used to develop the demand forecast
- compare forecast capital contributions for the CPP period to forecast asset relocation and customer connection capex for the same period
- compare the proposed rate of contribution to that observed historically
- review any explanation or justification for the proposed capital contribution forecast.

The documents and models that we reviewed are set out in Table 7.

Table 7 – Information provided – capital contributions

Title	Reference	Date
Electricity Capital Contribution Guide	04.01.08	3 Feb 2017
Consumer Connection and Asset Relocation expenditure forecast model	03.04 – 60-16	15 Feb 2017

[43] The $8,732 is calculated as the gross connection expenditure incurred in FY16 ($32,467,897) divided by the change in the number of connections in FY16 (3,326) and one plus the internal capitalisation rate in that year (11.8%).

Title	Reference	Date
Consumer Connections Capex POD	04.01.05.07	28 Feb 2017
Verifier Question and Answer Initial Summary Response_Q0008 Consumer Contributions	Ansarada Question ID 008	28 Feb 2017
Information provided following draft report		
Consumer Connection and Asset Relocation expenditure forecast model	03.09.22	8 May 2017

5.1.3 Our findings

In our view, the capital contributions forecast does not appear unreasonable nor inconsistent with other aspects of the CPP proposal, subject to the limitations noted below.

Our view is based on the following observations:

- the rate of contribution (per dollar of capex) has been stable historically – which is consistent with forecasting a stable rate of contribution over the CPP period
- using a stable rate of contribution means that there is a direct link – or consistency – between the expenditure and capital contribution forecasts
- the gross connection capex forecast for each year of the CPP period is directly proportional to the change in total connections (or ICPs) for that year – and so there is a direct link – or consistency – between the corresponding capital contribution forecast for connections over the CPP period and the ICP forecast for that same period
- assuming no change to current asset relocation expenditure in real terms (before capitalisation of internal costs) is not unreasonable in the circumstances where no other information is available about the likely need for relocations over the CPP period.

Although there are several limitations with the proposed forecast, we do not consider that these materially affect our view above. These limitations – some of which are acknowledged by Powerco – include:

- The net increase in ICPs is used to forecast gross connections capex, rather than the number of new connections – if the number of new connections are expected to differ from that realised in FY16, then this approach may under- or over- state this capex and therefore the corresponding capital contributions forecast; although this is likely to have a small impact because disconnections are typically quite small.
- The contribution rate was not adjusted down to reflect the likely increase in incremental revenue resulting from higher prices linked to the CPP proposal –

sensitivity analysis undertaken by Powerco indicates that this is likely to have a small impact, although we have not been able to verify this.[44]

5.1.4 Completeness and key issues for the Commission

The information provided by Powerco on forecast capital contributions was sufficient for us to undertake our verification. We are not aware of any information that we consider was omitted by Powerco.

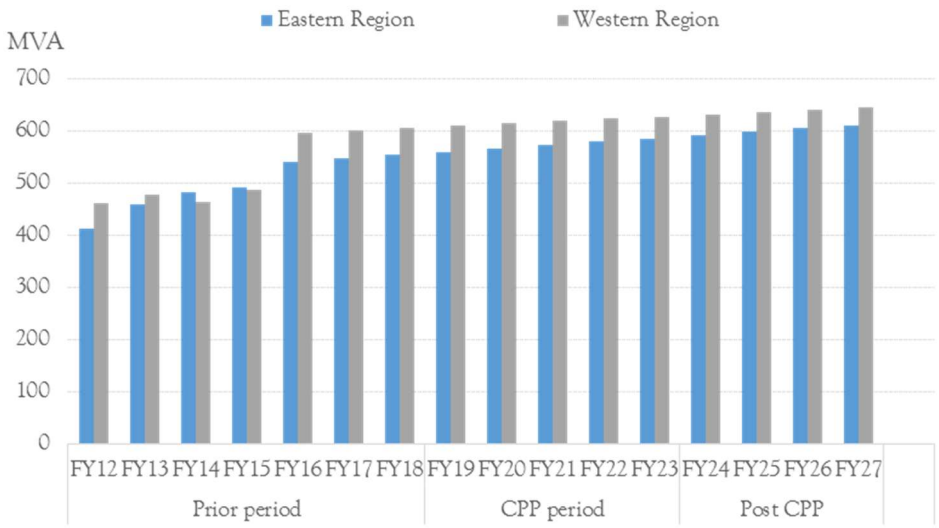
We also have not identified any key issues relating to forecast capital contributions that we consider the Commission should focus on when undertaking its own assessment of the information. However, if forecast total connections (or ICP) or the rate of internal capitalisation change as part of its assessment, then the Commission may want to reconsider any corresponding changes to the capital contribution forecast.

5.2 Demand

5.2.1 Powerco proposal and our general observations

Powerco forecasts a moderate increase in demand over the CPP period, as shown in Figure 13. The Eastern Region is forecast to have a slightly higher growth rate than the Western Region.

Figure 13 – Demand forecasts



[44] Powerco response to CPP verification question set ID008, question 9, dated 17 February 2017.

Powerco forecasts demand at the GXP, zone-substation and feeder level for its CPP proposal. Powerco advise, and it appears to us based on the models and documentation provided, that these forecasts have an immaterial impact on Powerco's capex and opex forecasts for the CPP period.[45] Powerco notes that this is because many of its proposed growth projects address already existing major security of supply breaches. There also does not appear to be a direct (i.e. automatic) link between the demand and expenditure forecasts in any case.

Demand is forecast by taking a base level of demand (as at 2015) for each GXP, zone-substation and feeder and multiplying this by a corresponding growth rate. These growth rates are calculated first for each feeder by combining historical ICP growth, forecast population growth (sourced from Statistics New Zealand by census area unit), and, in some cases, historical demand growth. The feeder growth rates are then combined (using MVA weights) to zone-substation and then GXP growth rates.

The base level of demand for feeders is the 98th percentile of demand observed in FY15, while the base level for zone-substations and GXPs is the 90th percentile of historically observed maximum demand, which is adjusted for anomalies, inter-GXP transfers of demand, and historical step changes in demand (e.g. from new industrial load, or large customers closing).

No adjustments are made to the demand forecasts for weather, technological (e.g. distributed generation, electric vehicles), energy efficiency or demand side capability (e.g. ripple control), economic nor social trends. However, the GXP demand forecasts are adjusted for any expected future grid or network developments.

Key assumptions underpinning the demand forecasts are:

- historical ICP number growth – used as a direct input to feeder-level growth rate forecasts – is an appropriate predictor of future demand growth
- forecast population growth – also used as a direct input to feeder-level growth rate forecasts – is also an appropriate predictor of future demand growth
- demand per ICP will remain at current levels
- the calculated base level of demand for each feeder, zone-substation and GXP is an appropriate starting point for preparing the demand forecasts.

Powerco notes that it is on a journey to improve its demand forecasting capability and approach. Powerco also considers high and low demand scenarios based on work undertaken by the Ministry of Business, Innovation and Employment (MBIE), although

[45] Powerco response to CPP verification question set ID007, question 1 and sensitivity analysis 1, dated 17 February 2017. We note, however, that the customer connection capex is highly sensitive to the forecast ICP numbers, but not the demand forecasts themselves. Powerco's ICP number forecasts are discussed in section 0 on capital contributions.

these scenarios did not appear to have any material impact on Powerco's capex and opex forecasts.

5.2.2 IM requirements and our approach to assessment

This section aims to address Schedule G8(1) of the IM, and our approach to assessing compliance of Powerco's CPP against the IM requirements.

Box 22 – IM requirements for demand

Schedule G8(1) of the IM:

The **verifier** must provide an opinion as to whether:

(a) the **key assumptions**, key input data and forecasting methods used in determining demand forecasts were reasonable; and

(b) it was appropriate to use the demand forecasts resulting from these methods and assumptions to determine the-

(i) **capex forecast**; and

(ii) **opex forecast**.

Our approach to assessment was:

- review the models, inputs and assumptions used to forecast demand
- compare the proposed demand growth to that observed historically
- compare the ICP connection forecast that underpins the demand forecast to that used to forecast capital contributions
- identify how, if at all, the demand forecasts were used to forecast capex and opex and what impact they had
- review any explanation or justification for the proposed demand forecasts and how they were used to forecast capex and opex.

The documents and models that we reviewed are set out in Table 8. No new information relating to the demand forecasts was provided following that reviewed for our draft report.

Table 8 – Demand documents and models provided

Title	Reference	Date
Network Development Plan 30 Jan.pdf	04.01.03	31 Jan 2017
Electricity Demand Forecasting Guidelines Feb 2017.pdf	04.01.09	14 Feb 2017
Demand - summary.xlsx	04.02.02.01	15 Feb 2017
Demand - Dem_Fcst_ICP_Data.xlsx	04.02.02.02	15 Feb 2017
Eastern Zone Sub Forecast Model.xlsx	04.02.02.03	15 Feb 2017

Title	Reference	Date
Feeder_Forecast-2016.xlsx	04.02.02.04	15 Feb 2017
GXP Forecast 2016 Model.xlsx	04.02.02.05	15 Feb 2017
Western Zone Sub Forecast Model.xls	04.02.02.06	15 Feb 2017
Verifier Question and Answer Initial Summary Response_Q007 Demand and ICP forecasts FINAL answers.pdf	Ansarada Question ID 007	24 Feb 2017

5.2.3 Our findings

In our view, the demand forecasts are not unreasonable and it was not inappropriate to for Powerco to rely on these in the limited way that it has to prepare its capex and opex forecasts for the CPP proposal.

Our view is based on these findings:

- the demand forecasts have an immaterial impact on the capex and opex forecasts
- it is reasonable to rely on population and ICP growth forecasts to forecast demand in circumstances where it is unclear how weather, technological, economic, social and other trends will affect demand on Powerco's network
- using historical maximum demand as a starting point is appropriate when forecasting demand
- the models appear robust (although we have not undertaken a model audit)[46] and consistent with what we would expect to forecast demand.

Our view is also subject to the following shortcomings with the demand forecasts (many of which are acknowledged by Powerco):

- Weather normalisation, energy efficiency, technology, distributed generation, and other policy or social trends were not directly accounted for in the demand forecasts, although this may be appropriate in some cases (e.g. where no material impact to forecast demand is expected from these trends) and was reflected to some degree in the high-level low and high case scenarios used as a cross check (and based on the EDGS scenarios done by the MBIE).[47]

[46] We understand that Powerco engaged Deloitte to audit key models that underpin the CPP application. We are not aware of any issues identified by this audit that relate to the demand models.

[47] Verifier Question and Answer Initial Summary Response_Q007 Demand and ICP forecasts FINAL answers, 24 February 2017, Powerco response to question 12.

- It is unclear what economic conditions or trends underpin the demand forecasts or how, if at all, these are incorporated into the population growth forecasts provided by Statistics NZ (and used to determine the demand forecasts).[48]
- It is also unclear whether it is consistent to combine *historical* ICP growth rates with *forecast* population growth rates to derive a forecast demand growth rate. [49]
- The common weights used to combine population and ICP growth rates to determine mass market feeder growth rates – which underpin most of the feeder, zone substation and GXP demand forecasts – were not based on rigorous modelling or theoretical derivation.[50]

We note that Powerco intends to overcome many of these shortcomings as part of its initiative to improve its demand forecasting capability over the next few years.[51]

We also note that Powerco has advised that the area and regional forecasts are reviewed by planners with local experience and knowledge and that, where necessary, adjustments are made to account for local circumstances. [52] We were not able to interrogate if all local conditions have been appropriately captured (given the large number); however, this process does appear to have been followed at first glance. In our view, it is critical that demand forecasting combines both theoretical and empirical elements.

5.2.4 Completeness and key issues for the Commission

The information provided by Powerco on forecast demand was sufficient for us to undertake our verification. We are not aware of any information that we consider was omitted by Powerco.

We also have not identified any key issues relating to forecast demand that we consider the Commission should focus on when undertaking its own assessment of the information. We do note, however, that this is largely because the demand forecasts have an immaterial impact of Powerco's expenditure forecasts. If this changes as part of the Commission's assessment of the CPP application, then it may want to focus on the limitations noted in section 5.2.3.

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48 For background, see, Verifier Question and Answer Initial Summary Response_Q007 Demand and ICP forecasts FINAL answers, 24 February 2017, Powerco response to question 5.

49 For background, see, Verifier Question and Answer Initial Summary Response_Q007 Demand and ICP forecasts FINAL answers, 24 February 2017, Powerco response to question 3.

50 Verifier Question and Answer Initial Summary Response_Q007 Demand and ICP forecasts FINAL answers, 24 February 2017, Powerco response to question 7.

51 See Ansarada document 04.01.09, *Electricity Demand Forecasting Guidelines*, February 2017, pp. 2–3.

52 Verifier Question and Answer Initial Summary Response_Q007 Demand and ICP forecasts FINAL answers, 24 February 2017, Powerco response to question 11.

5.3 Contingent projects

We are required to assess any contingent projects proposed by Powerco against the requirements in clause G10 of the IM (repeated below). As Powerco is not proposing any contingent projects, we did not undertaken any assessment.

Box 23 – IM requirements for contingent projects

Schedule G10 of the IM:

(1) For each proposed **contingent project**, the **verifier** must provide an opinion as to whether that **project** satisfies the following criteria:

(a) it is–

(i) reasonably required of an **EDB** in meeting the **expenditure objective**; and

(ii) one that associated assets are likely to be **commissioned**,

during the **CPP regulatory period**;

(b) a commencement date cannot be forecast with an appropriate degree of specificity by comparison with other proposed **projects**;

(c) the total of **capex forecast** and **opex forecast** in relation to the **project**–

(i) as disclosed in the **CPP proposal** exceeds 10% of the value of the **CPP applicant's** annual revenue in the most recently completed **disclosure year** in respect of an **ID determination**;

(ii) is reasonable in dollar terms; and

(iii) would be likely, when forecast with reasonable certainty, to meet the **expenditure objective**.

(2) For each proposed **trigger event**, the **verifier** must provide an opinion as to whether it meets the requirements of clause 5.6.5(3).

5.4 Cost escalation

5.4.1 Powerco proposal and our general observations

Powerco used forecast labour and material escalation rates to develop its capex and opex forecasts. These escalators were procured by NZIER and combined in its CPP forecast model with escalation weights (or input weightings) to escalate forecast capex and opex from real 2016 dollars to nominal dollars.[53]

[53] See Powerco, *CPP Financial Model - Calculation Modules - v3.2 - 19-May-2017.xlsm*, 19 May 2017, '3.2 Opex price escalation' and '3.3 Capex price escalation' sheets.

Cost escalation adds $132.4 million to the nominal dollar forecasts, split between:

- forecast inflation – $110.8 million
- real cost escalation – $21.6 million – and further split into:
  - real labour cost escalation – $7.3 million
  - real material cost escalation – $14.4 million.

Cost escalation can also be split between capex ($92.6 million) and opex ($39.8 million).[54, 55]

NZIER forecast its labour and material cost escalators using two broad approaches:[56]

- rely on international reference points such as futures prices and market consensus forecasts – used for all international metal prices
- use econometric models that connect cost escalation to domestic economy-wide trends – used for labour and other costs.

NZIER also converted the international metal price forecasts (in US$) to NZ$ using an assumed exchange. Assuming no change from the FY17 exchange rate assumption of (US$0.732 per NZ$) instead of the forecast provided by NZIER reduces nominal expenditure over the CPP period by $10.3 million, which forms part of the $14.4 million attributed to real material cost escalation.

Powerco then applied these escalators to its capex and opex forecasts in the CPP financial model by:

- first, calculating escalator indices for both capex and opex inputs[57]
- then multiplying the real $2016 expenditure forecast for each expenditure category by a weighted average escalator calculated as the sum product of:
  - the relevant escalator indices for either capex or opex
  - the assumed input weightings for the expenditure category.[58]

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54 These values are calculated by comparing the real $2016 expenditure forecasts to the nominal dollar forecasts in the CPP Financial Model. The other values were calculated by systematically replacing the labour and materials cost escalators used in that model with forecast inflation.

55 Based on an earlier set of escalator and expenditure forecasts, Powerco estimated the impacts as 3.3% and 0.1% of the nominal capex and opex forecasts respectively. See Powerco response to CPP verification question set ID009, sensitivity analysis 1, dated 17 February 2017.

56 NZIER, *Cost Escalators – Forecasts of cost escalation for asset management planning*, 18 April 2017, Ansarada document number 07.13, uploaded on 18 May 2017.

57 See the '3.1 NZIER indices' sheet.

58 See the '3.2 Opex price escalation' and '3.3 Capex price escalation' sheets.

5.4.2 IM requirements and our approach to assessment

As noted in chapters 3 and 4, the IM requires an opinion on the reasonableness of key assumptions relevant to the capex and opex forecasts respectively, including:

- the method and information used to develop them
- how they were applied
- their effect or impact on the forecasts by comparison to their effect or impact on actual capex or opex.

We consider that the labour and material escalators are key assumptions that are material to the overall capex and opex forecasts, and have therefore reviewed the assumptions in Powerco's CPP proposal.

Our approach to assessment was:

- review the source for the labour and material escalation rates – namely an independent expert report prepared by NZIER – including the assumptions, inputs and methods used to derive the rates
- compare the forecast escalation rates to those observed historically
- consider how, if at all, each proposed labour and material cost escalator had on Powerco's actual capex and opex historically
- review the weights used to combine the escalation rates before being applied to escalate the capex and opex forecasts
- identify how much impact the escalation rates had on the capex and opex forecasts.

The documents and models that we reviewed are set out in Table 9.

Table 9 – Cost escalation documents and models provided

Title	Reference	Date
CPP Financial Model - Calculation Modules - v2.0.xlsm	02.03.01	1 Feb 2017
Cost Escalators - NZIER - Data Tables October 2016 FINAL.xlsx	03.05.08	4 Feb 2017
CPP Financial Model - Calculation Modules - v2.1 - Updated 14 Feb.xlsm	03.03.03	16 Feb 2017
Verifier Question 009 Cost Escalators_Powerco Full Response _21_2_17	Ansarada Question ID 009	21 Feb 2017
Cost escalators - NZIER report 22 December 2015.pdf	Ansarada Question ID 009	21 Feb 2017
Information provided since draft report		
Cost escalators - NZIER report April 2017.pdf	07.13	18 May 2017
Cost Escalators - NZIER - Data Tables March 2017_judgement.xlsx	07.14	18 May 2017

Title	Reference	Date
CPP Financial Model - Calculation Modules - v3.2 - 19-May-2017.xlsm	03.09.48	19 May 2017

5.4.3 Our findings

Forecast escalators

In our view, the labour and materials escalators recommended by NZIER for Powerco to use in its asset management plan do not appear unreasonable in the circumstances.

However, given the significant value that escalation adds to the nominal capex and opex forecasts and the inherent uncertainty with them (especially the materials escalators), we recommend that the Commission consider procuring its own cost escalation forecasts as a cross-check.

Our view is based on the following:

- it is reasonable to apply material and labour cost escalation when forecasting capex and opex, provided that the underlying assumptions, methods and input data are reasonable
- NZIER is a reputable third party economic forecaster, and is suitably qualified to apply econometrics and professional judgement to forecast labour and materials escalators for NZ
- the labour and materials escalators recommended by NZIER appear to rely on reasonable data sources and estimation methods, although we were unable to review:
  - the calculations made by NZIER (including transposing the underlying source data) as most calculations were not provided – which is not unsurprising given that these would likely be proprietary
  - the statistical fit of the econometric models, their forecasting accuracy and the relevance of the independent variables used by NZIER as the model statistics and testing results were not provided
- the proposed labour and other cost escalation rate forecasts appear consistent with the average rates observed over the last 15 years and are only marginally higher than forecast inflation[59]
- although the proposed material cost escalation rate forecasts are broadly consistent with average rates observed over the last 15 years, there were some significant annual variances – which reinforces our view that material cost escalation rate forecasts are inherently unreliable (and much more so than labour escalation rate

[59] For a quick summary, see NZIER, *Cost Escalators – NZIEIR – Data Tables March 2017_judgement.xlsx*, March 2017, 'Summary' sheet, columns D and E.

forecasts) and jump around from time to time given that they largely rely on the foreign price of commodities and the market forecasts that govern them

- this inherent unreliability is consistent with NZIER's note that there is a high potential for significant revision to the material cost escalation rates for aluminium, copper, and steel commodities, and moderate for other capital goods[60] – to avoid introducing forecasting error to the regulated price setting process some regulators (e.g. the AER) assume that materials escalate at inflation
- the escalators are sensitive to the assumed USD:NZD exchange rate, which – like material escalators – is inherently unreliable and subject to change.

Application of forecast escalators

In our view, the approach used to apply the escalation rates within the CPP financial model to the capex and opex forecasts appears reasonable because:

- the approach combines the forecast escalation rates with weights that map these to each expenditure category or project, by combining:
  - capex index weights sourced from the Commission's Orion CPP decision and adjusted, where appropriate, for engineering judgement
  - capex and opex input composition weights sourced from fleet management plans that underpin the expenditure forecasts
- the model appears robust (although we have not undertaken a model audit)[61] and is consistent with what we would expect to apply cost escalation to expenditure forecasts.

Powerco notes that adjustments to the Orion escalation weights reflects management judgement.[62] We have not been able to verify the reasonableness of these adjustments, but note that they appear to have limited impact on the cost escalation applied to the capex and opex forecasts.

5.4.4 Completeness and key issues for the Commission

The information provided by Powerco on its cost escalation forecasts was sufficient for us to undertake our verification. We are not aware of any information that we consider was omitted by Powerco.

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60 See, for instance, NZIER, *Cost Escalators – NZIEIR – Data Tables March 2017_judgement.xlsx*, March 2017, 'Summary' sheet, cells G3:G5.

61 We understand that Deloitte was engaged by Powerco to audit the spreadsheets that support its CPP application, including the CPP Financial Model that applies the cost escalators to forecast capex and opex. We are not aware of any unresolved issues resulting from this audit.

62 Powerco, Verifier Question 009 Cost Escalators_Powerco Full Response _21_2_17, 21 February 2017, Ansarada question ID 009.

As noted above, although we consider that the proposed cost escalation forecasts are not unreasonable in the circumstances, we recommend that the Commission consider procuring its own forecasts from a suitably qualified third party as a cross check. The Commission may also want to consider replacing the material cost escalator forecasts with forecast inflation given the inherent uncertainty with them, and could test this approach with that third party.

6. Completeness of CPP proposal

Schedule G11 of IM requires us to assess the completeness of Powerco's CPP proposal, and is repeated below.

Box 24 – IM requirements on completeness of proposal

Schedule G11 of the IM:

A **verification report** must-

(a) list the information in, and relating to, the **CPP proposal** provided by the **CPP applicant** to the **verifier**, that was relied upon by the verifier in fulfilling its obligations under Schedule G;

(b) state each type of information in respect of which this schedule requires the **verifier's** consideration or opinion that the verifier considers has been omitted from the **CPP proposal**, including information that is incomplete or insufficient, and the relevant requirement in Part 5, Subpart 4 to provide the information in question;

(c) where information is identified as insufficient in accordance with paragraph (b), state the nature of additional information the **verifier** considers that the **CPP proposal** requires to fulfil the information requirement in question;

(d) state the extent to which the omission, incompleteness or insufficiency of information has impaired the **verifier's** judgement as to whether the **capex forecast** and **opex forecast** for the next period meets the expenditure objective; and

(e) explain why the **verifier** has selected the **identified programmes** in accordance with clause G4(1).

Information provided to us by Powerco that we relied on in preparing our final verification report is listed in appendix A. Most of this information was provided by Powerco via the data room (Ansarada), with read only access. We also used the data room to ask questions of and request information form Powerco, with responses provided by the same system. Other information relied upon is footnoted throughout the report, and includes the Commission's information disclosure database that we consider in Appendix F.

In our findings in chapters 2 to 5 and in conclusions from the program review in appendix D, we noted any concerns over the omission, incompleteness or insufficiency of information that may have affected our opinions. We also recommended how the Commission may want to address this when undertaking its own assessment of the information.

Finally, our approach to – and reasons for – selecting the 15 projects and programs that we did is set out in appendix C. Powerco provided us information on each of these projects and programs, with varying degrees of completeness. This information is identified in our detailed project and program review in appendix D.

Appendix A – Information provided

This appendix lists the documents and spreadsheets provided by Powerco to us via the data room (Ansarada), and which we had regard to when preparing our verification report, and is split as follows:

- Table 10 lists the information provided by Powerco and directly relied upon by us when developing the report – this information is also cited by us where relevant throughout the report
- Table 11 lists the question sets that Powerco provided responses to that were also relied upon by us when developing the report
- Table 12 lists the other information provided by Powerco that informed the report, and includes information that was superseded by other information provided.

For each item listed, the tables identify the Ansarada document number, the document name, and the date it was uploaded to the data room.

Table 10 – Relied upon information provided by Powerco via the data room

Ansarada document number	Document name	Date uploaded
01	**BAU & Background**	
01.01	**AMP, reports & planning documents**	
01.01.01	Powerco Asset Management Strategy Feb 2017	21/02/2017
01.01.02	Asset Management Framework - current MASTER for verification	22/02/2017
01.02	**Policies, standards & guidelines**	
01.02.24	310S001 Security of Supply Classification - Zone Substations	15/02/2017
01.02.40	393S049 Overhead Network Inspections Standard - Maintenance - 4OH DOH SOH	15/02/2017
01.02.57	393S041 Zone Substation Transformer Ratings - Planning - ZTR	16/02/2017
01.02.59	Economic Evaluation Template - Medium-V1.2-26-08-2014	24/02/2017
01.02.60	Economic Evaluation Template - Small-V1.2 -26-08-2014	24/02/2017
01.02.61	Electricity Network Options Analysis Guidelines v1.2 -26-08-2014	26/02/2017
01.02.62	ZP01594 Powerco Security of Supply V3-31-07-2014	1/03/2017
02	**Consultation materials**	
02.01	1_2015 snapshot_Powerco Consumer Research Overview	24/02/2017
02.02	2009-2011 Powerco Consultation Report	24/02/2017
02.03	2014_2015 research on preferences around interruptions	24/02/2017

Ansarada document number	Document name	Date uploaded
02.04	2013_Key Research_Consumer Engagement-Price-Quality Report	24/02/2017
02.05	2013 Wairarapa Electricity Survey	24/02/2017
02.06	2014_Stakeholder Report_Engagement on Future Investment Plan_AMP 2013	24/02/2017
02.07	2016_Preliminary Findings from the Willingness to Pay consumer survey	24/02/2017
02.08	2015 PWC_Quantitative Consumer Research Results - Willingness to Pay and General Findings	24/02/2017
02.09	2015 PWC_Quantitative Consumer Research Results_VOLL	24/02/2017
02.10	2017 PWC Full Results from consumer survey	24/02/2017
02.11	2017 PWC Further analysis of customer survey	24/02/2017
02.12	2016_Key Research_Stakeholder Preferred Engagement	24/02/2017
02.13	2015 Board Paper_1186_Customer Engagement Programme	24/02/2017
02.14	2015 CPP Consultation Strategy based on a May 2016 submission	3/03/2017
02.15	2015 BAU+Consultation with Councils	24/02/2017
02.16	2015 PWC_Colmar Brunton Presentation to the Powerco Board_Survey Approach and Scope	24/02/2017
02.17	2015_Colmar Brunton - Qualitative Survey - Understanding Consumers' (and SMEs) Willingness to Pay	24/02/2017
02.18	Schedule of Pco Consultation Docs_230217	24/02/2017
02.20	Summary table_consideration of customer feedback	31/05/2017
02.21	CPP Core Consultation Database - Summary to CC_May 2017	31/05/2017
02.19	**Consumer Engagement**	
02.19.01	Overview-document-Investing-in-your-energy-future	28/02/2017
02.19.02	Powerco_Have-Your-Say_24JAN17	28/02/2017
02.19.03	Example - CPP Rural advert 18.5x26.2cm	28/02/2017
02.19.04	Example Newspaper Insert - Powerco_Insert_BOP_Version 2	28/02/2017
02.19.05	Example Newspaper Ad - Powerco Manawatu Standard Tues 21 Feb 2017	28/02/2017
02.19.06	Example - Invitation to Powerco's 'Investing in Your Energy Future' Forum	28/02/2017
02.19.08	Example Forum Slides - Wellington retailers forum	28/02/2017
02.19.09	Example CEO letter_Contact - Dennis Barnes	28/02/2017
03	Model & Expenditure Tracker	
03.03	Version 2 (16 Jan)	

Ansarada document number	Document name	Date uploaded
03.03.03	CPP Financial Model - Calculation Modules - v2.1 - Updated 14 Feb	14/02/2017
03.04	**Version 2a (14 feb)**	
01.2	1.2 - Crossarm expenditure forecast model	15/02/2017
02.1	2.1 - Subtransmission Conductor expenditure forecast model	15/02/2017
02.2	2.2 - Distribution Conductor expenditure forecast model	14/02/2017
04.0	4.0 - Zone Substations - expenditure forecast model	15/02/2017
07.1	7.1 - SCADA and Communications expenditure forecast model	14/02/2017
07.2	7.2 - Protection expenditure forecast model	14/02/2017
07.3	7.3 - DC Supplies expenditure forecast model	14/02/2017
10	10 Electricity Indirect BST forecast	14/02/2017
12	12 Finance BST forecast	14/02/2017
13	13 HR BST forecast	14/02/2017
14	14 Health and Safety BST forecast	14/02/2017
15	15 Marketing and Communications BST forecast	14/02/2017
16	16 Research and Development BST forecast	14/02/2017
17	17 Legal BST forecast	14/02/2017
18	18 Regulatory BST forecast	14/02/2017
19	19 IST BST forecast	14/02/2017
20	20 Programme Office BST forecast	14/02/2017
24-NO	Network opex - Preventive Maintenance and Inspection	14/02/2017
25	25 Minor works portfolio - expenditure forecast	15/02/2017
26-NO	Network opex - SONS	14/02/2017
27-NO	Network opex - Corrective Maintenance	14/02/2017
28-NO	Network opex - VM	15/02/2017
30-NO	Network opex - maintenance step changes	16/02/2017
31-NO	Network opex - Preventive Maintenance and Inspection - GEM scheduled maintenance	25/02/2017
51	51 Reliability	16/02/2017
52	52 Network Evolution expenditure forecast model	20/02/2017
60-61	60-61 - Consumer Connection and Asset Relocation expenditure forecast model	15/02/2017
70	70. ICT capex forecast model	17/02/2017
73	BST consolidated forecast for verifier v24.02.17	26/02/2017
03.05	**Version 2b (Structural Review - 17 March)**	
03.05.01	CPP Financial Model - Calculation Modules - v2.0	17/03/2017

Ansarada document number	Document name	Date uploaded
03.07	**Background and Historical information**	
03.05.08	Cost Escalators - NZIER - Data Tables October 2016 FINAL	3/02/2017
03.09	**VERSION 3.1 (8 May) (Final moderations)**	
03.09.01	1.1 - Poles Expenditure Forecast Model	8/05/2017
03.09.02	1.2 - Crossarm expenditure forecast model	8/05/2017
03.09.03	10 - 24 Major Projects - summary	8/05/2017
03.09.04	2.1 - Subtransmission Conductor expenditure forecast model	8/05/2017
03.09.05	2.2 - Distribution Conductor expenditure forecast model	8/05/2017
03.09.06	2.3 - LV Conductor expenditure forecast model	8/05/2017
03.09.07	25 Minor works portfolio - expenditure forecast	8/05/2017
03.09.12	4.0 - Zone Substations - expenditure forecast model	8/05/2017
03.09.16	51 Reliability	8/05/2017
03.09.17	52 Network Evolution expenditure forecast model	8/05/2017
03.09.22	60-61 - Consumer Connection and Asset Relocation expenditure forecast model	8/05/2017
03.09.23	7.1 - SCADA and Communications expenditure forecast model	8/05/2017
03.09.24	7.2 - Protection expenditure forecast model	8/05/2017
03.09.25	7.3 - DC Supplies expenditure forecast model	8/05/2017
03.09.26	7.4 - Metering expenditure forecast model	8/05/2017
03.09.27	70. ICT capex forecast model	8/05/2017
03.09.29	10 Electricity Indirect BST forecast	8/05/2017
03.09.30	11 Leadership BST forecast	8/05/2017
03.09.31	12 Finance BST forecast	8/05/2017
03.09.32	13 HR BST forecast	8/05/2017
03.09.33	14 Health and Safety BST forecast	8/05/2017
03.09.34	15 Marketing and Communications BST forecast	8/05/2017
03.09.35	16 Research and Development BST forecast	8/05/2017
03.09.36	17 Legal BST forecast	8/05/2017
03.09.37	18 Regulatory BST forecast	8/05/2017
03.09.38	19 IST BST forecast	8/05/2017
03.09.39	20 Programme Office BST forecast	8/05/2017
03.09.41	22 CPP BST forecast	8/05/2017
03.09.43	Network opex - Corrective Maintenance	8/05/2017
03.09.44	Network opex - Preventive Maintenance and Inspection	8/05/2017

Ansarada document number	Document name	Date uploaded
03.09.46	Network opex - SONS	8/05/2017
03.09.47	Network opex - VM	8/05/2017
03.09.48	CPP Financial Model - Calculation Modules - v3.2 - 19-May-2017	19/05/2017
04	**Network**	
04.01	**Strategy and plans**	
04.01.09	Electricity Demand Forecasting Guidelines Feb 2017	14/02/2017
04.01.01	Maintenance Strategy v1.1	1/02/2017
04.01.01.01	Maintenance Strategy v1.1 -additional table appendix 2	1/02/2017
04.01.02	Vegetation Management Strategy	27/01/2017
04.01.03	Network Development Plan 30 Jan	31/01/2017
04.01.04	**Fleet management Plans**	
04.01.04.04	Fleet Management Plan - Overhead Conductors	20/01/2017
04.01.04.05	Fleet Management Plan - Overhead Structures	20/01/2017
04.01.04.06	Fleet Management Plan - Zone Substations	4/02/2017
04.01.04.07	Fleet Management Plan - Secondary Systems	4/02/2017
04.01.05	**PODs**	
04.01.05.03	POD - corrective maintenance	2/02/2017
04.01.05.04	POD - preventive maintenance and inspection	3/02/2017
04.01.05.07	Consumer Connections Capex POD	28/02/2017
04.01.06	Planned quality model v2 [Read-Only]	1/02/2017
04.01.07	Quality Note v2	1/02/2017
04.01.08	Electricity-Capital-Contribution-Guide-vF	3/02/2017
04.01.09.01	**PODS**	
04.01.09.01.01	POD G03 Putaruru GXP	3/02/2017
04.01.09.01.02	POD02 Palmerston North Reinforcement	3/02/2017
04.01.11	Business case for asset management strategy increase	28/03/2017
04.01.12	Business case for in-house call centre	28/03/2017
04.01.14	NPV and Unplanned model update note	28/03/2017
04.01.15	Tauranga Information Initiative - Summary Business Case_minor update_290317	29/03/2017
04.01.16	Business case for network evolutions activities	29/03/2017
04.02	**Models, data & assumptions**	
04.02.01	**Renewals**	
04.02.01.01	1.1 - Poles Expenditure Forecast Model	27/01/2017

Ansarada document number	Document name	Date uploaded
04.02.01.02	1.1a - Pole Survivor Curve Model	27/01/2017
04.02.01.03	2.2 - Distribution Overhead Conductor Expenditure Forecast Model	27/01/2017
04.02.01.04	2.2a - Distribution Overhead Conductor Fault Rate Model (Urban)	27/01/2017
04.02.01.07	1.2a - Crossarm Survivor Curve Model	27/02/2017
04.02.01.08	CPP Power Transformer Renewal with load duration curve	2/03/2017
04.02.01.09	4.1a - Power Transformers AHI Model	3/03/2017
04.02.01.10	EEA Conference 2015 - Power Transformers Asset Health Development	3/03/2017
04.02.01.13	Distribution conductor line down faults	3/05/2017
04.02.01.14	Crossarm defect overlap	3/05/2017
04.02.02	**Network Development**	
04.02.02.01	Demand - summary	15/02/2017
04.02.02.02	Demand - Dem_Fcst_ICP_Data	15/02/2017
04.02.02.03	Demand - Eastern Zone Sub Forecast Model	15/02/2017
04.02.02.04	Demand - Feeder_Forecast-2016	15/02/2017
04.02.02.05	Demand - GXP Forecast 2016 Model	15/02/2017
04.02.02.06	Demand - Western Zone Sub Forecast Model	15/02/2017
04.02.02.19	Communications Plan EW and AG Revisions 03-02-2017_280217	6/03/2017
04.02.03	**Quality**	
04.02.03.01	Planned SAIDI Model	2/03/2017
04.02.03.02	NAPA FY 15-16 SAIDI SAIFI per asset analysis	2/03/2017
04.02.03.03	Outdef 04-14 SAIDI SAIFI per asset analysis	2/03/2017
04.02.03.04	SAIDI per asset workbook	2/03/2017
04.02.03.05	Influence of Weather on Network Performance V3	6/03/2017
04.02.03.06	Verification that Western Distribution Overhead Network Health is Declining	6/03/2017
04.02.03.07	Report on Weather Influence 061016	6/03/2017
04.02.03.09	SAIDI per asset workbook - Update 07032017	8/03/2017
04.02.03.10	Planned SAIDI Model - Update 07032017 v2	8/03/2017
04.02.03.11	**Unplanned Models**	
04.02.03.11.01	Unplanned Regional Model Note -CPP - 21-04-17 - final draft	21/04/2017
04.02.03.11.02	Unplanned Regional Model 17-4-17 - CPP - final draft	21/04/2017
04.02.03.11.03	ageModelling (Crossarms) 170417 (CPP inputs)	21/04/2017
04.02.03.11.04	ageModelling (Fuses) 170417 (CPP inputs)	21/04/2017

Ansarada document number	Document name	Date uploaded
04.02.03.11.05	ageModelling (Poles) 1170417 (CPP inputs)	21/04/2017
04.02.03.11.06	ageModelling (Transformers - Ground Mounted - with totals) 170417 (CPP inputs)	21/04/2017
04.02.03.11.07	ageModelling (Transformers - Pole Mount) 170417 (CPP inputs)	21/04/2017
04.02.03.11.08	Fault Rate Analysis - 170417	21/04/2017
04.02.03.12	Reference note_Our Proposed Quality Path 17052017	17/05/2017
04.02.03.13	CPP SAIDI and SAIFI targets	19/05/2017
04.02.03.14	CPP quality path - reference dataset - create	19/05/2017
04.02.04	**Maintenance**	
04.02.04.01	Tauranga cyclical vegetation management effectiveness	7/03/2017
04.02.04.02	Network opex step change documents	29/03/2017
04.02.04.03	Network opex -step changes – corrective maintenance	29/03/2017
04.02.04.04	Network opex -step changes – preventive maintenance and inspection	29/03/2017
04.02.04.05	Output growth factors used in BST models	2/05/2017
04.02.04.07	Appproach to modelling second cuts in vegetation model	2/05/2017
04.02.04.08	Network opex - maintenance step changes v3.1	10/05/2017
04.02.04.09	v2 and 3 step change reconciliation	10/05/2017
04.02.05	Guidance note - relative cost of investment scenarios	21/04/2017
04.02.06	Relative cost to consumers of investment scenarios	21/04/2017
05	**Non-Network**	
05.01	**Overviews**	
05.01.01	170201-cpp is capability and expenditure v2.3	3/02/2017
05.01.02	170202-cpp is capability and expenditure v2.4	2/03/2017
05.01.03	New Foundation (ERP) material - Powerco Information Systems Strategy - Options Analysis Report Dec 2013	2/03/2017
05.01.04	New Foundations (ERP) material - Powerco Request for Information Presentation Oct 2014	2/03/2017
05.01.05	New Foundation (ERP) material - Asset and Financial Management System renewal options Feb 2016	2/03/2017
05.01.07	Powerco ERP needs case 28_03_2017 vF	28/03/2017
05.01.08	170410-electricity cpp is capability and expenditure v3.2.compressed	5/05/2017
05.01.09	Corporate Opex POD Steps_Supporting material	30/05/2017
05.02	**PODs**	
05.02.03	POD Corporate Opex	4/02/2017
05.02.07	170410-electricity cpp is capex pod v 2.2.compressed	5/05/2017

Ansarada document number	Document name	Date uploaded
07	**Expert Reports**	
07.05	KPMG Powerco IT Management Review 3 9 13 with responses	4/03/2017
07.07	110064-RPT-X0001-R0 - Remote Area Power Supplies Benefits Case	29/03/2017
07.08	110064-RPT-X0002-R0 - Energy Storage and Community Energy	29/03/2017
07.09	110064-RPT-X0003-R0 - Automatic Fault Location Related Automation Benefits Case	29/03/2017
07.10	110064-RPT-X0004-R0 - Real Time Asset Ratings Benefits Case	29/03/2017
07.11	110064-RPT-X0005-R0 - Low Voltage And Smart Meter Data Benefits Case	29/03/2017
07.12	EEA_Asset_Health_Indicators_-_Final	5/05/2017
07.13	Cost escalators - NZIER report April 2017	18/05/2017
07.14	Cost Escalators - NZIER - Data Tables March 2017_judgement	18/05/2017

Table 11 – Relied upon responses to questions provided by Powerco via the data room

Ansarada document number	Document name	Date uploaded
09	**Powerco Responses to Q2070 - Information Request Question**	
01	Response template to Q2070 item 1	24/02/2017
02	Response template to Q2070 Item 2	20/02/2017
03	Response template to Q2070 item 3	6/03/2017
06	Response template to Q2070 item 6	4/03/2017
07	Response template to Q2070 item 7	2/03/2017
08	Response template to Q2070 item 8	2/03/2017
09	Response template to Q2070 item 9	6/03/2017
09.01	Response template to Q2070_Items where docs already uploaded 20_21_46_43	24/02/2017
09.02	Response template to Q2070 item 85	2/03/2017
11	Response template to Q2070 item 11	4/03/2017
15	Response template to Q2070 item 15	24/02/2017
16	Response template to Q2070 item 16	6/03/2017
17	Response template to Q2070 item 17	24/02/2017
18	Response template to Q2070 item 18	8/03/2017
23	Response template to Q2070 item 23	6/03/2017
24	Response template to Q2070 item 24	8/03/2017

Ansarada document number	Document name	Date uploaded
25	Response template to Q2070 item 25	28/02/2017
31	Response template to Q2070 item 31	6/03/2017
32	Response template to Q2070 item 32	8/03/2017
33	Response template to Q2070 items 33	23/02/2017
34	Response template to Q2070 item 34	23/02/2017
35	Response template to Q2070 item 35	24/02/2017
36	Response template to Q2070 item 36	6/03/2017
44	Response template to Q2070 item 44	8/03/2017
45	Response template to Q2070 item 45	7/03/2017
46	Response template to Q2070 item 46	21/02/2017
48	Response template to Q2070 item 48	7/03/2017
49&67	Response template to Q2070 item 49, 67	3/03/2017
5&27&28&29&30	Response template to Q2070 item 5_27_28_29_30	3/03/2017
50.63	Response template to Q2070 item 50, 63	3/03/2017
52	Response template to Q2070 item 52	24/02/2017
53	Response template to Q2070 item 53	6/03/2017
54	Response template to Q2070 item 54	28/02/2017
55	Response template to Q2070 item 55	25/02/2017
57	Response template to Q2070 item 57	22/02/2017
59	Response template to Q2070 Item 59	22/02/2017
60	Response template to Q2070 item 60	3/03/2017
62	Response template to Q2070 item 62	6/03/2017
65	Response template to Q2070 item 65	2/03/2017
70	Response template to Q2070 item 70	6/03/2017
71	Response template to Q2070 item 71	27/03/2017
72	Response template to Q2070 item 72	7/03/2017
78	Response template to Q2070 Item 78	23/02/2017
81	Response template to Q2070 item 81	6/03/2017
83	Response template to Q2070 Item 83	22/02/2017
84	Response template to Q2070 item 84	7/03/2017
92&94	Response template to Q2070 items 92 and 94	23/02/2017
93&95	Response template to Q2070 Items 93 and 95	23/02/2017
96	Response template to Q2070 item 96	4/03/2017
Ansarada Question Ref	**Verifier Question**	**Date**
6518	Project and programme selection We nominate the following 15 projects and programmes in accordance with Clause G4 of the Input Methodologies. We may nominate one or more further projects or programmes	21/01/2017

Ansarada document number	Document name	Date uploaded
	once we have reviewed relevant CPP application material, up to a combined total of 20 projects and programmes.	
9957	We are required to review and provide an opinion on your policies and planning standards, as set out in the IMs. Can you please provide a consolidated list of your policies and planning standards that we can use to help identify which ones we wish to review as part of our verification?	27/01/2017
7991	The IMs require us to review and provide an opinion on the demand forecasts used to derive your capex and opex forecasts (see clause G8).	27/01/2017
6153	Please see information request attached seeking confirmation of whether Powerco intends to propose any contingent projects as part of its CPP Application.	1/02/2017
273	Please find attached a populated question template seeking a copy of the NZIER report on cost escalation that is referred to in the CPP financial model as the source for the opex and capex cost escalators and for the exchange rate forecast.	3/02/2017
273.1	This document appears to be a spreadsheet containing the data tables that are included in the NZIER report. Please confirm whether NZIER also produced a report - in word or PDF format - that explains the assumptions, inputs, and methodology used to determine the cost escalation values included in the spreadsheet.	3/02/2017
6419	Please find attached a list of selected policies and processes that we would appreciate getting copies of to support our review. These were selected from file 01.02.02.	11/02/2017
2070	Please find attached a spreadsheet containing a register of information requests for further models, explanations, or other documents, organised by portfolio. This register will likely change over time as new information becomes available. Please note that the register does not include specific questions that we expect to ask by portfolio / topic, which we expect to start uploading over the next few days.	16/02/2017
9603	Please find attached a series of questions on cost escalation.	17/02/2017
7379	Please find attached a series of questions on consumer contributions.	17/02/2017
3702	Please find attached a set of questions relating for forecast demand and ICP connections.	17/02/2017
2096	Please find attached a set of questions on corporate opex.	17/02/2017
2774	Please find attached a set of questions on vegetation management opex.	17/02/2017
7284	Please find attached a set of questions on the proposed SONS operating expenditure forecast.	21/02/2017
5682	Please find attached a set of questions relating to maintenance and inspection expenditure. This covers the three categories of expenditure: (1) preventative maintenance and inspections, (2) corrective maintenance, and (3) reactive maintenance.	22/02/2017
8000	Please find attached a set of questions related to overhead conductor renewals.	22/02/2017
3309	Please find attached a set of questions relating to expenditure on overhead structure renewals.	22/02/2017

Ansarada document number	Document name	Date uploaded
4052	Please find attached a set of questions on secondary system renewals.	24/02/2017
3879	Please find attached a set of questions on zone substation renewals.	24/02/2017
7890	Please find attached a set of questions on the Palmerston North major project.	24/02/2017
1316	Please find attached a set of questions on the Putaruru major project.	24/02/2017
4413	Please find attached a set of questions on service measures, service levels and the quality standard variation.	1/03/2017
4594	Please find attached a set of questions on ICP number forecasts. These questions are targeted specifically at the ICP number forecast model, which was not available at the time we compiled our previous questions on demand and ICP numbers (Q007).	24/02/2017
8178	Please find attached a set of questions on minor growth and security works capital expenditure.	1/03/2017
8178.1	Please find attached a set of questions related to minor growth and security works capital expenditure.	1/03/2017
2282	Please find attached a set of questions on network evolution capital expenditure.	1/03/2017
1144	Please find attached a set of questions about reliability capital expenditure.	1/03/2017

Table 12 – Other supporting information provided by Powerco via the data room

Ansarada document number	Document name	Date uploaded
01	**BAU & Background**	
01.02	**Policies, standards & guidelines**	
01.02.01	Pco BMS Asset Management Policies and Standards	1/02/2017
01.02.02	Pco BMS Policies and Standards_All with business catogory indicators	4/02/2017
01.02.03	100P005 Audit and Risk Committee Charter	14/02/2017
01.02.04	100P006 Regulatory and Asset Management Committee Charter	14/02/2017
01.02.05	140P003 Risk Management Policy	14/02/2017
01.02.06	140S005 Electricity Network Environmental Management Plan	14/02/2017
01.02.07	173S004 Permission of Network Owner to Carry Out Maintenance of Trees Around Network	14/02/2017
01.02.08	210S005-A Power Quality - Part A - Investigation and Resolution Process - Test - AEN	14/02/2017

Ansarada document number	Document name	Date uploaded
01.02.09	210S005-B Power Quality - Part B - Investigation and Report - Test - AEN	14/02/2017
01.02.10	300P001 Safety In Design Policy	14/02/2017
01.02.11	320S008 Electricity Field Services Governance Framework Manual	14/02/2017
01.02.12	350P001 Network Asset Management Policy	14/02/2017
01.02.13	350S006 Zone Substation Design And Construction Requirements - ZBG	14/02/2017
01.02.14	370S015 Scheduled Capital Work Order Management	14/02/2017
01.02.15	393S093 Powerco Pole Dictionary - Design - 4OH DOH SOH	14/02/2017
01.02.16	393S146 Powerco Pole Type Test Procedure - Design - 4OH DOH SOH ZST	14/02/2017
01.02.17	EAL31 Deliver EFSA Capital Works Programme Process	14/02/2017
01.02.18	124P002 Accounting for Network Fixed Assets - Capital Expenditure Repairs and Maintenance	15/02/2017
01.02.19	124S001 Non-Network Capital Expenditure	15/02/2017
01.02.20	190P001 Business Management System	15/02/2017
01.02.21	350S001 Guide to the Capitalisation of Network Asset Expenditures	15/02/2017
01.02.22	100R001 Risk Management Framework	16/02/2017
01.02.23	141S001 Business Development Project Evaluation and Approval Standard	15/02/2017
01.02.25	310S003 Distribution Feeder Security and Reliability Classification	15/02/2017
01.02.26	310S004 Zone Substation Security Short Term	15/02/2017
01.02.27	310S016 Economic Considerations Live Line Work	15/02/2017
01.02.28	310S060 Project Optimiser (Coin) Manual	15/02/2017
01.02.29	310S072 Economic Value Testing of Live Line vs Dead Line Maintenance	15/02/2017
01.02.30	392S034 Powerco Asset Criticality Definition - Electricity Networks - AEN	15/02/2017
01.02.31	393S115 Electricity Network Defect Management System - Maintenance - AEN	15/02/2017
01.02.32	393S115A RED Defect Process - Information Requirements	15/02/2017
01.02.33	393S115B AMBER Defect Process - Information Requirements	15/02/2017
01.02.34	393S115C GREEN Defect Process - Information Requirements	15/02/2017
01.02.35	393S143 Defect Rating Manual for Amber Defects	15/02/2017
01.02.36	125F010 Employee v Contractor Questionnaire	16/02/2017

Ansarada document number	Document name	Date uploaded
01.02.37	190P002 Quality Policy	15/02/2017
01.02.38	393S008 Overhead Line Design Standard - 4OH DOH SOH	15/02/2017
01.02.39	393S010 Overhead Line Construction Standard - 4OH DOH SOH	15/02/2017
01.02.41	393S156 Electricity Design Standard - AEN	15/02/2017
01.02.42	EAL26 Asset Inspection and Routine Servicing Process	15/02/2017
01.02.43	EAL28 Tender Process	15/02/2017
01.02.46	EON02 Amber Defects Process	15/02/2017
01.02.47	EON03 Green Defects Process	15/02/2017
01.02.48	EX09 Schedule of Rates Decision Tree	15/02/2017
01.02.49	EON01 Red Defects Process	15/02/2017
01.02.50	393S082A Powerco Poles - Part A - Specification - 4OH DOH SOH	15/02/2017
01.02.52	310S015 Electricity Network Asset Lifecycle Plan - Maintenance - AEN	16/02/2017
01.02.53	124F001 Non-Network Capex Proposal Form	16/02/2017
01.02.54	124P012 Capital Expenditure Policy for Non-Network Assets	16/02/2017
01.02.55	140S001 Critical Business Models - Governance Framework	16/02/2017
01.02.56	180S001 Programme Management Framework	16/02/2017
01.02.58	124S005 Internal Cost Capitalisation Procedure	23/02/2017
02	**Consultation materials**	
03	**Model & Expenditure Tracker**	
03.03	**Version 2 (16 Jan)**	
03.03.01	CPP Financial Model - Calculation Modules - v2.0	20/01/2017
03.03.02	CPP Financial Model - Forecasting modules - v2.0	20/01/2017
03.04	**Version 2a (14 feb)**	
01.1	1.1 - Poles Expenditure Forecast Model	15/02/2017
02.3	2.3 - LV Conductor expenditure forecast model	14/02/2017
03.1	3.1 - Subtrans Cable Fleet - expenditure forecast model	15/02/2017
03.2	3.2 - Distribution Cable Fleet - expenditure forecast model	15/02/2017
03.3	3.3 - LV Cable Fleet - expenditure forecast model	15/02/2017
05.1	5.1 - Distribution Transformers - Pole Mounted - expenditure forecast model	14/02/2017
05.2	5.2 - Distribution Transformers - Ground Mounted - expenditure forecast model	15/02/2017
05.3	5.3 - Distribution Transformers - Other - expenditure forecast model	15/02/2017

Ansarada document number	Document name	Date uploaded
06.1	6.1 - Distribution Switchgear - Fuses - expenditure forecast model	15/02/2017
06.2	6.2 - Distribution Switchgear - Pole Mount Switchgear - expenditure forecast model	15/02/2017
06.3	6.3 - Distribution Switchgear - CBs, Recl and Sect - expenditure forecast model	15/02/2017
06.4	6.4 - Distribution Switchgear - Ground Mount Switchgear - forecast model	15/02/2017
07.4	7.4 - Metering expenditure forecast model	14/02/2017
09	10 - 24 Major Projects - summary	14/02/2017
11	11 Leadership BST forecast	14/02/2017
21	21 Facilities BST forecast	14/02/2017
23	23 Insurance BST forecast	14/02/2017
25-NO	Network opex - Reactive Maintenance	14/02/2017
28	28 Network opex - VMv2 27032017	28/03/2017
29-NO	Network opex - trend factors for base-step-trend	23/02/2017
72	72 Facilities capex forecast model	17/02/2017
03.05	**Version 2b (Structural Review - 17 March)**	
03.05.02	2016 Closing RAB and Adjusted RAB	30/03/2017
03.05.03	6.1 RAB roll forward by asset category	30/03/2017
03.05.04	2016 Closing Tax NBV and Tax Base	3/04/2017
03.05.05	CPP_ARL2016	4/04/2017
03.06	**Version 3 (4 Apr)**	
03.06.01	1.1 - Poles Expenditure Forecast Model	21/04/2017
03.06.02	1.2 - Crossarm expenditure forecast model	21/04/2017
03.06.03	10 - 24 Major Projects - summary	4/04/2017
03.06.04	2.1 - Subtransmission Conductor expenditure forecast model	21/04/2017
03.06.05	2.2 - Distribution Conductor expenditure forecast model	4/04/2017
03.06.06	2.3 - LV Conductor expenditure forecast model	4/04/2017
03.06.07	25 Minor works portfolio - expenditure forecast	4/04/2017
03.06.08	28 Pre CPP Major Projects expenditure model	4/04/2017
03.06.09	3.1 - Subtrans Cable Fleet - expenditure forecast model	4/04/2017
03.06.10	3.2 - Distribution Cable Fleet - expenditure forecast model	4/04/2017
03.06.11	3.3 - LV Cable Fleet - expenditure forecast model	21/04/2017
03.06.12	4.0 - Zone Substations - expenditure forecast model	4/04/2017
03.06.13	5.1 - Distribution Transformers - Pole Mounted - expenditure forecast model	4/04/2017

Ansarada document number	Document name	Date uploaded
03.06.14	5.2 - Distribution Transformers - Ground Mounted - expenditure forecast model	4/04/2017
03.06.15	5.3 - Distribution Transformers - Other - expenditure forecast model	4/04/2017
03.06.16	51 Reliability	4/04/2017
03.06.17	52 Network Evolution expenditure forecast model	4/04/2017
03.06.18	6.1 - Distribution Switchgear - Fuses - expenditure forecast model	4/04/2017
03.06.19	6.2 - Distribution Switchgear - Pole Mount Switchgear - expenditure forecast model	4/04/2017
03.06.20	6.3 - Distribution Switchgear - CBs, Recl and Sect - expenditure forecast model	4/04/2017
03.06.21	6.4 - Distribution Switchgear - Ground Mount Switchgear - forecast model	4/04/2017
03.06.22	60-61 - Consumer Connection and Asset Relocation expenditure forecast model	4/04/2017
03.06.23	7.1 - SCADA and Communications expenditure forecast model	4/04/2017
03.06.24	7.2 - Protection expenditure forecast model	4/04/2017
03.06.25	7.3 - DC Supplies expenditure forecast model	4/04/2017
03.06.26	7.4 - Metering expenditure forecast model	4/04/2017
03.06.27	70. ICT capex forecast model	4/04/2017
03.06.28	72 Facilities capex forecast model	4/04/2017
03.06.29	10 Electricity Indirect BST forecast	4/04/2017
03.06.30	11 Leadership BST forecast	4/04/2017
03.06.31	12 Finance BST forecast	4/04/2017
03.06.32	13 HR BST forecast	4/04/2017
03.06.33	14 Health and Safety BST forecast	4/04/2017
03.06.34	15 Marketing and Communications BST forecast	4/04/2017
03.06.35	16 Research and Development BST forecast	4/04/2017
03.06.36	17 Legal BST forecast	4/04/2017
03.06.37	18 Regulatory BST forecast	4/04/2017
03.06.38	19 IST BST forecast	4/04/2017
03.06.39	20 Programme Office BST forecast	4/04/2017
03.06.40	21 Facilities BST forecast	4/04/2017
03.06.41	22 CPP BST forecast	21/04/2017
03.06.42	23 Insurance BST forecast	4/04/2017
03.06.43	Network opex - Corrective Maintenance	4/04/2017

Ansarada document number	Document name	Date uploaded
03.06.44	Network opex - Preventive Maintenance and Inspection	21/04/2017
03.06.45	Network opex - Reactive Maintenance	4/04/2017
03.06.46	Network opex - SONS	21/04/2017
03.06.47	Network opex - VM	21/04/2017
03.07	**Background and Historical information**	
	03.05.06 CPP Renewals forecast by area (pre-v1A 20161111)	31/01/2017
03.05.01	Memo - CPP - Historical opex and capex reclassifications and adjustments	25/01/2017
03.05.04	CPP - historical and budgeted capex FY11-18 - 26 Jan 2017	26/01/2017
03.05.05	CPP - historical and budgeted opex FY11-18 - 26 Jan 2017	26/01/2017
03.05.07	Inventory of expenditure models	1/02/2017
03.05.09	Opex and Capex categorisation enhancements	8/02/2017
03.05.10	Summary of historical network opex	7/03/2017
03.08	**Version 2 & 3 tracker**	
03.08.01	CPP tracker - refined forecast (v3) and verifier base (v2)	21/04/2017
03.08.02	CPP tracker - refined forecast (v3.1 and v3)	8/05/2017
03.09	**Version 3.1 (8 may) (final moderations)**	
03.09.08	28 Pre CPP Major Projects expenditure model	8/05/2017
03.09.09	3.1 - Subtrans Cable Fleet - expenditure forecast model	8/05/2017
03.09.10	3.2 - Distribution Cable Fleet - expenditure forecast model	8/05/2017
03.09.11	3.3 - LV Cable Fleet - expenditure forecast model	8/05/2017
03.09.13	5.1 - Distribution Transformers - Pole Mounted - expenditure forecast model	8/05/2017
03.09.14	5.2 - Distribution Transformers - Ground Mounted - expenditure forecast model	8/05/2017
03.09.15	5.3 - Distribution Transformers - Other - expenditure forecast model	8/05/2017
03.09.18	6.1 - Distribution Switchgear - Fuses - expenditure forecast model	8/05/2017
03.09.19	6.2 - Distribution Switchgear - Pole Mount Switchgear - expenditure forecast model	8/05/2017
03.09.20	6.3 - Distribution Switchgear - CBs, Recl and Sect - expenditure forecast model	8/05/2017
03.09.21	6.4 - Distribution Switchgear - Ground Mount Switchgear - forecast model	8/05/2017
03.09.28	72 Facilities capex forecast model	8/05/2017
03.09.40	21 Facilities BST forecast	8/05/2017

Ansarada document number	Document name	Date uploaded
03.09.42	23 Insurance BST forecast	8/05/2017
03.09.45	Network opex - Reactive Maintenance	8/05/2017
04	**Network**	
04.01	**Strategy and plans**	
04.01.04	**Fleet management Plans**	
04.01.04.01	Fleet Management Plan - Cables	20/01/2017
04.01.04.02	Fleet Management Plan - Distribution Switchgear	26/01/2017
04.01.04.03	Fleet Management Plan - Distribution Transformers	20/01/2017
04.01.05	**PODs**	
04.01.05.05	POD - reactive maintenance	3/02/2017
04.01.05.06	SONS POD	5/02/2017
04.01.09.01	**PODS**	
04.01.09.01.03	POD04 Whangamata Reinforcement	7/03/2017
04.01.09.01.04	1. Whangamata Supply Improvement Options Analysis	7/03/2017
04.01.09.01.05	Whangamata Project Costs	7/03/2017
04.01.09.01.06	WGM_11kV_2MVA_1MWh_Battery_Cost Estimate	7/03/2017
04.02	**Models, data & assumptions**	
04.02.01	**Renewals**	
04.02.01.05	6.1 - Distribution Switchgear - Fuses Expenditure Forecast Model	27/01/2017
04.02.01.06	6.1a - Distribution Switchgear - Fuses Survivor Curve Model	27/01/2017
04.02.01.11	The Art of Wooden Pole Testing Ken Pattie_Jamie Silk_EEA2016v1	3/03/2017
04.02.01.12	Pole Life Extension Techniques Mar-2017	3/03/2017
04.02.02	**Network Development**	
04.02.02.07	Forecast number of consumer connections	20/02/2017
04.02.02.08	Palmerston Project Costs 1.11.16	2/03/2017
04.02.02.09	Palmerston upgrade - estimates for Board Memo	2/03/2017
04.02.02.10	Palmerston North Reinforcement Option Analysis	2/03/2017
04.02.02.11	645 Powerco ITS Approval of Putaruru Project v02 FINAL	2/03/2017
04.02.02.12	EDISON - Engineers Estimate Rev 3 - REF mods	2/03/2017
04.02.02.13	Feb 16 Putaruru Project Update	2/03/2017
04.02.02.14	Hinuera GXP Security Improvement Economic Evaluation	2/03/2017
04.02.02.15	Subtrans Needs to Projects Mapping-HighLow Growth	2/03/2017
04.02.02.16	Tab 25 1225 Putaruru Project_Approval to change construction scope FINAL 12052015	2/03/2017

Ansarada document number	Document name	Date uploaded
04.02.02.17	Transpower-Powerco Joint Report - Hinuera Reinforcement Review	2/03/2017
04.02.02.18	Feb 16 Attachment 1 Putaruru slides 2	3/03/2017
04.02.02.20	Kelvin Grove Supply Transformers Option Analysis	6/03/2017
04.02.02.21	Pyes Pa Capacity Reinforcement - Options Analysis	6/03/2017
04.02.02.22	Roberts Ave to Peat St Supply-Updated	6/03/2017
04.02.02.23	Taupo Quay 2nd Supply-Updated	6/03/2017
04.02.02.24	Project Brief X609W X2585	8/03/2017
04.02.02.25	Project Evaluation Template 11-12-2012 PU-M014	8/03/2017
04.02.04	**Maintenance**	
04.02.04.05	Output growth factors used in BST models	2/05/2017
04.02.04.06	Network opex - trend factors for base-step-trend	2/05/2017
04.02.07	opex and capex benchmarking	3/05/2017
05	**Non-Network**	
05.01	**Overviews**	
05.01.06	Third Horizon - New Plymouth Facilities Step Change Justification	4/03/2017
05.02	**PODs**	
05.02.01	170201 - cpp is opex pod v 1.0	3/02/2017
05.02.02	170201-cpp is capex pod v 1.0	3/02/2017
05.02.04	170202 - cpp is opex pod v 1.1	2/03/2017
05.02.05	170202-cpp is capex pod v 1.1	2/03/2017
05.02.06	Facilities Business Case_POD	4/03/2017
06	**Deliverability Plan**	
06.01	Deliverability Plan MASTER	20/02/2017
06.02	Electrix Recruitment Strategy for Powerco 2018 - Letter	21/02/2017
06.03	161220 Resourcing Plan CPP Foundation Agreement	21/02/2017
07	Expert Reports	
07.01	Review of Repex Survival Curves rv2_final	23/02/2017
07.02	EEA - Risk Based Vegetation Guide - 2016	23/02/2017
07.03	Guide for Security of Supply August 2013_provided for FS_WSP PB	24/02/2017
07.04	Energia Benchmarking Report - Powerco Nov 2014	2/03/2017
07.06	EA Technology Circuit Breakers CBRM - Powerco Report	7/03/2017
07.15	Expert Challenge_Nov 2016_David Owen_Caerus Consulting_review of Deliverability	29/05/2017

Ansarada document number	Document name	Date uploaded
07.16	Expert Challenge_Nov 2016_Partna Consulting_ Review of quality proposals	29/05/2017
07.17	Expert Challenge_Nov 2016_Tas Scott_MittonElectronet_ Review of network opex	29/05/2017
07.18	Expert Challenge_Oct 2016_Hyland Mcqueen review of Repex Survival Curves	29/05/2017
08	**Meetings & significant discussion minutes**	
08.01	Powerco Board Committe_Top Down Challenge (2)_27 Oct 2016-confidential material redacted	29/05/2017
08.02	Powerco Board Committee_Top Down Challenge (1)_6 Oct 2016-confidential material redacted	29/05/2017

Appendix B – Assessment techniques and information

6.1 Assessment techniques

Clause G9 of the IM lists several assessment techniques that we must use in completing our verification, and requires us to explain which techniques we have applied and why others were not applied. Box 25 sets out the clause G9(1) IM assessment techniques that we must consider.

Box 25 – IM requirements for assessment techniques

Schedule G9(1) & (2) of the IM:

(1) When-

(a) undertaking analysis and reviews of information; and

(b) considering the matters,

required by this Schedule, the **verifier** must use some or all of the following assessment techniques:

(c) process benchmarking;

(d) process or functional modelling;

(e) unit rate benchmarking;

(f) trending or time-series analysis;

(g) high level governance and process reviews;

(h) internal benchmarking of forecast costs against costs in the **current period**;

(i) **capex category** and **opex category** benchmarking;

(j) **project** and **programme** sampling; and

(k) critiques or **independent** development of-

(i) demand forecasts;

(ii) labour unit cost forecasts;

(iii) materials forecasts;

(iv) plant forecasts; and

(v) equipment unit cost forecasts.

(2) The **verifier** must explain why particular techniques listed in subclause (1) were applied and others were not applied.

In completing our assessment, some of the above assessment techniques were applied (as either primary or supporting) and others were not. An explanation of reasons for our approach is contained in Table 13 below.

Table 13 – Assessment techniques applied

Technique from IM	Extent applied by us	Reasons why used/not used
Process benchmarking	Not applied	Relied upon other assessment techniques
Process or functional modelling	Supporting assessment technique	Test sensitivity on expenditure forecasts of various Powerco models to different assumptions and scenarios
Unit rate benchmarking	Not applied	With the majority of expenditure delivered via outsourced methods, undertaking unit rate benchmarking was viewed to be of limited value compared to other assessment techniques
Trending or time-series analysis	Primary assessment technique	A primary technique to ascertain the level of change proposed during and after the CPP period and understand what projects/programs to sample
High level governance and process reviews	Primary assessment technique	Understand the level of rigour behind the forecasts prepared and whether they consider interdependencies with other categories, are likely to change once further analysis or internal review/approval is undertaken, and whether forecasting assumptions and techniques used are reasonable to meet the expenditure objective
Internal benchmarking of forecast costs against costs in the current period	Supporting assessment technique	Used to determine whether costs in the forecast take into account efficiencies/ inefficiencies of scale or different procurement methods
Capex category and opex category benchmarking	Supporting assessment technique	Within the limitations of the data set available for other EDBs, this contributed to a view on whether Powerco appears to be efficient or inefficient compared to its peers
Project and program sampling	Primary assessment technique	Required to inform our conclusion of whether the proposed expenditure in key categories deemed material meets the expenditure objective
Critiques or independent development of: • demand forecasts • labour unit cost forecasts • materials forecasts • plant forecasts, and • equipment unit cost forecasts	Supporting assessment technique	Used to determine whether costs used in forecast take into account efficiencies/ inefficiencies due to factors such as scale, different procurement methods or realistic/actual unit rates.

6.2 Use of information

We relied on a range of information to undertake our verification. Most of this information was provided by Powerco, either as part of the CPP proposal or separately in response to information requests or questions.

Clause G11 of the IM (repeated below) requires our verification report to address matters relating to information – which we do as follows:

- appendix A lists the information in and relating to the CPP proposed provided by Powerco that we relied upon in preparing our verification report
- chapter 6 assesses the completeness of Powerco's CPP proposal
- each chapter on service measures, levels and quality standards, capex, opex, demand, capital contributions and contingent projects identifies:
  - information that we consider is omitted, incomplete or insufficient
  - the nature of any information required to fulfil the information requirement in question
  - the extent to which the omission, incompleteness or insufficient of information has impaired our verification
- appendix C explains our selection of projects and programs.

Box 26 – IM requirements on completeness of proposal

Schedule G11 of the IM:

A **verification report** must-

(a) list the information in, and relating to, the **CPP proposal** provided by the **CPP applicant** to the **verifier**, that was relied upon by the **verifier** in fulfilling its obligations under Schedule G;

(b) state each type of information in respect of which this schedule requires the **verifier's** consideration or opinion that the **verifier** considers has been omitted from the **CPP proposal**, including information that is incomplete or insufficient, and the relevant requirement in Part 5, Subpart 4 to provide the information in question;

(c) where information is identified as insufficient in accordance with paragraph (b), state the nature of additional information the **verifier** considers that the **CPP proposal** requires to fulfil the information requirement in question;

(d) state the extent to which the omission, incompleteness or insufficiency of information has impaired the **verifier's** judgement as to whether the **capex forecast** and **opex forecast** for the **next period** meets the **expenditure objective**; and

(e) explain why the **verifier** has selected the **identified programmes** in accordance with clause G4(1).

Appendix C – Program selection

As part of our verification, we must nominate – to Powerco – up to 20 projects or programs that form part of Powerco's forecast capex and opex that we then review before forming a view on whether these forecasts satisfy the expenditure objective. We cannot vary our selection of projects or programs once nominated.

This appendix sets out the requirements that we must follow when selecting these projects or programs and a proposed approach to give effect to these.

Requirements

Box 27 sets out requirements in clause G4 of the IM to nominate up to 20 projects and / or programs for detailed review to support our verification.

Box 27 – IM requirements for selecting identified projects and programs

Schedule G4 of the IM:

(1) For the purposes of the reviews under clauses G5(1)(d) and G6(1)(g), the **verifier** must select no more than 20 **projects** or **programmes** to be 'identified programmes'

(2) In determining which, and how many, **projects** or **programmes** to select as identified programmes, the verifier must consider–

(b) the long term interests of **consumers**;

(c) the **Commission's** ability to effectively review whether the **CPP applicant's capex forecast** and **opex forecast** are consistent with the **expenditure objective**;

(d) the **CPP applicant's** rationale for seeking a CPP;

(e) its ability to provide an opinion on whether the **capex forecast** information in the intended **CPP proposal** has been prepared in accordance with the **policies** and **planning standards**-

(i) in aggregate; and

(ii) for each of the **capex categories**;

(f) its ability to provide an opinion on whether the **opex forecast** information in the intended **CPP proposal** has been prepared in accordance with the **policies** and **planning standards**-

(i) in aggregate; and

(ii) for each of the **opex categories**;

(g) its ability to assess any **quality standard variation** proposed; and

(h) the materiality of the **programmes** or **projects** to the **CPP proposal**, the **capex forecast** and the **opex forecast**.

(3) The **identified programmes** selected in accordance with subclause (1) must address-

(a) a key risk that the **CPP applicant** is exposed to;

(b) a key driver of the need to submit a **CPP proposal**; or

(c) an **obligation** that has a significant impact in the context of the **CPP applicant's** overall **business**.

(4) The **verifier** must -

(a) notify the **CPP applicant** of its select **projects** or **programmes**; and

(b) not change its selection after such notification.

We nominated the 15 projects and programs identified in Table 14. We identified these projects and programs having regard to the requirements set out in clause G4, as required by clause G11(e). Our detailed review of these projects and programs is contained in appendix D and our findings are summarised in chapters 3 and 4 on capex and opex respectively.

Table 14 – Selected projects and programs

Capex	Opex
C1. Overhead structure renewals program	O1. Preventative maintenance and inspection

Capex	Opex
C2. Overhead conductor renewals program	O2. Corrective maintenance
C3. Zone substation renewals program	O3. System operations and network support
C4. Secondary system renewals program	O4. Vegetation management
C5. Growth and security major project – Palmerston North	O5. Corporate expenditure
C6. Growth and security major project – Pataruru	
C7. Growth and security minor works program	
C8. Reliability program	
C9. Network evolution program	
C10. ICT capex program	

The starting point

The CPP covers the five-year period from 1 April 2018 and includes approximately $1,327.5 million ($2016) of capital and operating expenditures, compared to $936.9 million ($2016) for the previous five years.

Powerco's consultation explains that the increased CPP investment is associated with:

1. **Providing safe, secure and resilient networks**. This requires Powerco to focus on the underlying health of its networks, rather than focussing on average measures of reliability.
2. **Investing in Powerco's communities**. This requires Powerco to facilitate economic growth by providing network capacity that its customers need.
3. **Understanding and leveraging new technology**. This requires Powerco to gain practical experience of new technology through trials and pilot schemes.

As part of our verification, we need to understand the projects or programs that make up this expenditure. This will help us assess whether Powerco's expenditure forecasts satisfy the expenditure objective and promote the long-term interests of consumers.

Powerco needs to demonstrate the trade-off to consumers between the expenditure proposed – and the impact on prices – and the service outcomes that result. Powerco intends to consult with consumers on this trade-off before finalising its CPP application, but this should also form a key consideration when selecting the projects or programs.

Approach

Drawing from the above discussion, we adopted a simple three-step selection approach to identifying projects or programs:

1. **Materiality** – identify the projects and programs that:

b) make up a material portion of Powerco's expenditure forecasts – 5% or more of total expenditure, or

c) reflect – or form part of – a material step up in spend for a given expenditure category – 30% or more in real terms and greater than $1M

2. **Driver** – of those projects and programs, shortlist only those that address:

   a) a key risk that Powerco is exposed to

   b) a key driver of the need to submit a CPP proposal, or

   c) an obligation that has a significant impact in the context of Powerco's overall business

3. **Identification** – of the shortlisted projects and programs, select those – up to a maximum of 20 – that:

   a) most closely align to the rationale for Powerco's intended CPP application

   b) link to a proposed quality standard variation

   c) we consider necessary to provide an opinion on whether Powerco's expenditure forecasts satisfy the expenditure objective, were prepared in accordance with Powerco's policies and procedures, or promote the long-term interests of consumers, or

   d) that has the greatest impact on prices faced by consumers over the next regulatory period.

A further consideration is how to deal with interactions between proposed capex and opex. For instance, renewing or replacing assets to reduce asset failures may well lead to lower reactive maintenance opex.

Selected projects and programs

Table 15 shows our assessment of the projects and programs proposed by Powerco using the approach described above. The projects and programs were identified in the spreadsheet *CPP tracker with project detail* provided by Powerco on 22 December 2016.

After applying this approach, we identified 15 projects and programs for detailed review. We nominated these programs and projects to Powerco on 21 January 2017 via the data room.

Table 15 – Assessment of projects and programs

Name	Step 1 – materiality		Step 2 – expenditure driver			Step 3 – other considerations			Select Y/N
	Share of total spend (%)	Five-year step change (%)	Address key risk	Address key driver for CPP	Address significant obligation	Aligned to CPP rationale	Linked to quality standard variation	Necessary to form opinion	
Capex	**66%**	**59%**							
Overhead structure renewals	13%	72%	Y	Y		Y	Y	Y	Y
Overhead conductor renewals	4%	209%	Y	Y		Y	Y	Y	Y
Cable renewals	2%	-3%	Y	Y		Y	Y		N
Zone substation renewals projects	5%	114%	Y	Y		Y	?	Y	Y
Distribution transformer renewals	3%	9%	Y	Y		Y	Y		N
Distribution switchgear renewals	3%	9%	Y	Y		Y	Y		N
Secondary system renewals	2%	111%	Y	Y	?	Y	Y		Y
Growth & security major projects **[Palmerston North; Pataruru]**	9%	209%	Y	Y		Y	Y	Y	Y
Growth & security minor projects	12%	31%	Y	Y		Y	Y	Y	Y
Reliability program	2%	52%	Y	Y		Y	?	Y	Y
Consumer connection	4%	-5%		Y			?		N

Name	Step 1 – materiality		Step 2 – expenditure driver			Step 3 – other considerations			Select Y/N
	Share of total spend (%)	Five-year step change (%)	Address key risk	Address key driver for CPP	Address significant obligation	Aligned to CPP rationale	Linked to quality standard variation	Necessary to form opinion	
Asset relocations	0%	-9%			Y		?		N
Network evolution	2%	495%	Y	Y		Y		Y	Y
ICT capex	3%	38%	Y	Y				Y	Y
Facilities capex	1%	44%		Y					N
Opex	**34%**	**33%**							
Corrective maintenance	6%	50%	Y	Y	Y	Y	?	Y	Y
Preventive maintenance and inspection	4%	46%	Y	Y		Y	?	Y	Y
Reactive maintenance	3%	7%	Y	Y	Y		?		N
System operations and network support	6%	60%	Y	Y				Y	Y
Vegetation management	3%	77%	Y	Y	Y	Y	Y	Y	Y
Corporate opex	8%	4%		Y				Y	Y
ICT opex	2%	56%	Y	Y					N
Insurance and governance	1%	9%							N
Facilities opex	1%	9%							N

Appendix D – Identified program review

This appendix provides the outputs from our detailed review of each selected project and program. These outputs are presented against a common template and in the order shown in Table 16, starting with those from the capital program.

Table 16 – Selected projects and programs

Capex	Opex
C1. Overhead structure renewals program	O1. Preventative maintenance and inspection
C2. Overhead conductor renewals program	O2. Corrective maintenance
C3. Zone substation renewals program	O3. System operations and network support
C4. Secondary system renewals program	O4. Vegetation management
C5. Growth and security major project – Palmerston North	O5. Corporate expenditure
C6. Growth and security major project – Pataruru	
C7. Growth and security - minor works program	
C8. Reliability program	
C9. Network evolution program	
C10. ICT capex program	

Note C5 and C6 are covered jointly below because of similarities in the assessment and our findings.

Program C1: Overhead structures renewals program

Project description

The overhead structures replacement program aims to replace poles and cross arms that have deteriorated in condition or require replacement as a result of other drivers. The project is based on:

1. condition based replacement of poles and cross arms
2. reducing the backlog of defected poles and cross arms
3. replacing poles and cross that are not rated to carry new conductors (see the overhead conductor replacement program)
4. third party interference (i.e., vehicle v pole).

The primary objective identified by Powerco is to maintain the safety of the network.

The fleet is made up of 225,521 (84.9%) concrete poles, 39,104 (14.7%) wood poles and 1,061 (0.4%) steel poles.

Cost estimate / expenditure forecast

Table 17 shows the forecast expenditure during the CPP period.

Table 17 – Forecast expenditure – overhead structures ($2016, thousands)

Item	FY19	FY20	FY21	FY22	FY23	Total
Expenditure	29,668	35,577	37,702	37,800	36,855	177,602

Relevant policies and planning standards

The Overhead Network Inspections Standard - Maintenance sets out the inspection and defecting process.

Information provided

Table 18 presents the information that has been provided by Powerco in relation to the identified program.

Table 18 – Information provided

Title	Reference	Date
Fleet Management Plan – Overhead Structures	04.01.04.05	20 Jan 2017
1.1a - Pole Survivor Curve Model	04.02.01.02	27 Jan 2017
1.1 – Poles Expenditure Forecast Model	04.02.01.01	27 Jan 2017
2.1 Crossarm Expenditure Forecast Model	03.04.01.2	15 Feb 2017

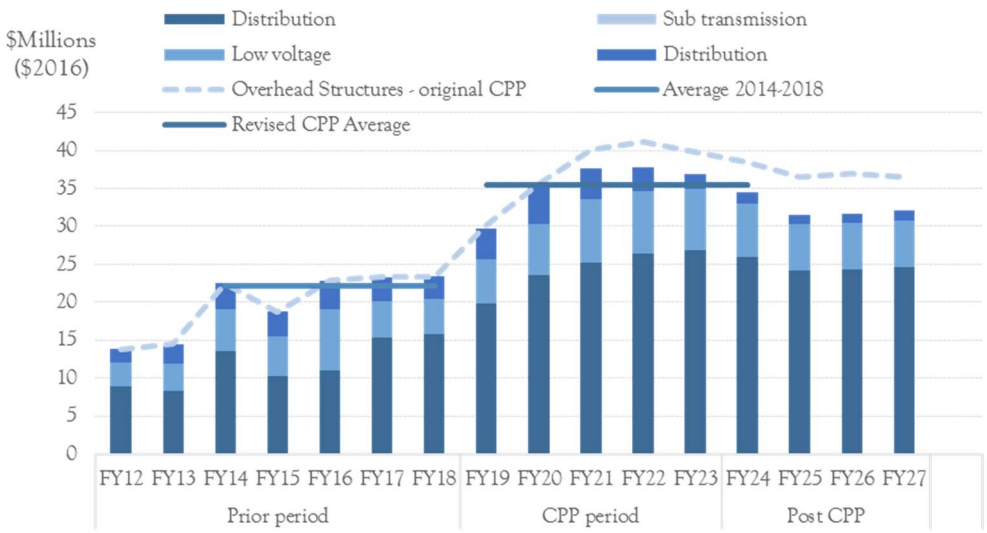
Title	Reference	Date
1.2a – Crossarm Survivor Curve Model	04.02.01.07	27 Jan 2017
393S049 Overhead Network Inspections Standard - Maintenance - 4OH DOH SOH	01.02.40	15 Feb 2017
Distribution Overhead Conductor Expenditure Forecast Model	02.2 2.2	14 Feb 2017
Distribution Overhead Conductor Fault Rate Model (Urban)	04.02.01.04 2.2a	27 Jan 2017
Verifier Question and Answer Initial Summary Response _Q014 Renewals _Overhead Conductor UPDATED Q1	Ansarada Question ID 014_Updated	22 Feb 2017
Information provided following draft report		
Distribution conductor line down faults	04.02.01.13	3 May 2017
Crossarm defect overlap	04.02.01.14	3 May 2017
Poles Expenditure Forecast Model	03.09.01	8 May 2017
Crossarm Expenditure Forecast Model	03.09.02	8 May 2017

Assessment of forecast method used

Expenditure trends

Figure 14 shows the historical and forecast expenditure for the overhead structures replacement program.

Figure 14 Overhead structures – historical and forecast expenditures ($million, $2016)



The increase from the average expenditure during the prior period compared to the average expenditure forecast during the CPP period is $13.4 million per annum, an increase of 60.4%. The increase in this category is driven by the reduction of the defect backlog from 2019 to 2022 and the overhead structures replaced due to the conductor replacement program.

Post CPP, the overhead structures replacement program is forecast to reach a steady state with average expenditure of $32.4 million per year.

Expenditure justification

The total expenditure for this asset category is forecast based on three subcategories:

- For condition based failures, a probabilistic model is used to forecast the likely number of pole failures. This approach is similar to other EDBs and it is considered that, provided the inputs are appropriate, it will provide a reasonable forecast of replacement needs.
- For non-condition based failures, a flat trend based on historical rates of failure. This includes vehicle impacts into poles or failures caused by vegetation. This is considered a reasonable approach.
- For poles requiring replacement as a result of the conductor replacement program, Powerco has used historical data from similar projects to calculate the number of poles per kilometre requiring replacement due to insufficient strength and the percentage of those poles that would have otherwise required replacement due to condition. This is considered a reasonable approach.

Powerco does not undertake any significant life extension work on its poles. It has investigated various options in the past but have not found them to be economic due to the cost of remediation versus replacement, effectiveness of the treatment in extending life, environmental concerns, limitation of implementing the remediation due to terrain, and operational limitations of not being permitted to climb staked poles. Powerco provided a summary of work practices undertaken by other EDBs which showed historical trials and application of life extension practices, but limited current use of these practices.

A revised inspection and data capture process was implemented in 2008 and has enabled improved capture of pole defects. This has resulted in an increased backlog of pole and crossarm defects. Powerco sets out a target backlog[63] based on the number of pole and cross arm defects expected to be identified each year and a three year replacement period to align with requirements for green defects.[64] The model accounts for the reduction in backlog to the target level. This approach is considered reasonable.

Industry practice in some EDBs and internationally demonstrate there is potential to defer asset replacement expenditure through life extension techniques, particularly staking wood poles. Powerco's pole fleet, however, contains a relatively small number of wood poles and this is reducing as wood poles are replaced with non-wood structures.

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[63] Powerco uses the term backlog to describe the number of defected poles on the network. These may be green defects with a 3 year replacement time through to red defects with a 12 month replacement time.

[64] Powerco, *Overhead structures fleet management plan*, version 2, December 2016, Fig. 9, p. 15, Ansarada document number 04.01.04.05.

Hence it is unlikely that the benefits of introducing staking at this point in the asset lifecycle would offset the costs.

We have reviewed the models and supporting documentation related to Overhead Structures. In our view, it is likely that the required expenditure is overstated due to the following reasons:

Pole inspection process

Poles are inspected on a five-year cycle. There is no secondary cycle for high risk poles. This approach is likely to result in inspectors being conservative in their assessment of pole condition, particularly with respect to green defects that require an assessment as to whether a pole's condition will deteriorate to a point that requires replacement before the next five-year inspection and therefore should be scheduled for replacement within three years. This is likely to result in poles being identified as defective earlier than necessary. Information provided by Powerco indicates that some poles are re-assessed prior to planned replacement and this sometimes results in deferral of replacement (and sometimes additional poor condition poles are added to the project).

Survivor modelling

The survivor modelling approach is similar to the approach undertaken by other utilities. They use asset data to develop survivor curve then apply the survivor curve to the asset population to calculate the expected number of asset failures.

However, an issue with Powerco's approach is the use of defect data rather than replacement data to calculate the survivor curve. Most notably, green defects are included in the forecast. Green defects need to be replaced within three years and are often deferred following design inspections, (Question ID 015, question 2) meaning that the survivor curve is likely to be conservative and result in early replacement (though we note sometimes additional poor condition poles are also identified).

We note that a three- year lag was added into the model to address the inclusion of green defects in the survivor curve calculation (reflecting the time between defect identification and defect remediation). However, the problem lies in the calculated characteristics of the survivor curve, specifically relating to the high probability of replacement at a young age, rather than a fixed lag in replacement.

Cross arms

Volumes of cross arms are forecast using a survivor curve model based on the same methodology as for pole replacements. The approach appears appropriate and consistent with common industry practice. However, this approach has the same issues with the inclusion of green defects as explained for poles in the section above.

The overlap between cross arm replacement and pole and conductor replacement appears to be calculated and included in the forecast correctly.

As a result of including green defects in the calculation of the survivor curve, the forecast appears to overstate the replacement volumes and expenditure of cross arms.

Key assumptions used

Key assumptions that we consider are reasonable:

- The overlap between the poles replaced by the conductor program and the poles replaced by the pole replacement program has been incorporated in the model and assumed as 16% overlap with low voltage poles and 6% overlap with distribution poles.
- Unit rates were calculated based on historical conductor replacement projects. The costs components for poles, cross arms and conductor were separated out and only the pole and cross-arm costs included in the forecast for this asset category.
- Application of life extension practice appear to be in-line with practices of peer EDBs.

However, in our view, the following assumptions do not appear reasonable:

- The survivor modelling assumes that all poles identified as green defects are replaced in three years. This does not appear to be appropriate as information was provided stating replacement is often deferred when re-inspected during the project design phase.
- The inclusion of green defects in the survivor curve modelling is likely to lead to a conservative model and overstatement of replacement requirement. Green defected poles are likely to be younger poles and therefore inclusion of the defect date in the survivor curve calculation will change the characteristic of the curve to have a higher failure rate at younger ages, not just result in a fixed shift in timing of replacement. Adjusting the replacement timing of poles by three years to account for the green defect replacement period does not appear reasonable.

Benchmarking

Benchmarking was undertaken to compare Powerco to other New Zealand EDBs. The full analysis is shown in appendix F. The data set used for benchmarking did not have the granularity required to compare expenditure at the asset category level, so the analysis was limited to the higher level capex and opex categories.

It is not possible to draw conclusions specifically relating to overhead structure replacement practices, however, overhead structure replacements form a significant portion of the Powerco replacement expenditure forecast and the benchmarking shows that the total replacement expenditure is increasing compared to similar EDBs when normalised by customer density and circuit length. It would be reasonable to assume that the increase is partly due to the size of the overhead structure replacement program proposed for the CPP period.

Contingency factors

No contingency factors have been included in the forecast expenditures.

Interaction with other forecast expenditures

This program is linked to the overhead conductor replacement program. Some poles and cross arms are not structurally capable of carrying the new heavier load of the modern standard conductor type and therefore will need to be replaced. A percentage of the poles replaced by the overhead conductor replacement program will be in poor condition and would have required replacement anyway through the pole defect and replacement process. Powerco accounted for this overlap in its modelling process.

The volumes of these poles are modelled in the Overhead Conductor Expenditure Forecast Model, but included in the overhead structures forecast for volumes and expenditure.

Deliverability

The forecast expenditure represents a step up from historical expenditures. Powerco has indicated that the increased field activity can be provided by its external contractors, while increases in the SONS (see opex program review at O3) will also be required.

Powerco has undertaken modelling of the increased activities and has discussed this with its contractors, who are prepared to employ the additional staff required.

Even though the increased activities require additional trained labour, we do not envisage that Powerco will not be able to source the required resources.

Our finding

In our view, the program for replacement of distribution overhead structures is overstated and as such not all of the program has been verified. The portion unverified by us is up to $38 million ($2016), $29 million of this attributed to the conductor program, and the remainder due to the survivor curve issue.

Although the overall approach taken by Powerco to forecast replacements is appropriate and in-line with common industry practice, we note that:

- a large portion of the forecast for the replacement of distribution overhead structures relates to the overhead conductors renewal program, which has not been found to be prudent
- the use of the date of defects rather than the date of replacement, inclusion of green defects and an inspection process that is likely to lead to conservative practices in the field – as evidenced by replacement of green defect poles sometimes being deferred at project design phase, with some other poor condition poles added to the project scope – may lead to an overstatement of the replacement requirements.

We note that any changes to the overhead conductor renewal program will have a direct impact on the volume of poles and cross arms forecast for replacement.

Program C2: Overhead conductors renewal program

Project description

The overhead conductor replacement program aims to replace 73.6 km of sub transmission line, 1,088.5 km of HV distribution line and 160.2 km of LV line and 25,361 low voltage service connections (LV fuse assembly units).

The project is based on:

- replacing conductors with type issues
- asset replacement due to deterioration of asset condition.

Cost estimate / expenditure forecast

Table 19 shows the forecast capex during the CPP period.

Table 19 – Forecast expenditure – overhead conductor ($2016, thousands)

Item	FY19	FY20	FY21	FY22	FY23	Total
Expenditure	6,809	8,431	11,310	13,821	14,877	55,248

Relevant policies and planning standards

Overhead Network Inspections Standard – Maintenance sets out the inspection and defecting process.

Information provided

Table 20 presents the information that has been provided by Powerco in relation to the identified program.

Table 20 – Information provided – overhead conductor

Title	Reference	Date
Fleet Management Plan – Overhead Conductors	04.01.04.04	20 Jan 2017
Subtransmission Conductor expenditure forecast model	02.1 2.1	15 Feb 2017
Distribution Overhead Conductor Expenditure Forecast Model	02.2 2.2	14 Feb 2017
Distribution Overhead Conductor Fault Rate Model (Urban)	04.02.01.04 2.2a	27 Jan 2017
LV Conductor expenditure forecast model	02.3 2.3	14 Feb 2017
Verifier Question and Answer Initial Summary Response _Q014 Renewals _Overhead Conductor UPDATED Q1	Ansarada Question ID 014_Updated	22 Feb 2017
393S049 Overhead Network Inspections Standard - Maintenance - 4OH DOH SOH	01.02.40	15 Feb 2017

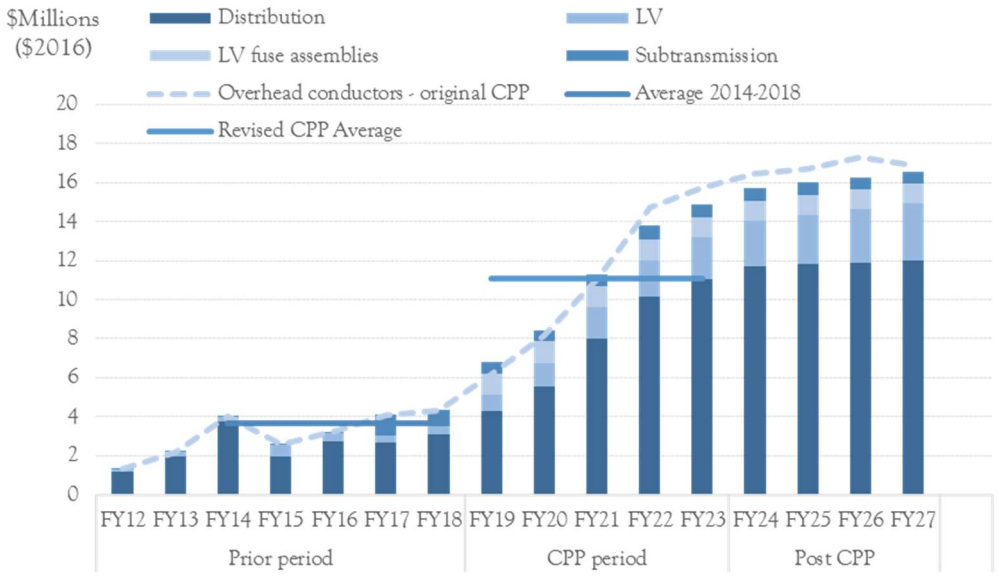
Title	Reference	Date
Information provided after draft decision		
Distribution conductor line down faults	04.02.01.13	3 May 2017
Subtransmission Conductor expenditure forecast model	03.09.04	8 May 2017
Distribution Overhead Conductor Expenditure Forecast Model	03.09.05	8 May 2017
LV Conductor expenditure forecast model	03.09.06	8 May 2017

Assessment of forecast method used

Expenditure trends

Figure 14 shows the historical and forecast expenditure. The change from the average expenditure during the historical and current period compared to the average expenditure forecast during the CPP period $7.4 million, or 202.5%.

Figure 15 – Conductor replacement capex – historical and forecast expenditures ($million, $2016)



The increase in this category is driven by the distribution conductor replacement program, which accounts for an average of $7.8 million per year, increasing from $4.3 million in 2019 to $10.1 million in 2023. The sub transmission conductor replacement accounts for approximately $0.6 million per year, and the low voltage conductor replacement approximately $1.5 million per year, and low voltage fuse assemblies $1.1 million per year.

Changes from the original CPP are to include LV fuse assemblies previously classified as corrective maintenance and a reduction to reflect overlap with the Growth and Security program.

Expenditure justification

The primary objective identified by Powerco is to improve the safety of the network and the secondary objective is to improve network reliability performance. The total expenditure for this asset category is forecast based on four different forecasting approaches, one for each of sub transmission, distribution, low voltage conductors and LV fuse assemblies.

There were no options explicitly considered for this program, however, the Fleet Management Plan states that consideration is given to future demand when conductors are replaced and an allowance for future demand driven replacement was incorporated into the model based on the forecast in the minor works portfolio.

Sub transmission

The sub transmission conductor replacement forecast has been based on known conductors with identified type issues, particularly aluminium-conductor steel-reinforced (ACSR) and copper conductors, which accounts for 75% of sub transmission replacements.

Evidence was provided showing the number of faults on the sub transmission network, and although a direct link between the type issues to the number of faults was not established, it is evident that the type issue will lead to conductor failures, so it is considered reasonable to replace the affected conductors due to their criticality to the network.

The remaining 25% of sub transmission replacements are forecast on an age based methodology. We have not been provided the model used. The expenditure forecast by this methodology is estimated to be a total of $0.7 million in FY22 and FY23 and therefore not considered material.

Distribution

Replacement of distribution conductors with type issues accounts for 69% by volume and the remaining 31% covers other distribution conductors based on forecast condition deterioration.

The forecast for all conductors, including those identified as having a type issue, was developed using an age based forecasting model. The model calculated increasing fault rates as conductors aged, then assumed they were replaced once they reached a threshold. The threshold was set to achieve a target network fault rate.

To find conductors that are in poor condition, Powerco undertakes cyclic inspection of conductors in accordance with its overhead assets inspection procedures. Conductor inspections are undertaken visually and are based on visual cues such as broken strands, rust or indications of external impacts. The deterioration, however, is not necessarily visible by an external inspection, and Powerco has stated it is difficult to identify the problems. Additionally, not all conductors with type issues can be located, i.e. small diameter copper conductors suffering brittleness can be readily found as all locations are recorded on GIS; however, ACSR conductors with insufficient grease cannot be found

through visual inspection but need to be inferred through conductor type records and probable installation date records.

The original forecast made by Powerco included the replacement of all modelled and type issue conductors. In response to the reviewer questions about the uncertainty in locating all problem locations, Powerco reduced the forecast volumes of distribution conductor by a total of 80.3 km (10% of original forecast). The reduction starts in 2021 and continuing beyond the CPP period. This reflects Powerco's acknowledgement of the difficulties in relying upon visual inspection to locate all conductors that are in poor condition, and therefore inability to prudently achieve the original forecast in practice.

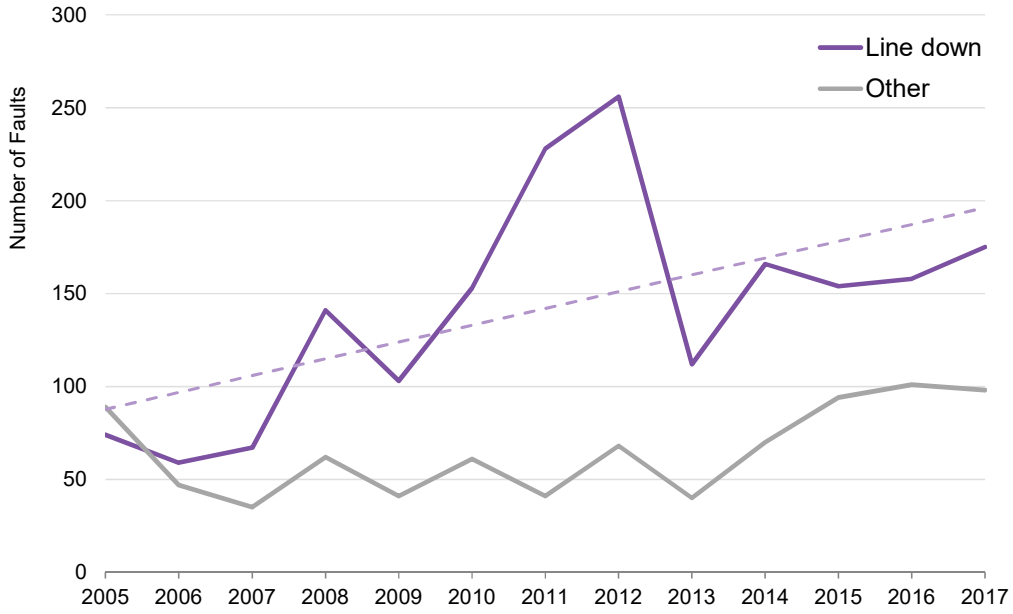
We note the following aspects of the forecasting approach and justification that are likely to lead to uncertainty in the forecast or an overstatement of the expenditure required:

- **Safety:** Powerco has provided evidence of an increasing number of asset failures. Approximately 64% of these failures result in conductors on the ground and this failure mode is also driving the increasing failure trend. Although conductors on ground present a safety risk, it is mitigated through protection[65], and since Powerco operates a large rural network, it is likely many failures would occur in low population areas. However, Powerco was unable to provide any further quantified information to assess the risk to the public, quantification of the benefits nor undertaken an assessment based on ALARP principles.[66] Although it is not common practice to allow the performance of the network to continue to deteriorate and increase risk to the public, Powerco has not demonstrated if current failure rate should be maintained or improved. The Commission should review this and determine a prudent level (failure rate) to target based on risk to public, reliability benefits, historical performance and trend, and cost to remediate.

[65] Powerco, *Distribution conductor line down faults*, 2017, Ansarada document number 04.02.01.13.

[66] Historically Powerco has managed the safety risk presented by overhead conductors based on the 'as low as reasonably practicable' (ALARP) principle. ALARP is a risk based approach to minimise safety risk with consideration given to factors such as the likelihood of the hazard occurring, the degree of harm from the hazard, the availability of ways to eliminate or minimise the risk and cost.

Figure 16 – Trend of conductor failures by failure mode



- **Asset aging curves:** the use of a single aging curve for all conductor types, split into coastal and non-coastal, may over forecast the rate at which the fault rate increases. Powerco states in its Fleet Management Plan that conductor with type issues have poor performance regardless of age. The inclusion of faults due to conductor with type issues, which account for approximately 50% of fault[67]s but make up only 22% of the network by circuit length, is likely to result in a higher rate of apparent aging for the non-type issue conductors which make up 78% of the network.
- **Reliability:** Powerco has stated it aims to maintain network reliability. Since 31% of the replacement forecast is for age related deterioration, i.e. non-type issue related, the impact of other expenditure programs should also be considered when determining the level of improvement required from the conductor replacement program, so that reliability can be maintained across the network efficiently. This consideration was not evident in the information presented to us.

Low voltage

Low voltage conductor was forecast based on a probabilistic approach using a Weibull distribution to calculate a survival curve which was then applied to the conductor population for each network region. The output is then adjusted to ramp up from 2017 to 2023 where the full volumes are assumed to be replaced.

This approach is based on common industry practice and is considered reasonable.

[67] Data sourced from Commerce Commission, Information Disclosure data base using average distribution line faults and average fault rates provided in Table 5 of the Fleet management Plan.

LV Fuse assembly units

The volumes of fuse assembly units are calculated based on a straight line flat trend calculated by the total number of assets on the network divided by the expected life. Although this is a simple approach, these are low value items and the benefits of undertaking a more complex analysis is unlikely to result in a material benefit to accuracy of replacement volumes or a material change in forecast expenditure.

Key assumptions used

Key assumptions that we consider are appropriate include:

- A boundary value (distance from the coast) has been set to discriminate between coastal and non-coastal conductors. Coastal conductors deteriorate more quickly due to corrosion and wind loads and are replaced at a younger age.
- The overlap between the poles replaced by the conductor program and the poles replaced by the pole replacement program has been incorporated in the model and assumed as 16% overlap with low voltage poles and 6% overlap with distribution poles.
- Unit rates were calculated based on historical conductor replacement projects. The cost components for poles, cross arms and conductor were separated out and only the conductor costs included in the forecast for this asset category.
- The low voltage conductor uses a Weibull distribution to estimate failure rates. The characteristics assume 50% of conductors were replaced by 70 year of age. This assumption seems reasonable and the forecasting approach is in line with industry practice.
- Powerco has included an allowance for future improvements, such as asset management improvements and an increased commitment term for service providers, which will reduce the cost of the program.

However, in our view, the following assumptions do not appear supported:

- The need to prevent increases in the fault rate is appropriate, however, the need to reduce the fault rate to the proposed level has not been demonstrated to be prudent and cost effective
- The forecast assumes that the network, on average, should perform as well as their best performing conductor (FMP, page 32). This is incorporated into the model and results in a forecast improvement in reliability. However, this does not appear to be reflected in the broader CPP proposal or the reliability forecast.
- The network performance assumption is implemented in the model as a replacement threshold. The choice of threshold directly drives the volumes of conductor that needs to be replaced. The selection of this value could drive an improvement in network performance and could result in an overstatement of forecast expenditure required to maintain the asset.
- Powerco has assumed that all of the conductor in poor condition can be located and replaced. In practice, it is likely that visual inspection practices will be unable

to locate all defected conductors. Following discussion with the review team, Powerco moderated the original forecast to reflect the difficulty in identifying deteriorated conductors. This moderation is an educated guess only and cannot be verified from the information available.

Benchmarking

Benchmarking was undertaken to compare Powerco to other NZ EDBs. The full analysis is shown in appendix F. The data set used for benchmarking did not have the granularity required to compare expenditure at the asset category level, so the analysis was limited to the higher level capex and opex categories.

It is not possible to draw conclusions specifically relating to overhead conductor replacement practices, however, conductor replacement forms a significant portion of the Powerco replacement expenditure forecast and the benchmarking shows that the total replacement expenditure is increasing compared to similar EDBs when normalised by customer density and circuit length. It would be reasonable to assume that the increase is partly due to the size of the conductor replacement program proposed for the CPP period.

Contingency factors

No contingency factors have been included in the forecast expenditures.

Interaction with other forecast expenditures

This program has a strong link with the overhead structures (poles and cross arms) replacement program. When conductors are replaced with the modern standard type, old cross arms and poles may not be structurally capable of carrying the weight of the conductor and therefore need to be replaced. A portion of these poles and cross arms will be in poor condition and would need to be replaced anyway through the pole defect and replacement process. This overlap has been accounted for in the modelling of the distribution conductors and poles replacement forecasts.

There is a relationship between corrective opex and asset replacement, such that increasing corrective opex, which involves repairing minor defects before they develop into major defects or failures, would be expected to decrease or defer the amount of replacement required, and vice versa. Powerco stated that no reduction to reactive or corrective opex was included to reflect the increased replacement program.[68] This may result in an overstatement of expenditure required but is considered immaterial during the CPP, noting Powerco has made reductions in corrective maintenance opex since the draft verification report.

[68] Initial summary response to raised questions, Question ID 014, Question 9.

During interview, the review team determined that this program has an overlap with the Growth and Security program. Conductors replaced under that program will include some that are in poor condition and included in the conductor renewal program. Powerco subsequently made an adjustment to reduce the conductor renewal program by $1.2 million over the CPP period.[69]

Deliverability

The forecast expenditure represents a step up from historical expenditures. Powerco has indicted that the increased field activity can be provided by its external contractors, while increases in the SONS (see opex program review at O3) will also be required.

Powerco has undertaken modelling of the increased activities and has discussed this with its contractors, who are prepared to employ the additional staff required.

Even though the increased activities require additional trained labour, we do not envisage that Powerco will not be able to source the required resources.

The implementation of this program will result in significant outages to customers due to the radial design of the network.

Our finding

In our view, Powerco's proposed expenditure for replacement of sub transmission conductors, low voltage conductors and LV fuse assemblies does not appear unreasonable. Our view is based on the following observations:

- The forecast for the sub transmission conductors is based on known type issues and the estimated component is not material.
- The forecast for the low voltage conductors is based on common industry practice and uses reasonable assumptions.
- The forecast for LV fuse assemblies is based on an age based replacement assumption that is suitable given its low materiality.

In our view, the program for replacement of distribution conductors is overstated as the need for the proposed step increase to the replacement program has not be clearly demonstrated. Our reasons for this view are:

- 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.

[69] Powerco response to Ansarada question number 2070, item 34, 22 February 2017.

- Some assumptions included in the replacement model did not appear to be supported; a key example being the target fault level adopted which directly leads to the volume of conductor replacements forecast, also driving around half of expenditure in the overhead structures renewal program.
- The data set used to calculate the aging curves includes conductor faults due to type issues. This curve is then applied to all conductor types and is likely to result in more rapid aging of the conductor fleet and therefore result in an overstatement of replacement.
- Total network reliability has not been considered in setting the target fault rate for conductors.

Powerco has:

- included a reduction in expenditure since the draft report to reflect some improvements in asset management and proposed changes to service provider management
- established an appropriate failure prediction model.

The portion unverified is up to $29 million ($2016). To determine the prudent level of expenditure for distribution conductor, a review of the appropriate failure rate could be established based on risk to public, reliability benefits, historical performance and trend, and cost to remediate.

There is a limitation with the proposed forecast that creates uncertainty, however we do not believe that this limitation can be reduced. The limitation is that the final forecasts reflects moderation of the original forecast to reflect the difficulty in identifying deteriorated non type issues and LV conductors. This moderation is an educated guess only and cannot be verified from the information available.

Program C3: Zone substations renewals program

Project description

This program aims to replace deteriorated assets that are located within a zone substation. It is based on the following six asset sub-categories:

- **Power transformer**: this program aims to replace transformers in substations that are forecast to be in poor condition. It also covers installation of bunding and firewalls.
- **Indoor switchgear**: replacement of full switchboards and retrofitting of others with arc suppression components to reduce arc flash risk.
- **Outdoor switchgear**: replacement of individual assets in poor condition across its fleet of circuit breakers, switches, reclosers and fuses at substations.
- **Buildings**: undertake strengthening works in zone substation buildings to meet new NZ building code seismic standards.
- **Load control injection plant**: replacement of a specific load control asset type that is obsolete and incompatible with modern technology.
- **Other zone substation**: this includes 4 key programs covering substation earth grids, lightning protection, fencing and security, and seismic compliance. It is will run across multiple substations.

Cost estimate / expenditure forecast

Powerco proposes total expenditure of $71.7 million to be spent across the six subcategories.

Table 21 – Forecast expenditure – zone substations (real$2016, thousands)

Item	FY19	FY20	FY21	FY22	FY23	Total
Power Transformers	3,654	5,534	4,854	4,632	4,898	23,573
Indoor Switchgear	9,648	6,239	6,410	5,550	5,281	33,127
Buildings	320	342	232	430	514	1,838
Outdoor Switchgear	131	2,240	1,321	1,234	1,209	6,134
Load Control Injection	0	0	1,620	1,558	747	3,925
Other Zone Substation Assets	639	642	641	616	592	3,130
Total	14,392	14,996	15,078	14,019	13,241	71,726

Relevant policies and planning standards

140S005 Electricity Network Environmental Management Plan is relevant to the bunding program.

AS NZS 1170 seismic standard for buildings and foundations.

Information provided

Table 22 – Information provided

Title	Reference	Date
Fleet Management Plan – Zone Substations	04.01.04.06	04 Feb 2017
Zone Substation – expenditure forecast model	03.04.04.04	15 Feb 2017
CPP Power Transformer Renewal with load duration curve	04.02.01.09	02 Mar 2017
4.1a – Power Transformers AHI Model	04.02.01.09	03 Mar 2017
EEA Conference 2015 – Power Transformers Asset Health Development	04.02.01.10	03 Mar 2017
Information provided following draft report		
EEA Asset Health Indicators_-_Final	07.12	5 May 2017
Zone Substations - expenditure forecast model	03.09.12 4.0	8 May 2017

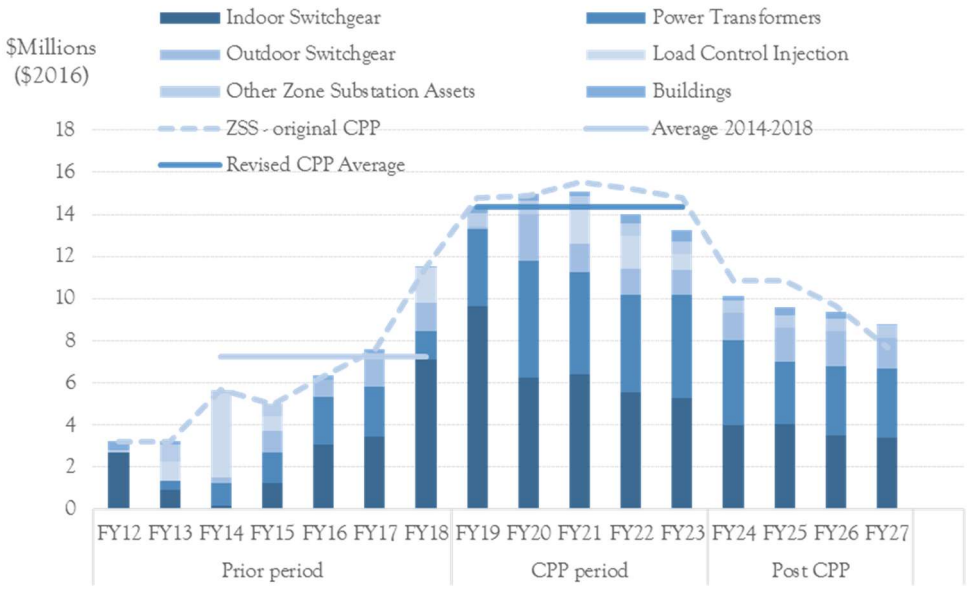
Assessment of method used

Expenditure trends

Figure 17 shows the historical and forecast expenditure for the zone substations replacement program.

The change from the average expenditure during the prior period compared to the average annual expenditure forecast during the CPP period is $7.1 million, an increase of 98.5%. The increase is driven by the increase in power transformer and indoor switchgear replacements.

Figure 17 Zone substations – historical and forecast expenditures ($million, per year, $2016)



Expenditure justification

Powerco has developed its forecast based on different methodologies for each asset type within this category.

- Power transformers are forecast for replacement based on an asset health model developed by Powerco. The model uses asset condition assessment results (for example oil testing) to provide a health rating for each of five attributes. The worst attribute health rating is then used to calculate the overall asset condition and forecast a replacement year based on a linear trend. The replacement date calculated by the AHI model is then adjusted to align with other works at each substation.
- The Power Transformer Asset Health Index (AHI) model was based on the Electricity Engineers Association Asset Health Indicator Guide. This appears to be a reasonable approach.
- Indoor switchgear is currently assessed based on asset condition. The main driver for replacement is the reduction of arc flash risk so that the fleet of assets has an arc flash incident energy of no greater than 8 cal/cm^2.
- Outdoor switchgear has been forecast using an age based forecast considering only the asset age compared to the maximum practical life of the asset.
- Buildings are being assessed against the new building standard as set out in AS NZS 1170 seismic standard for buildings and foundations. Powerco has set a target for all buildings to meet 67% of the standard (New Zealand Society of Earthquake Engineering Grade B). Any buildings that fall below that threshold are schedule for remedial strengthening work. This approach appears prudent as it relies on physical inspections to identify buildings requiring work and structured to meet an appropriate industry standard.

- Load control injection assets have been forecast based on obsolescence of the technology of the targeted asset type. The CycloControl plant technology is not compatible with modern devices and there is no longer technical support for the asset. Targeted replacement of this asset type is considered reasonable.
- Other zone assets comprise a range of ad-hoc lower value assets within a substation. The key replacements relate to fencing and security, lightning protection, seismic compliance and earthing works to be complete at multiple substations across the network.

The following aspects of these approaches to forecasting do not appear reasonable:

Power transformers

- Comparison of the AHI model outputs to the projects proposed for the CPP period indicated that the Replacement Year identified in the expenditure forecast model did not align to the dates calculated in the AHI model for all transformers. The impact of this was not material.
- Both the Moturoa T1 and T2 transformers are included in the replacement program. Replacement of the Moturoa T1 transformer was brought forward by eight years from 2028 to 2020, while the Moturoa T2 did not have a replacement date forecast and has a good health index of H4. Bring forward of replacements by this length of time does not appear prudent. We note that changes to coordinate with other replacements were in the order of one to three years, including four transformers that were deferred beyond the CPP period.
- The AHI model did not forecast a replacement date for Kimbolton T1 and it has a good health index of H4. It does not appear prudent to replace this transformer within the CPP period.
- When selecting its replacement projects, Powerco's planning documents do not indicate that it seeks to minimise economic costs to consumers by considering the cost of the energy at risk and substation security. For instance, the risk of loss of supply due to a transformer failing could be assessed against the potential deferral of replacement expenditure to determine the lowest economic cost to consumers. Considering the substation security (where there is N-1 redundancy for transformers) and energy at risk, it is likely that two transformers could be deferred beyond the CPP period. Powerco's approach therefore potentially leads to an overstatement of transformer replacement, by up to $5 million ($2016).

Outdoor switchgear

- Powerco has taken a simple age based forecasting approach assuming the switchgear will be replaced at its maximum practical life.[70] No evidence has been provided to demonstrate the practical life is based on actual historical network replacement

[70] Powerco, *Distribution switchgear fleet management plan*, December 2016, p. 40, Ansarada document 04.01.04.02.

data and the values (45 years or 50 years) appear to be assumptions. In practice the switchgear is replaced based on condition derived from physical inspection in the field. The different approaches between forecasting and replacement mean there is potential for a difference between the volumes forecast based on an asset age compared to the switchgear that actually requires replacement when physically inspected in the field. The forecast results in a step increase in expenditure which cannot be verified as prudent and may be an overstatement of expenditure.

- Although Powerco has started to move to the CBRM model from EA Technologies, which is a commonly used tool in industry, it has not been used to determine its forecast for the CPP.

Key assumptions used

Key assumptions that we consider are reasonable:

- A threshold has been set for arc fault incident energy of 8 cal/cm^2. The focus for replacement is on oil insulated switchgear which has an additional fire risk as a result of arc flash. Other mitigation options have been considered so there is no evidence that indicates this assumption is not reasonable.
- Powerco aims for all zone substation buildings to meet 67% of the building seismic standard. This assumption appears reasonable as it is based on the NZ Society of Earthquake Engineering compliance Grade B for an industry standard.
- Powerco has assed projects and changed timing to align the works at each zone substation where possible. Review of the date changes shows 126 projects were deferred by an average of 2.5 years and 23 were brought forward by an average of 3 years. This indicates a conservative approach to its forecasting practices, but does not appear to be unreasonable.

The following assumptions do not appear reasonable:

- The apparent use of nominal asset age replacement lives for an age based model as applied for outdoor switchgear. There is no evidence that these lives are based on the average age of assets at the time of replacements which would provide some support to the approach taken.

Benchmarking

Benchmarking was undertaken to compare Powerco to other New Zealand EDBs. The full analysis is shown in appendix F. The data set used for benchmarking did not have the granularity required to compare expenditure at the asset category level, so the analysis was limited to the higher level capex and opex categories.

It is not possible to draw conclusions specifically relating to zone substation replacement practices, however, zone substation replacements form a significant portion of the Powerco replacement expenditure forecast and the benchmarking shows that the total replacement expenditure is increasing compared to similar EDBs when normalised by customer density and circuit length. It would be reasonable to assume that the increase

is partly due to the size of the zone substation replacement program proposed for the CPP period.

Contingency factors

No contingency factors have been included in the forecast expenditures.

Interaction with other expenditure projects or programs

There is an interaction identified with the Network Evolution program, which also proposes expenditure related to load control assets, and an interaction identified with the secondary systems program as when switchboards are replaced, the protection and control systems are typically also replaced. It is not clear how these programs have been taken into account in the forecasts and therefore may result in an overstatement of expenditure required.

Deliverability

The forecast expenditure represents a step up from historical expenditures. Powerco has indicated that the increased field activity can be provided by its external contractors, while increases in the SONS (see opex program review at O3) will also be required. Powerco has undertaken modelling of the increased activities and has discussed this with its contractors, who are prepared to employ the additional staff required. Even though the increased activities require additional trained labour, we do not envisage that Powerco will not be able to source the required resources.

Our finding

In our view, Powerco's proposed expenditure for renewal of the following zone substation asset categories does not appear unreasonable:

- buildings
- load control injection
- indoor switchgear
- Outdoor switchgear
- other zone substation assets.

Our view is based on the following observations:

- forecast replacement of indoor switchgear is based on a prudent assumption for safety
- forecasts for replacement load injection control plant and other zone substation assets appear reasonable
- buildings are being assessed against the new building for buildings and foundations.

In our view, Powerco's proposed expenditure for renewing five of its proposed power transformer assets. With the information provided, we identify the potential to defer replacing five of the 18 transformers forecast for replacement in the CPP period based on:

- two transformers that were forecast for replacement in the CPP period that did not have a replacement year calculated by the AHI model and currently have a good health index of H4 (Kimbolton T1 and Moturoa T2)
- one transformer that had its replacement year brought forward by an excessive amount (8 years) (Moturoa T1)
- two transformers due to the ability to defer when consideration is given to the energy at risk.

The portion unverified is up to $5 million ($2016).

Program C4: Secondary systems – renewals

Project description

The secondary systems renewals program aims to replace deteriorated assets that are generally located within zone substations. These assets fall into the following four categories:

- **Protection relays** – focus on replacing old relays with modern numerical relays and also accounts for relay replacements required by switchboard and transformer replacements.
- **SCADA and communications devices** – consolidation of the network into one DNP3 communication protocol to ensure compatibility and the required functionality.
- **Metering** – completing the program aimed at replacement of GXP check meters with modern equivalents, the Tauranga Information Initiative and replacement of ripple relays.
- **DC supplies** – replacement of non-standard DC systems with standard DC systems as they deteriorate in condition, or as network assets are replaced with modern equivalents and require standard voltage supplies.

There are two specific programs:

- replacement of the automatic under frequency load shedding (AUFLS) scheme with the extended reserve scheme that has been specified by the Electricity Authority
- replacement of ripple relays for the Tauranga Information Initiative that forms part of the network evolution program.

Cost estimate / expenditure forecast

Table 23 shows the forecast expenditure during the CPP period. Powerco forecasts expenditure of $28.3 million.

Table 23 – Secondary systems – forecast expenditure (real$2016, thousands)

Item	FY19	FY20	FY21	FY22	FY23	Total
Expenditure	8,698	8,651	6,214	2,462	2,256	28,280

Relevant policies and planning standards

No specific policy or standards apply to secondary systems expenditures.

Information provided

Table 24 presents the information that has been provided by Powerco in relation to the identified program.

Table 24 – Information provided – renewals secondary systems

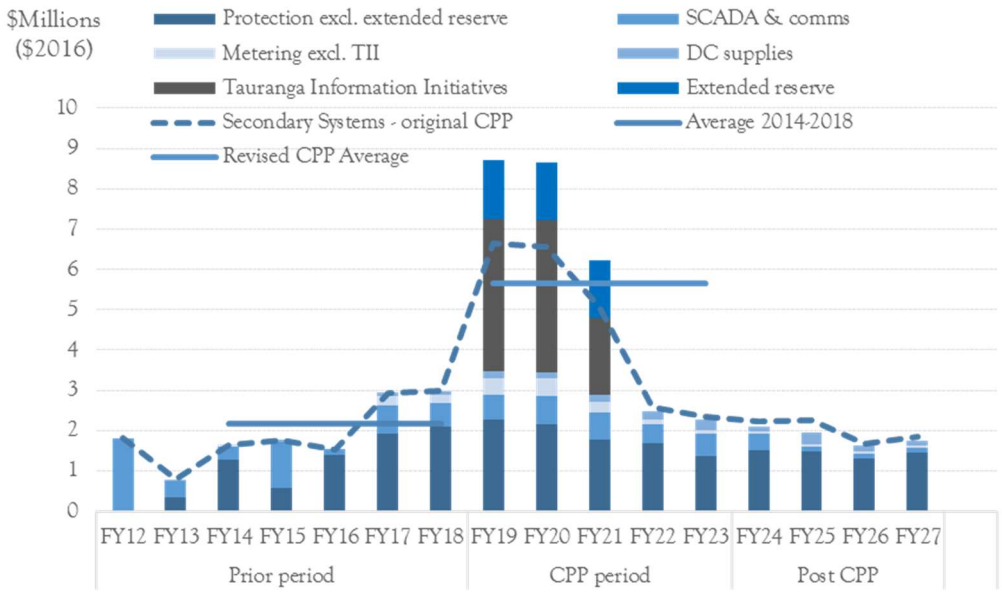
Title	Reference	Date provided
Fleet Management Plan - Secondary Systems	04.01.04.07	4 Feb 2017
SCADA and Communications expenditure forecast model	03.04 - 7.1	14 Feb 2017
Protection expenditure forecast model	03.04 - 7.2	14 Feb 2017
DC Supplies expenditure forecast model	03.04 - 7.3	14 Feb 2017
Metering expenditure forecast model	03.04 - 7.4	14 Feb 2017
Verifier Question and Answer Initial Summary Response_Q0017 Asset Renewals – Secondary Systems	Question ID 017	3 March 2017
Business case for network evolutions activities	04.01.16	29 March 2017
Tauranga Information Initiative - Summary Business Case_minor update_290317	04.01.15	29 March 2017
Information provided following draft report		
SCADA and Comms expenditure forecast model	03.09.23	8 May 2017
Protection expenditure forecast model	03.09.24	8 May 2017
DC Supplies expenditure forecast model	03.09.25	8 May 2017
Metering expenditure forecast model	03.09.26	8 May 2017

Assessment of method used

Expenditure trends

Figure 17 shows the historical and forecast expenditure for the secondary systems replacement program, excluding the Tauranga Information Initiative. Powerco proposes an annual average increase of $3.5 million ($2016) pa on average from historical costs with a total expenditure of $28.3 million ($2016). This is 160% higher than the prior period. Since the Extended Reserve Replacement is a one-off project required for a regulatory obligation, it has been shown separately in Figure 17 to enable an easier caparison of the expenditure trends on a like for like basis.

Figure 18 Secondary systems – historical and forecast expenditures ($million, per year, $2016)



Protection relay replacement accounts for approximately 39% of the total forecast when the extended reserve scheme is excluded. Of the total repays replaced, the age based model approach accounts for approximately 60% while the switchgear and transformer driven replacements account for approximately 40%.

Expenditure justification

The justification for this asset category has been based on technology obsolescence and asset age. The primary objective identified by Powerco is to maintain the safety of the network. The forecasting approach for each sub category of this expenditure forecast is described below.

The following assets appear to be forecast appropriately:

- **Metering** – is based on obsolescence of device and the completion of the GXP check meter replacement program. The total program value is not material and decreasing during the period. We have not seen any evidence that indicates this expenditure is inappropriate.
- **DC supplies** – these are forecast based on age and condition and have an additional driver of consolidation to standard voltages for compatibility with modern assets. The total expenditure is not material. We have not seen any evidence that indicates this expenditure is inappropriate.
- **SCADA** – assets are replaced based on obsolescence of technology and the longer-term strategy to move the entire network to an industry standard communication protocol of DNP3. This will provide long term compatibility and improved functionality. The forecast expenditure is higher than historical expenditure but of

a similar magnitude. We have not seen any evidence that indicates this expenditure is inappropriate.

- **Protection (Extended reserve)** – this is a replacement of a load shedding scheme known as AUFLS that has been specified by the Electricity Authority, the replacement scheme known as the extended reserve. Since this expenditure is required to meet a regulatory obligation we consider it is prudent.
- **Protection (primary asset driven)** – excluding the extended reserve program, 40% of the forecast replacement of protection relays is driven by replacement of the primary asset they are protecting, predominantly switchboards or power transformers. This approach is in line with common industry practice. We have not seen any evidence that indicates this expenditure is inappropriate.
- **Protection (age based forecast)** – 60% of the forecast protection relay replacement program is based on an age based model. Use of an age based approach is in line with common industry practice.

Key assumptions used

In general, there is no evidence that suggests that the assumptions made for the secondary systems expenditure forecast are inappropriate.

Contingency factors

We note that a 10% contingency factor has been applied to the Tauranga Information Initiative component of the forecast. This may result in an overstatement of expenditure by approximately $926,900 ($2016, including capitalisation).

We found no evidence that contingency factors have been included in the remaining forecast expenditures.

Interaction with other expenditure projects or programs

There is an interaction identified with the zone substation program. When switchboards and power transformers are replaced, the protection and control systems are also typically replaced.

By replacing older electromechanical relays with modern relays Powerco should receive benefits from reduced maintenance expenditure. Newer relays require less frequent calibration and inspection, and when they do require maintenance it typically has a reduced cost as the degree of isolation required is less. We have not seen evidence of these benefits being quantified or accounted for in maintenance opex forecasts, however are of the view these are likely to be immaterial within the CPP period.

There is an interaction for the Tauranga Information Initiative project and the network evolution program where some of the expenditure ($371,471 ($2016, including capitalisation)) is allocated in addition to the $10.2 million ($2016, including capitalisation) identified through this program. This expenditure is justified in the business case for the Tauranga information Initiative and, excluding the contingency included, we have not found any evidence to suggest this expenditure is not reasonable.

Deliverability

The forecast expenditure represents a step up from historical expenditures. Powerco has indicated that the increased field activity can be provided by its external contractors, while increases in the SONS (see opex program review at O3) will also be required.

Powerco has undertaken modelling of the increased activities and has discussed this with its contractors, who are prepared to employ the additional staff required.

Even though the increased activities require additional trained labour, we do not envisage that Powerco will not be able to source the required resources.

Our finding

In our view, Powerco's proposed secondary systems renewal expenditure does not appear unreasonable.

Our view is based on the following observations:

- the extend reserves scheme – an external driver is behind the program to comply with new requirements
- Predominantly – except for part of the relay replacement program – the forecast expenditure appears reasonable to meet the expenditure objective
- appropriate modelling has been undertaken to determine the forecast expenditures.

We do note that Powerco has included allowance for a 10% contingency for a major expenditure item which may result in an overstatement of expenditure in the order of $926,900 ($2016, including capitalisation).

Program C5, C6 and C7: Growth and security – Major projects and minor growth and security works

Project description

Powerco describes the growth and security program of works as being necessary to "ensure the capacity of our network is adequate to meet the peak demand of our customers at appropriate levels of reliability, now and in the future".[71] Most of the expenditure proposed is to meet security needs, rather than growth. Growth and security capex is broken down into three sub-categories:

- major projects
- minor growth and security works
- reliability.

This section describes our review of major projects and minor growth and security works sub-categories. The review of major projects was based on a sample of two projects in detail (Palmerston North and Pataruru), while the review of minor growth and security works looked at the portfolio as a whole with some project sampling.

Cost estimate / expenditure forecast

Powerco proposes total expenditure of $264.6 million ($2016) within the two sub-categories; $131.9 million ($2016) on major projects and $132.6 million ($2016) on minor growth and security.

Table 25 – Forecast expenditure – growth and security major projects and minor works ($2016, thousands)

Item	FY19	FY20	FY21	FY22	FY23	Total
Major projects	27,148	21,970	25,112	32,386	25,325	131,942
Minor Growth & Security	29,719	27,895	27,444	21,603	25,973	132,634
Total	**56,867**	**49,865**	**52,556**	**53,989**	**51,298**	**264,576**

Relevant policies and planning standards

Planning for growth and security works is generally undertaken in accordance with Powerco's standard 310S001, Security of Supply Classification – Zone Substations. Evaluation of options is undertaken in accordance with the Electricity Network Options

[71] Powerco, *Electricity Asset Management Plan 2016*, 2016 section 8.3.

Analysis Guideline, using one of three economic evaluation templates (for small, medium or large projects).

Information provided

Table 26 presents the information that has been provided by Powerco in relation to the identified program.

Table 26 – Information provided – growth and security major projects and minor works

Title	Reference	Date
Network Development Plan 30 Jan.pdf	04.01.03	31 Jan 2017
POD02 Palmerston North Reinforcement.pdf	04.01.05.01	3 Feb 2017
POD G03 Putaruru GXP.pdf	04.01.05.02	3 Feb 2017
Forecast Growth & Security Major Projects Model	03.04 – 24	14 Feb 2017
Forecast Growth & Security Minor Works Model	03.04 –25	15 Feb 2017
393S041 Zone Substation Transformer Ratings - Planning - ZTR.pdf	01.02.57	16 Feb 2017
Powerco response to Ansarada question number 2070, item 34,	Question ID 2070	22 Feb 2017
Economic Evaluation Template - Medium-V1.2-26-08-2014.xlsx	01.02.59	24 Feb 2017
Economic Evaluation Template - Small-V1.2 -26-08-2014.xlsx	01.02.60	24 Feb 2017
Electricity Network Options Analysis Guidelines v1.2 - 26-08-2014.pdf	01.02.61	26 Feb 2017
ZP01594 Powerco Security of Supply V3-31-07-2014.pdf	01.02.62	1 March 2017
Verifier Question and Answer Initial Summary Response_Q0019 Major Project - Palmerston North	Question ID 019	3 March 2017
Verifier Question and Answer Initial Summary Response_Q0020 Major Project - Putaruru	Question ID 020	3 March 2017
Verifier Question and Answer Initial Summary Response_Q0022 Growth and Sec - Min Growth Security wks	Question ID 022	3 March 2017
Powerco Communication Strategy	04.02.02.19	6 March 2017
Information provided following draft report		
Major Projects – summary model	03.09.03	8 May 2017
Minor works portfolio - expenditure forecast model	03.09.07	8 May 2017

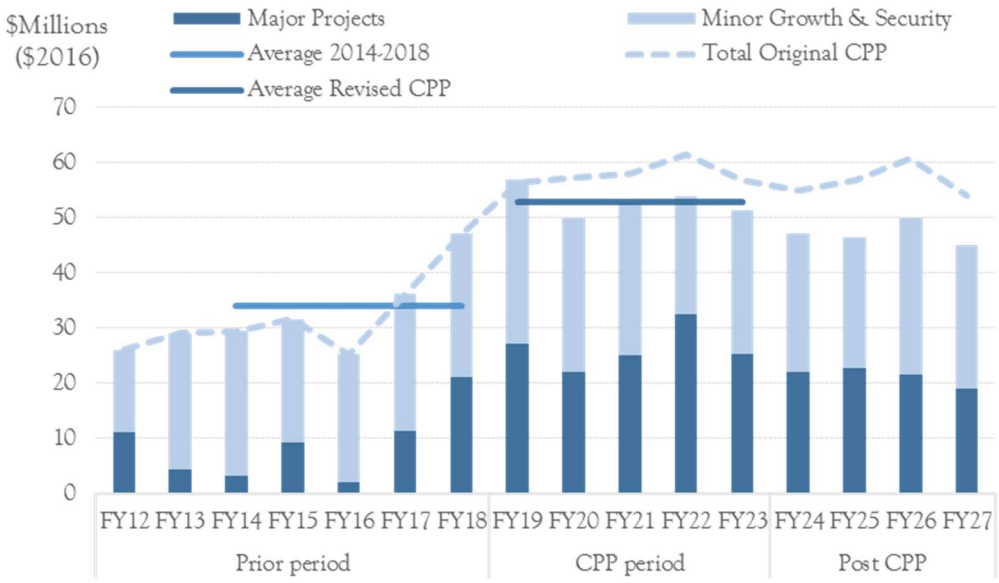
Assessment of method used

Expenditure trends

Powerco initially forecast a total of $290.0 million ($2016) on major projects and minor growth and security. Following discussions with the review team, it modified this to

reflect the inherent uncertainty in the forecast. Powerco now proposes a total of $264.6 million an average annual increase of $19.0 million ($2016) from historical costs, an increase of 56%. The increase is more pronounced on major projects, 182%, with the increase for minor growth and security, 8%.

Figure 19 – Growth and security major projects and minor works ($million per year, $2016)



Source: Powerco data. FSC and WSP analysis.

Powerco has forecast the expenditure in the two sub-categories in different ways:

- major projects – bottom-up estimate of each project
- minor growth and security works – combination of bottom-up estimates for 'minor projects', base-step-trend for 'routine projects' and 'communications'.

Powerco undertakes an annual process that has a contingency analysis spreadsheet as an output, which identifies potential breaches of the security standards across the network. A process is then undertaken which results in a list of projects, which is refined further. Historically this has resulted in a smaller sized program in terms of number of projects and expenditure and similarly the list of works proposed in the CPP is smaller than the longer list identified within the contingency analysis.

Expenditure justification

The driver behind most of Powerco's proposed expenditure is security of supply. In most cases, the increase from historical expenditure is due to Powerco not meeting its required security standard. Powerco developed the program to essentially deal with existing load at risk resulting from past growth.

A minority of the growth and security expenditure is to meet new growth.

Key assumptions used

Powerco has a comprehensive set of policy and planning documents relating to the identification and response to growth and security issues. In our view, based on our assessment in relation to this CPP proposal, the bulk of these documents appear of the nature and quality required for the capital expenditure forecast to meet the expenditure objective.

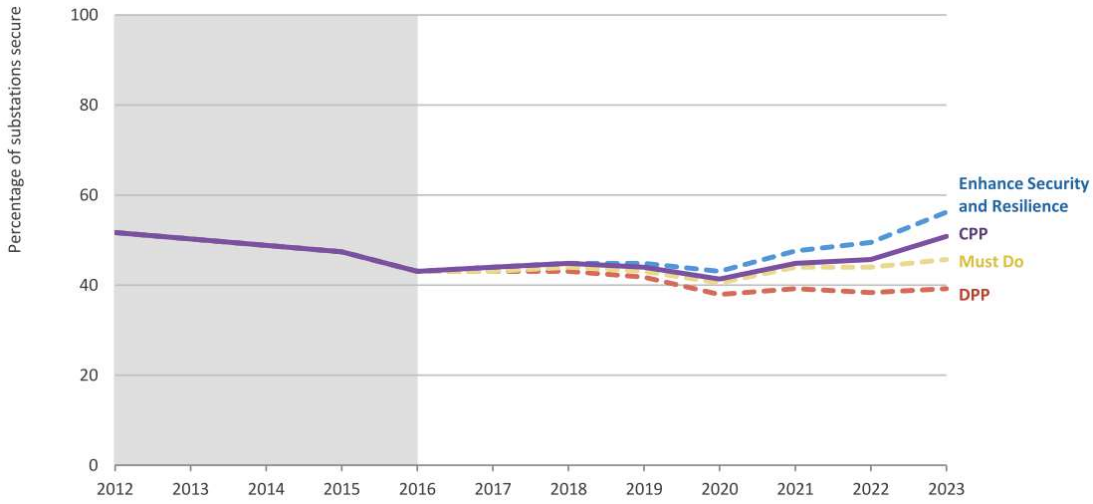
However, we believe that some of these documents and the practices that follow from them do not appear to be of that nature and quality. These are discussed below.

Planning/ZSS Growth & Security: Document 01.02.24 310S001 Security of Supply Classification - Zone Substations sets out the security standard for zone substations. It specifies a target for the duration of an outage. To achieve the target duration, most substations would require an N-1 deterministic standard to be adopted. Under this system, no load would be placed at risk for the loss of a single item of network infrastructure. This is common practice in NZ, but is inconsistent with many overseas jurisdictions that adopt a probabilistic standard that seeks to minimise the costs of supply loss plus the cost of remediation.

The N-1 deterministic standard leads to earlier augmentation and hence higher remediation costs than if the standard allowed some energy to be placed at risk of loss. The approach leads to higher economic costs for consumers and is therefore inconsistent with the expenditure objectives.

Figure 20 below indicates the level of compliance with the security standards over time.

Figure 20 – Extract from Powerco 2018-2023 Investment Proposal, 'Have your say' document January 2017



Source: Powerco, 'Have your say' public consultation document

We note that Powerco in practice does accept some load at risk and has used the value of lost load to prioritise some historical expenditures. The level of proposed expenditures returns the risk level to about that experienced in 2012. Powerco stated in

interview that this level was arrived at through a qualitative assessment of risk, cost and operational restrictions, resulting in a level of expenditure that Powerco believes it can reasonably spend within the CPP period to reduce the level of energy at risk.

Powerco has stated that it intends to change its planning standard to adopt a probabilistic approach, meaning that it will be allowed to accept energy at risk (presumably provided it is economic to do so, i.e., based on a cost benefit analysis of the expected cost of energy at risk). The work to implement this change will be undertaken over the next few years.

The intent to adopt a new approach that will apply during the CPP period leads to forecasts being made on a different basis to actual future expenditures. This leads to uncertainty in the forecasts, with potential over-forecasting likely. By introducing a new standard for expenditures to be undertaken in the CPP period, it is unclear how the need to undertake the proposed projects will be affected. However, since a deterministic standard will be replaced by a probabilistic standard, it is likely the proposed suite of projects will overstate the expenditure necessary to mitigate the excess risk and align with the revised standard.

To account for the uncertainty created by the proposal to adopt a changed standard in future, Powerco moderated its forecast expenditures by deferring some of the projects that are likely to be impacted by the changed standard. While the review team is not able to verify that the remaining forecast expenditures would comply with the future standard, the level of expenditure proposed appears conservative and not unreasonable to achieve a reduction in load at risk to a more appropriate level. We note that the portion of growth and security expenditures that is uncertain is that for major projects ($131.9 million), as minor projects and security is generally consistent with historical expenditures. We reviewed two major projects – Palmerston North Reinforcement and Putaruru GXP having a combined capex of $37.0 million – as prudent. Hence, the uncertainty relates to $94.9 million.

Contingency factors

No specific contingency factors have been included in the forecast expenditures.

Interaction with other expenditure projects or programs

The ability to package up works to take to market, appoint contractors, supervise and manage contracts and finally to commission and bring into service new assets will be directly reliant upon Powerco being able to execute the plans to increase the number of FTEs within SONS. Therefore, in terms of influence on other expenditure forecasts, SONS is directly influenced. However, Powerco should be able to capitalise at least some of these costs.

During interviews with Powerco staff, we determined that this program has an overlap with the overhead conductor renewal program. Powerco subsequently adjusted that program, estimated at $1.2 million ($2016) over the CPP period.[72]

Deliverability

The forecast expenditure represents a step up from historical expenditures. Powerco outsources all capital works to external contractors, with increases also require for internal resources (within SONS) to support the contactors.

Powerco has undertaken modelling of the increased activities and has discussed this with its contractors, who are prepared to employ the additional staff required.

There are risks – which Powerco acknowledges – that additional demands for specialist contractors such as commissioning of new substations is a risk. Notwithstanding these risks, Powerco is undertaking prudent measures to gauge the market appetite and availability and is likely to be able to source the required resources.

Our finding

From the information made available it is not possible to make a definitive finding on the prudency of the expenditure proposed. Expenditure at levels greater than historical averages are required to meet the need to provide adequate security of supply and to meet ongoing ICP growth; however, we cannot be certain the prudent level of expenditure has yet been arrived at, and therefore have not put a value on how much if anything the forecast may be overstated.

We note that the forecast expenditure returns the load at risk of interruption at a zone substation to a similar level to that existing in 2012, which does not appear unreasonable.

The prudency of the forecast for major projects and minor growth and security works could be demonstrated by further assessment of the value of lost load associated with each of the major projects and a sample of the minor works. The assessment would be to model unplanned reliability of each project or type of project based on an assumed value of consumer reliability. The aim would be to determine the optimal timing for a project based on minimising net costs to customers. We note that Powerco has performed this calculation for some projects in the forecast period.

[72] Powerco response to Ansarada question number 2070, item 34, 22 February 2017.

Program C8: Growth and security – reliability

Project description

Powerco describes Growth and Security capital expenditure as being necessary to "ensure the capacity of our network is adequate to meet the peak demand of our customers at appropriate levels of reliability, now and in the future". The majority of expenditure proposed is to meet security needs, rather than growth. This category is broken down into several sub-categories, including:

- major projects
- minor growth and security works
- reliability.

This review section describes our review of the reliability sub-category. Expenditure is generally related to improving the resilience of the network by introducing more automation into the network, and segmentation of feeders. Powerco has stated that the program has been a cost-effective way of maintaining reliability with an ageing network.

Cost estimate / expenditure forecast

Powerco proposes total expenditure of $21.3 million.

Table 27 – Forecast expenditure – growth and security reliability ($2016, thousands)

Item	FY19	FY20	FY21	FY22	FY23	Total
Expenditure	3,184	4,591	4,720	4,529	4,322	21,345

Relevant policies and planning standards

Regulations set in terms of the Commerce Act contain strong disincentives to deteriorating reliability.

Internal policy is to achieve a target level of 90% of customers consider that Powerco's electricity reliability is acceptable or better. Reliability targets are proposed as part of the Price Path determination process.

Information provided

Table 28 presents the information that has been provided by Powerco in relation to the identified program.

Table 28 – Information provided – growth and security reliability

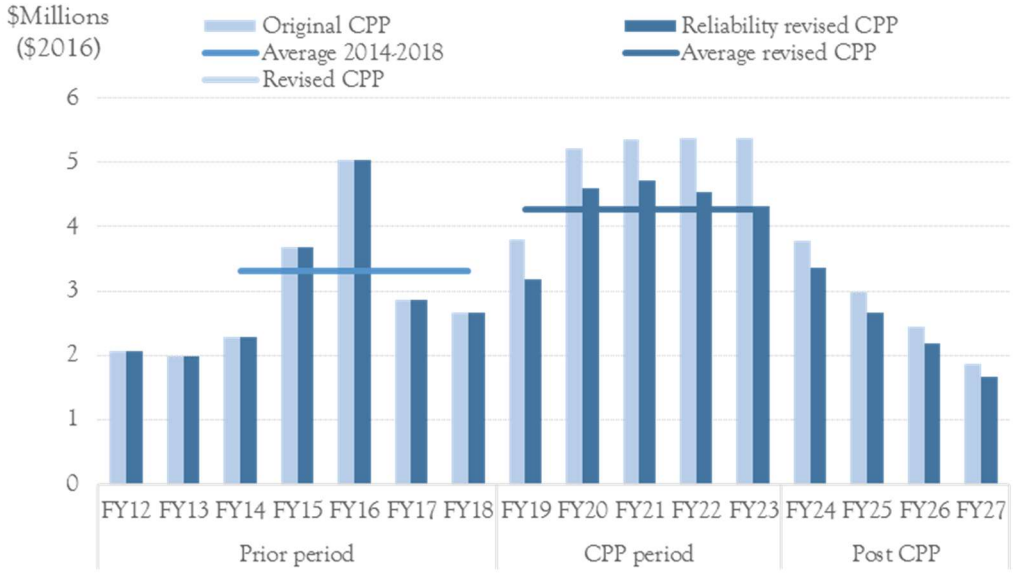
Title	Reference	Date
Network Development Plan 30 Jan.pdf	04.01.03	31 Jan 2017
Forecast Growth & Security Reliability Model	03.04 - 51	20 Feb 2017
Verifier Question and Answer Initial Summary Response_Q0024 Growth and Security - Reliability	Ansarada Question ID 024	3 March 2017
Information provided following draft report		
Reliability program forecast model	03.09.16	8 May 2017

Assessment of method used

Expenditure trends

Powerco's historical and forecast expenditures are shown in Figure 21. Powerco proposes an annual average increase of $1.8 million from historical costs, an increase of 55.5%.

Figure 21 Reliability – historical and forecast expenditures ($million, per year, $2016)



The increases are driven by increased volumes with unit rates remaining static. To date Powerco's reliability program has focused on automation for the eastern region, which has higher ICP counts than the western region and hence more benefit for customers per dollar spent. This program has largely been completed on the 'backbone' of feeders. In the CPP period, Powerco will focus on providing automation to spur lines in the eastern region and automation in the western region. The forecast expenditure also includes $1.76 million for the CPP period for Earth Fault Neutraliser installations in the eastern region. No expenditure for Earth Fault Neutraliser installations occurred in the prior period.

Expenditure justification

Powerco's primary justification for an increase in expenditure is to offset an expected decline in reliability as the network ages. The decline in reliability is expected to occur due to an increase in outage events as the condition of the network declines over the CPP period. Expenditure on automation / self-healing will reduce the impact of an increase in outages by reducing the number of customers experiencing loss of supply during a given outage.

Powerco has not provided evidence such as modelling demonstrating that the expected decline in reliability due to its aging network reflects the impact from other programs of work that may also affect reliability. In particular, the proposed increases in the asset replacement program may reduce the number of aged assets and arrest the perceived decline in reliability. The vegetation program may also reduce the number of vegetation related faults and hence improve reliability.

Without modelling, it is not possible to verify that the proposed expenditures on reliability improvements are required to maintain reliability or if an overall improvement in reliability would occur.

Key assumptions used

We consider that the following assumption appears appropriate:

- the cost of standard types of work will remain at historical values.

However, consider that the following assumptions does not appear supported based on the information that we have seen:

- Powerco has assumed that the number of outages will increase over time, with the expenditure on this program 'cancelling out' the impact of this increase, resulting in maintenance of reliability rather than improvements.

Contingency factors

No specific contingency factors have been included in the forecast expenditures.

Interaction with other expenditure projects or programs

The ability to package up works to take to market, appoint contractors, supervise and manage contracts and finally to commission and bring into service new assets will be directly reliant upon Powerco being able to execute the plans to increase the number of FTEs within SONS. Therefore, in terms of influence on other expenditure forecasts, SONS is directly influenced, however, Powerco should be able to capitalise at least some of these costs.

Improvements in resilience of the network, achieved via this program primarily through the installation of Earth Fault Neutralisers, have positive impacts upon the quality of the electricity supplied.

Other programs of work that will improve reliability include vegetation management and asset replacement. Improved inspection techniques will also result in the early identification of defects, limiting the number of asset failures. As discussed in Appendix E, Powerco has modelled the likely impact from proposed vegetation management and asset replacement expenditure. However, in our view the unplanned reliability model does not adequately account for the impact of the reliability program and therefore we are unable to verify that the reliability program is the right size (i.e. is not too big or too small) or is needed to maintain reliability.

Deliverability

The forecast expenditure represents a step up from historical expenditures. Powerco outsources all capital works to external contractors, with increases also require for internal resources (within SONS) to support the contactors.

Powerco has undertaken modelling of the increased activities and has discussed this with its contractors, who are prepared to employ the additional staff required. Even though the increased activities require additional trained labour, we do not envisage that Powerco will not be able to source the required resources.

Our finding

In our view, Powerco's proposed growth and security (reliability) expenditure is overstated. Our view is based on the following observations:

- The case for making additional capital investment to arrest a forecast decline in performance due to overall asset network health has not been made on a quantitative basis. Modelling of unplanned reliability supplied by Powerco to show the impact of renewals expenditures indicates that unplanned reliability would be maintained without the reliability program. Hence, the inclusion of the reliability program could be expected to improve unplanned reliability. Given Powerco's intention to maintain rather than improve unplanned reliability, it is not clear that a lot of the reliability program is required.
- It does appear that the types of expenditure carried out in the past and proposed for the future deliver cost effective outcomes; however, in the absence of a cost benefit analysis or any modelling of unplanned reliability the appropriate level of expenditure cannot be verified.

The portion unverified is approximately $15 million ($2016).

Program C9: Network evolution

Project description

The network evolution program is aimed at establishing a smart network and moving Powerco towards being a distribution system integrator over the next five to ten years, including providing for two way flows of electricity, allowing unfettered connection of localised generation and allowing customers to conduct energy transactions over the network. Individual projects range from developing battery storage and electric vehicle charging systems to investigating self-healing networks.

Cost estimate / expenditure forecast

Table 29 shows the forecast expenditure during the CPP period totalling $18.1 million ($2016).

Table 29 – Forecast expenditure – network evolution (real$2016, thousands)

Item	FY19	FY20	FY21	FY22	FY23	Total
Expenditure	2,852	2,867	3,568	4,428	4,412	18,126

Relevant policies and planning standards

Key documents influencing expenditure within this category are:

- asset management strategy
- asset management framework.

Information provided

Table 30 presents the information that has been provided by Powerco in relation to the identified program.

Table 30 – Information provided – network evolution

Title	Reference	Date provided
Asset management strategy	01.01.01	21 Feb 2017
Asset management framework	01.01.02	22 Feb 2017
Capital Expenditure Forecasting Network Evolution Model	03.04 – 52	20 Feb 2017
Tauranga information initiative summary business case	04.01.15	29 March 2017
Business case for network evolutions activities	04.01.16	29 March 2017
Remote Area Power Supplies Benefits Case	07.07	29 March 2017
Energy Storage and Community Energy	07.08	29 March 2017

Title	Reference	Date provided
Automatic Fault Location Related Automation Benefits Case	07.09	29 March 2017
Real Time Asset Ratings Benefits Case	07.10	29 March 2017
Low Voltage And Smart Meter Data Benefits Case	07.11	29 March 2017
Information provided following draft report		
Guidance note - relative cost of investment scenarios	04.02.05	21 April 2017
Relative cost to consumers of investment scenarios spreadsheet	04.02.06	21 April 2017
Network Evolution expenditure forecast model	03.09.17	8 May 2017

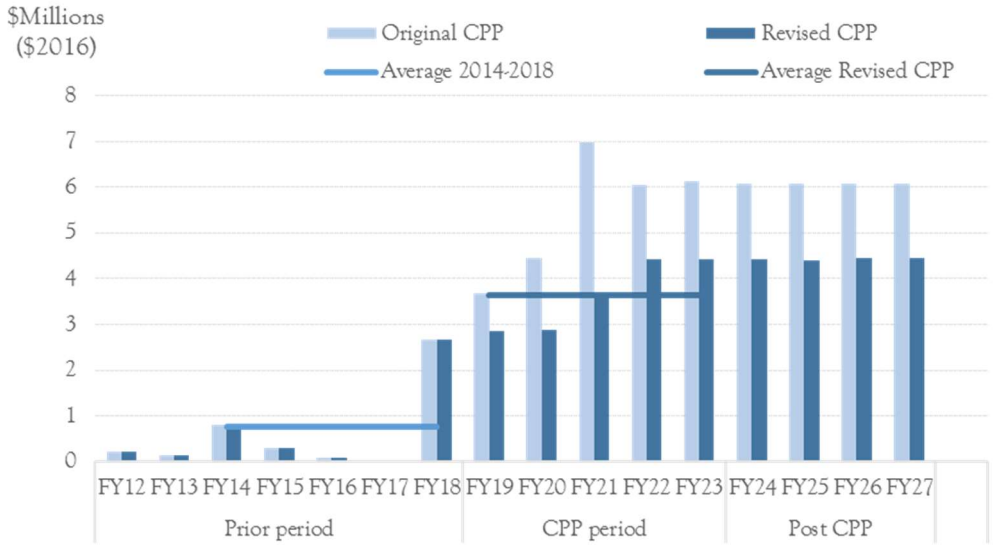
Assessment of method used

Expenditure trends

Powerco's historical and forecast expenditures are shown in Figure 22. Powerco proposes total expenditure of $18.1 million ($2016) over the CPP period, an increase of $14.3 million ($2016) from the current five year period, or 370%. This increase is from a small base, with expenditure proposed to increase significantly from negligible amounts to $2.7 million ($2016) in FY18, similar amount in FY19, climbing progressively to $4.4 million ($2016) by FY23 and remaining at similar levels thereafter. Powerco originally forecast total expenditure of $27.3 million, moderating the forecast following discussion with the review team to reflect likely benefits and future efficiencies, and reallocating some expenditures to the Secondary Systems category.

The forecast has been prepared based on several discrete projects with recurring expenditure proposed over the CPP period and beyond.

Figure 22 Network evolution – historical and forecast expenditures ($million, per year, $2016)



Expenditure justification

Powerco has prepared a draft business case that states that the expenditure will be NPV positive under the scenarios envisaged. Some justification for the works is that it will reduce the need for network solutions in years following the CPP period, and in other cases that it will result in least net cost for consumers.

Key assumptions used

Key assumptions that appear appropriate include acquisition and upgrade of the ripple relay fleet from Trustpower.

Powerco has made an efficiency adjustment of 0.5% in 2022 and 1% from 2023 onwards, a net reduction of approximately $67,000.

Contingency factors

We note that a 10% contingency factor has been applied to the Tauranga Information Initiative component of the forecast. This may result in an immaterial overstatement of expenditure by approximately $33,770 ($2016, including capitalisation).

No evidence has been found that contingency factors have been included in the remaining forecast expenditures.

Interaction with other expenditure projects or programs

Trade-offs with other expenditure projects and programs are evident based on the business case provided by Powerco and have been reflected in the CPP forecasts. As noted under the key assumptions section Powerco has made an allowance for efficiencies from 2022 onwards.

Some of the step changes within the SONS opex category are attributed to this (network evolution) capex, either for management of initiatives or for increased opex costs due to new assets put into service.

Powerco also includes research and development expenditure within the corporate opex category, which is discussed further in appendix D. This expenditure is forecast to remain at current levels – at about $0.7–0.8 million ($2016) per year. Although it appears that this expenditure is not captured within the proposed network evolution expenditure (i.e. there is no double up), we have not been able to confirm this using the information provided.

Deliverability

The forecast expenditure requiring external providers appears to be deliverable. Powerco will rely more heavily upon internal resources to be able to carry out the projects, with a new team proposed for creation, documented within the SONS category. While we have documented risks within the SONS section regarding recruitment of new capability, we do not envisage that Powerco will not be able to source the required resources.

Our finding

In our view, Powerco's proposed expenditure for the network evolution is overstated. Based on our assessment of the CPP proposal, it appears reasonable for some research and development expenditures to be included in the CPP period. We note that:

- Powerco stated elsewhere that 'uptake rates of solar PV, energy storage devices and EVs on the network is extremely low and, at current growth rates, will not have a material impact within the next ten years'.[73] This statement is at odds with the plan to invest considerable capex during the CPP in this area.
- We believe that capex for this category of approximately $2 million per annum would be more appropriate, e.g. the forecast may be overstated by up to $8.1 million.

[73] Response to item 6 of question ID 007, Powerco February 2017.

Program C10: ICT

Project description

The ICT program is part of Powerco's non-network capex portfolio. Expenditure typically includes provision or replacement of desktop PCs, notebook computers, servers, printers, mobile devices and networking equipment. It also includes software and information system expenditure.

A significant new project proposed for the CPP period is to implement a new enterprise resource planning (ERP) solution.

Cost estimate / expenditure forecast

Powerco proposes total expenditure of $53.07 million ($2016).

Table 31 – Forecast expenditure - ICT (real$2016, thousands)

Item	FY19	FY20	FY21	FY22	FY23	Total
Expenditure	17,902	8,457	13,225	6,860	6,627	53,072

Relevant policies and planning standards

ICT expenditure is undertaken in accordance with several internal policies, including those relating to treasury, insurance, recruitment, remuneration, travel, learning and development, and wellness.

Information provided

Table 32 presents the information that has been provided by Powerco in relation to the identified program.

Table 32 – Information provided- ICT

Title	Reference	Date
170201-cpp is capability and expenditure v2.3	05.01.01	3 Feb 2017
170202-cpp is capability and expenditure v2.4	05.01.02	2 March 2017
Forecast non-network capex - ICT capex	03.04 – 70	17 Feb 2017
New Foundation (ERP) material - Powerco Information Systems Strategy - Options Analysis Report Dec 2013	05.01.03	2 March 2017
New Foundations (ERP) material - Powerco Request for Information Presentation Oct 2014	05.01.04	2 March 2017
New Foundation (ERP) material - Asset and Financial Management System renewal options Feb 2016	05.01.05	2 March 2017
KPMG Powerco IT Management Review 3 9 13 with responses.pdf	07.05	4 March 2017

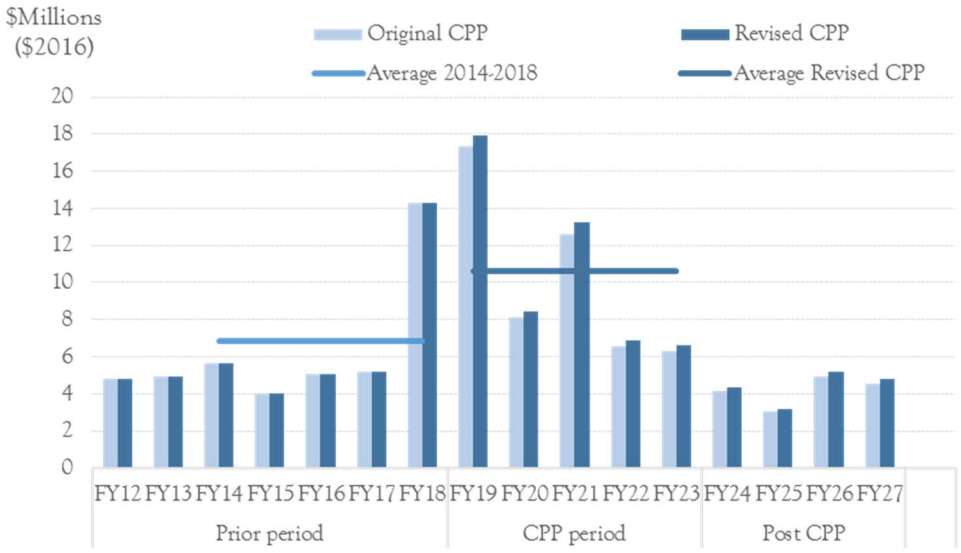
Title	Reference	Date
Customised Price Path: ERP needs case	05.01.07	28 March 2017
Information provided following draft report		
Customised price path: Information services capability and expenditure v3.2	05.01.08	5 May 2017
Information services capital expenditure – program overview document v2.2	05.02.07	5 May 2017
ICT capex forecast model	03.09.27	8 May 2017

Assessment of method used

Expenditure trends

Powerco proposes total expenditure of $53.07 million ($2016), having originally forecast $50.91 million. Powerco attributed this change to a more precise cost allocation between its gas and electricity businesses, and an increase in a major project[74]. Compared with historical expenditure Powerco proposes a total increase of $18.9 million ($2016) or 55.1% over the CPP period. Approximately 70% of the expenditure is for maintaining existing capability while the remaining 30% is to provide new capability. The most significant item of expenditure ($23.2 million ($2016)) is for Powerco's project to implement a new ERP solution.

Figure 23 ICT – historical and forecast expenditures ($million, per year, $2016)



[74] Powerco, *Customised price path: Information services capability and expenditure v3.2*, April 2017, Ansarada document 05.01.08.

Expenditure justification

The majority of the expenditure proposed is of a business as usual nature and from the documentation provided has been well justified as being required in order to support other core network or non-network business activities. Justification for the ERP has been made based on replacing several discrete legacy systems with a modern ERP, and supporting Powerco's strategy to lift asset management capability.

A counterfactual was prepared by Powerco demonstrating that retaining legacy systems or adopting a different replacement strategy of 'best of breed' discrete systems would result in an additional cost of $2.7 million ($nominal).[75]

Key assumptions used

We consider that the following assumptions appear appropriate:

- requirements for renewal of equipment will be undertaken with a similar approach to historical practice
- between 83.27% and 86.99% of expenditure in this category will be allocated to the electricity business;
  - this is a change from the original forecast which used a constant 81.95%; Powerco has elected to have a varying allocation from year to year as the relative share of the electricity business increases, primarily due to the CPP
- efficiency adjustments of 1% in 2022 and 2% from 2023 onwards, a net reduction of approximately $205,000.

Contingency factors

No contingency factors have been included in the forecast expenditures.

Interaction with other expenditure projects or programs

There are no direct interactions with other expenditure forecasts although it is reasonable to assume that implementation of the new ERP will be required to support changes in asset management practices and management of an increased expenditure profile. As noted under the key assumptions section Powerco has made an allowance for efficiencies from 2022 onwards.

Deliverability

The forecast expenditure represents a step up from historical expenditures, though this is mainly for externally provided expenditure for the ERP. Powerco should be able to source the required resources given that they are widely available within NZ and that

[75] Customised Price Path: ERP needs case, Powerco, 28 March 2017.

Powerco appears to have successfully recruited similar resources over the FY12 to FY16 period.

Our finding

In our view, Powerco's proposed ICT expenditure does not appear unreasonable.

Our view is based on the following observations:

- the overall approach taken by Powerco to forecast the ICT program is appropriate and in-line with common industry practice, and meets the expenditure objective
- the ERP, while a significant exercise, has undergone a planning process undertaken in a manner in line with industry practice, with business requirements documented along with a process to determine the appropriate scope to meet these requirements, with the project progressing along a path that would lead to efficient expenditure based on the approach to market
- stripping out the costs for the new ERP, Powerco's proposed expenditure during and post the CPP period is in-line with historical expenditure
- the need for expenditure on replacement of ICT assets is accepted.

Program O1: Preventive maintenance and inspection

Program description

Powerco has three maintenance opex portfolios, which are shown below together with the broadly corresponding Commerce Commission benchmarking categories (in brackets):

- Preventive Maintenance & Inspection (routine and corrective maintenance and inspection)
- Corrective Maintenance (asset replacement and renewal)
- Reactive Maintenance (service interruptions and emergencies).

This program review is of preventative maintenance & inspection; activities undertaken include routine maintenance activities such as testing, inspecting and asset servicing. Asset servicing includes scheduled maintenance activities on assets undertaken in a programmed fashion, whilst inspection activities are undertaken to obtain knowledge of asset condition, also in a programmed manner. Outputs from inspections influence other expenditure categories including corrective maintenance opex and asset renewal capex.

Cost estimate / expenditure forecast

Powerco proposes total expenditure of $58.5 million.

Table 33 – Expenditure forecast - preventative maintenance and inspection ($2016, thousands)

Item	FY19	FY20	FY21	FY22	FY23	Total
Expenditure	11,261	12,134	12,409	11,408	11,328	58,539

Relevant policies and planning standards

Key documents influencing expenditure within this category are:

- Network Asset management policy
- Asset management strategy
- Asset management framework
- Maintenance strategy
- Maintenance standards (numerous – determine maintenance intervals).

Information provided

Table 34 presents the information that has been provided by Powerco in relation to the identified program.

Table 34 – Information provided - preventative maintenance and inspection

Title	Reference	Date
Maintenance Strategy V1.1	04.01.01	1 Feb 2017
Maintenance Strategy – additional table	04.01.01.01	1 Feb 2017
POD - Preventive Maintenance and Inspection	04.01.05.04	3 Feb 2017
Network Opex - Routine Maintenance and Inspection Model	03.04 – 24	14 Feb 2017
Network opex - maintenance step changes (model)	03.04 – 30	23 Feb 2017
Network opex - Preventive and corrective maintenance additional work (model)	03.04 – 31	25 Feb 2017
Verifier Question and Answer Initial Summary Response_Q0013 Maintenance Opex	Ansarada Question ID 013	3 March 2017
Verifier Question and Answer Initial Summary Response_Q0013 Maintenance Opex Updated	Ansarada Question ID 013	8 March 2017
Explanatory note regarding network opex step changes	04.02.04.02	29 March 2017
Network opex step changes preventative maintenance and inspection	04.02.04.04	29 March 2017
Information provided following draft report		
Guidance note - relative cost of investment scenarios	04.02.05	21 April 2017
Relative cost to consumers of investment scenarios spreadsheet	04.02.06	21 April 2017
Network opex - Corrective Maintenance forecast model	03.09.43	8 May 2017
Network opex - Preventive Maintenance and Inspection forecast model	03.09.44	8 May 2017
Network opex - maintenance step changes	04.02.04.08	10 May 2017
04.02.04.09 v2 and 3 step change reconciliation	04.02.04.09	10 May 2017

Assessment of method used

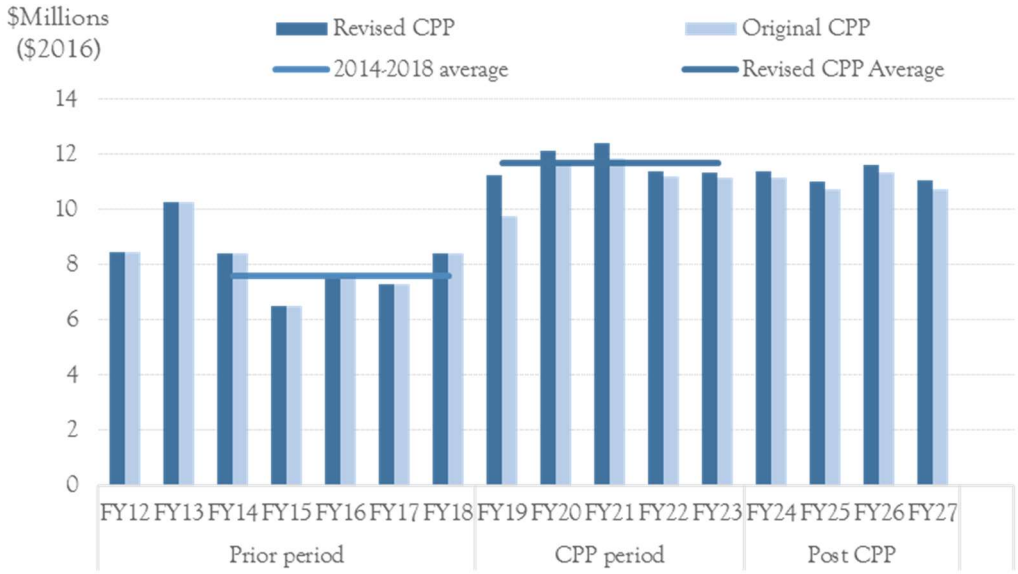
Expenditure trends

Powerco's historical and forecast expenditures are shown in Figure 24. Historical costs declined from FY12 to FY15 before returning to an average of $7.6 million from 2014 to 2018 (forecast). Powerco proposes an average annual increase of $4.1 million from historical costs, an increase of 53.7%. Expenditure is forecast to remain fairly flat post the CPP period.

Powerco originally forecast expenditure of $55.6 million, and following the draft verification report increased this to $58.5 million over the CPP period. The increase was attributed to a reallocation between maintenance categories and some revised estimates for new inspection activities. The 'top down' cost savings incorporated were outlined in general terms in Powerco's document 'Asset Management Capability

Enhancement Business Case' (Ansarada document number 04.01.11) and in exact dollar terms in the forecast cost model (Ansarada document number 03.09.44).

Figure 24 – Preventative maintenance and inspection – historical and forecast expenditures ($million, per year, $2016)



Powerco forecasts its expenditure over the CPP period using the base, step and trend method and using a bottom up approach to expenditure forecasting for GEM-scheduled maintenance. Powerco applies this method using FY16 as its base year, making some adjustments, and adding step changes. It also applies scale escalation.

The increase in expenditure is driven primarily by an increasing volume of activities, and by undertaking new inspection activities. Forecast increases in network scale have a minor impact on the increase.

Expenditure justification

Powerco proposes step changes in expenditure to promote two primary asset management objectives:

- asset stewardship, including pole top photography, acoustic testing of overhead lines and poles, additional inspections, zone substation repainting
- operational excellence, including asset information capture, scheduled maintenance on new types of assets (e.g. communications and network insight devices).

$13.0 million or 71% of the step change is associated with collection of information, supporting Powerco's strategy to:

- implement an ISO 55000 compliant asset management framework by 2022

- improve collection and analysis of information on asset condition to enable good practice maintenance and renewals decisions
- implement a mechanism for capturing/calculating the full economic cost of asset ownership, for use in planning (the replace/repair decision).

Although not explicitly reflected in most capital and operating expenditure forecasts, Powerco also expects to achieve cost savings by replacing assets at the optimal time, avoiding replacing an asset too soon and incurring expenditure earlier than necessary, or delaying replacement too late and incurring higher expenditure during reactive replacements. Powerco expects these benefits to accrue towards the end of the CPP period, and deliver lowest costs to consumers over the longer term.

Key assumptions used

Powerco has assumed that unit rates will remain steady and that growth in the network will increase base year expenditure by 0.62% per year over the CPP period. That growth factor is calculated using the elasticities determine by the Commission for the current DPP, Powerco's current forecast of ICP numbers, and the historical growth in line length. These assumptions all appear reasonable.

Contingency factors

No specific contingency factors have been allowed for.

Interaction with other expenditure projects or programs

Outcomes of expenditure undertaken in this program influences expenditure in corrective maintenance opex and asset replacement capex; defects identified will be rectified in one of these two categories, generally resulting in an increase in expenditure. By identifying defects and rectifying them in a controlled manner this should logically lead to a decrease in corrective or reactive maintenance opex as defects would be rectified as part of a program not on an emergency or reactive basis.

Expected cost reductions for corrective maintenance appear to be accounted for in the forecasts, but not specifically within the reactive maintenance (except for the general efficiencies applied to FY22 and FY23).

Deliverability

The forecast expenditure represents a step up from historical expenditures. Powerco outsources all capital works to external contractors, with increases also require for internal resources (within SONS) to support the contactors.

Powerco has undertaken modelling of the increased activities and has discussed this with its contractors, who are prepared to employ the additional staff required.

Even though the increased activities require additional trained labour, we do not envisage that Powerco will not be able to source the required resources.

Our finding

In our view, Powerco's proposed preventative maintenance and inspection expenditure does not appear unreasonable.

Our view is based on the following observations:

- The FY16 base year does not appear inefficient when total opex is compared to similar expenditure incurred by other NZ EDBs – and so appears to be a reasonable starting point for applying the base, step and trend method.
- The change from a largely reactive to a more proactive maintenance approach is prudent and will likely result in lower whole of life costs. Powerco has not been able to model this in much detail but has made a general efficiency adjustment for other maintenance categories.
- Appropriate modelling has been undertaken to determine the forecast expenditures.

Program O2: Corrective maintenance

Project description

Powerco has three maintenance opex portfolios, which are shown below together with the broadly corresponding Commerce Commission benchmarking categories (in brackets):

- Preventative Maintenance & Inspection (routine and corrective maintenance and inspection)
- Corrective Maintenance (asset replacement and renewal)
- Reactive Maintenance (service interruptions and emergencies).

This program review is of corrective maintenance; rectifying defects identified on the network that are of a non-urgent nature; defects that require immediate attention are dealt with as part of reactive maintenance.

Cost estimate / expenditure forecast

Powerco proposes total expenditure of $65.6 million.

Table 35 – Forecast expenditure – corrective maintenance ($2016, thousands)

Item	FY19	FY20	FY21	FY22	FY23	Total
Expenditure	12,585	13,818	13,829	12,894	12,457	65,584

Relevant policies and planning standards

Key documents influencing expenditure within this category are:

- Asset management policy
- Asset management strategy
- Asset management framework
- Maintenance strategy
- Vegetation management strategy
- Maintenance standards (numerous).

Information provided

Table 36 presents the information that has been provided by Powerco in relation to the identified program.

Table 36 – Information provided – corrective maintenance

Title	Reference	Date
Maintenance Strategy	04.01.01	1 Feb 2017
Maintenance Strategy – additional table	04.01.01.01	1 Feb 2017
POD - Corrective Maintenance	04.01.05.03	3 Feb 2017
Network Opex – Corrective Maintenance (model)	03.04 – 27	14 Feb 2017
Network opex - maintenance step changes (model)	03.04 – 30	23 Feb 2017
Network opex forecast - Preventive and corrective maintenance additional work (model)	03.04 – 31	25 Feb 2017
Verifier Question and Answer Initial Summary Response_Q0013 Maintenance Opex	Ansarada Question ID 013	3 March 2017
Verifier Question and Answer Initial Summary Response_Q0013 Maintenance Opex Updated	Ansarada Question ID 013	8 March 2017
Explanatory note regarding network opex step changes	04.02.04.02	29 March 2017
Network opex step changes - Corrective maintenance	04.02.04.03	29 March 2017
Information provided following draft report		
Guidance note - relative cost of investment scenarios	04.02.05	21 April 2017
Relative cost to consumers of investment scenarios spreadsheet	04.02.06	21 April 2017
Network opex - Corrective Maintenance forecast model	03.09.43	8 May 2017
Network opex - Preventive Maintenance and Inspection forecast model	03.09.44	8 May 2017
Network opex - maintenance step changes	04.02.04.08	10 May 2017
04.02.04.09 v2 and 3 step change reconciliation	04.02.04.09	10 May 2017

Assessment of method used

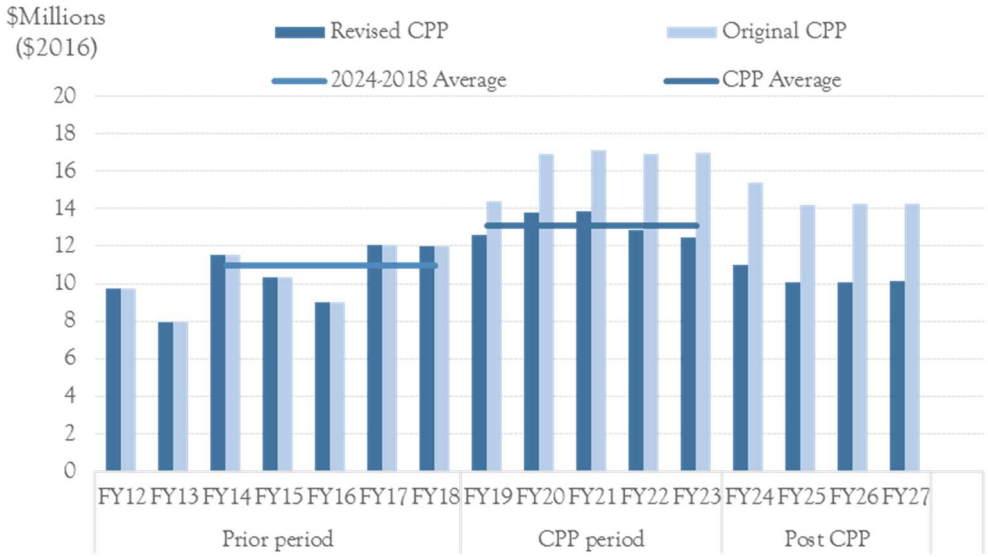
Expenditure trends

Powerco's historical and forecast expenditures are shown in Figure 25. Powerco's historical costs have gradually trended higher from FY13 onwards, from a low of $8 million in FY13 to a forecast $12 million in FY17 and FY18. For the CPP Powerco proposes an average annual increase of $2.1 million from historical costs, a total increase of $10.6 million ($2016), 19.3%. Powerco originally proposed total expenditure of $82.3 million, following the draft verification report revising this to $65.6 million over the CPP period. The reduction was primarily due to reallocating some expenditure to renewals capital expenditure (replacement of locks and LV fuses), accounting for efficiencies, and accounting for a double-up between this category and preventative maintenance and inspection. Powerco also revised downwards the number of new defects it anticipates discovering during the CPP period. The 'top down' cost savings incorporated were outlined in general terms in Powerco's document 'Asset Management Capability Enhancement Business Case' (Ansarada document number

04.01.11) and in exact dollar terms in the forecast cost model (Ansarada document number 03.09.43).

Expenditure is forecast to drop off following the CPP period due to a backlog of defects being cleared and improvements in the average network health, returning to DPP levels.

Figure 25 – Corrective maintenance – historical and forecast expenditures ($million, per year, $2016)



Powerco forecasts its expenditure over the CPP period using the base, step and trend method. Powerco applies this method using FY16 as its base year, making some adjustments, and adding step changes. It also applies scale escalation.

The increase in expenditure is driven primarily by an increasing volume of activities, principally addressing a greater volume of amber defects than in the past. Forecast increases in network scale have a minor impact on the increase.

Expenditure justification

Powerco has determined that the current backlog of amber defects (11,209) is unacceptable. Powerco plans to address a greater number of amber defects over the CPP (10,800) than it has in the past, aiming by the end of the period to have a much smaller volume of amber defects (a six-month pool) to rectify in future.

Powerco has justified this approach in three main ways:

- unmanaged defects represent unacceptable operational and safety risks and potential to not meet obligations under the Electricity Act
- cost effectiveness – rectifying proactively rather than reactively is expected to be more efficient
- impact on customers – unplanned outages are expected to reduce.

Key assumptions used

Powerco has assumed that unit rates will remain steady, and that growth in the network will account for a 0.33% increase in base expenditure each year. It has also made assumptions around the number of new defects that will be identified over the CPP period requiring rectification under this program. These assumptions all appear reasonable – the latter initially did not, but since the draft verification report Powerco undertook further analysis and applied a diminishing rate of defect discovery from year to year.

Contingency factors

No specific contingency factors have been allowed for.

Interaction with other expenditure projects or programs

With the majority of the corrective maintenance program relating to repair or replacement of assets, there is a direct relationship with the other maintenance opex categories (reactive and preventative) along with asset renewals (capex).

Defects identified during inspection activities carried out under preventative maintenance and inspection drive the step changes under corrective maintenance. Powerco has stated that if these defects were not identified at the 'amber' stage they would become 'red' defects or cause outages and be costlier to rectify, therefore increased expenditure on corrective maintenance should in time logically lead to a decrease in reactive maintenance opex as defects would be rectified as part of a program not on an emergency or reactive basis. In the current forecasts prepared by cost reductions for corrective maintenance appear to be accounted for but not within reactive maintenance.

There is some potential for the forecasts to overlap with the asset renewals capex program forecasts, though in practice actual expenditure will be clearly allocated to one or the other.

Deliverability

The forecast expenditure represents a step up from historical expenditures. Powerco outsources all capital works to external contractors, with increases also require for internal resources (within SONS) to support the contactors.

Powerco has undertaken modelling of the increased activities and has discussed this with its contractors, who are prepared to employ the additional staff required.

Even though the increased activities require additional trained labour, we do not envisage that Powerco will not be able to source the required resources.

Our finding

In our view, Powerco's proposed preventative maintenance and inspection expenditure does not appear unreasonable.

Our view is based on the following observations:

- The FY16 base year does not appear inefficient when total opex is compared to similar expenditure incurred by other NZ EDBs – and so appears to be a reasonable starting point for applying the base, step and trend method.
- The change from a largely reactive to a more proactive maintenance approach is prudent.
- Appropriate modelling has been undertaken to determine the forecast expenditures.
- The revised forecast has dealt with any issues we originally had with this category.

Although there is a limitation with the proposed forecast, we do not consider that these materially affect our view above. The limitation is not to do with corrective maintenance but reactive maintenance; there should be some benefits apparent towards the end of the CPP period as defects are rectified before they become 'red defects' requiring reactive or emergency work. In any case Powerco has made a cost efficiency adjustment somewhat mitigating this limitation.

Program O3: System operations and network support

Project description

System operations and network support (SONS) covers Powerco's internal costs to manage and operate the network, including management of all network capex and opex. Functions carried out include:

- asset management:
  - network planning
  - access and consent
  - network development
  - asset strategy
- operations:
  - design
  - service delivery
  - network operations centre
- commercial:
  - customer relations
  - customer solutions
  - customer experience
  - revenue.

Cost estimate / expenditure forecast

Powerco proposes total expenditure of $82.5 million ($2016).

Table 37 – Expenditure forecast – system operations and network support (real$2016, thousands)

Item	FY19	FY20	FY21	FY22	FY23	Total
Expenditure	15,463	16,479	17,057	16,786	16,701	82,486

Relevant policies and planning standards

Key documents influencing expenditure within this category are:

- asset management policy
- asset management strategy
- asset management framework
- vegetation management strategy
- maintenance strategy.

Information provided

Table 38 – Information provided – system operations and network support

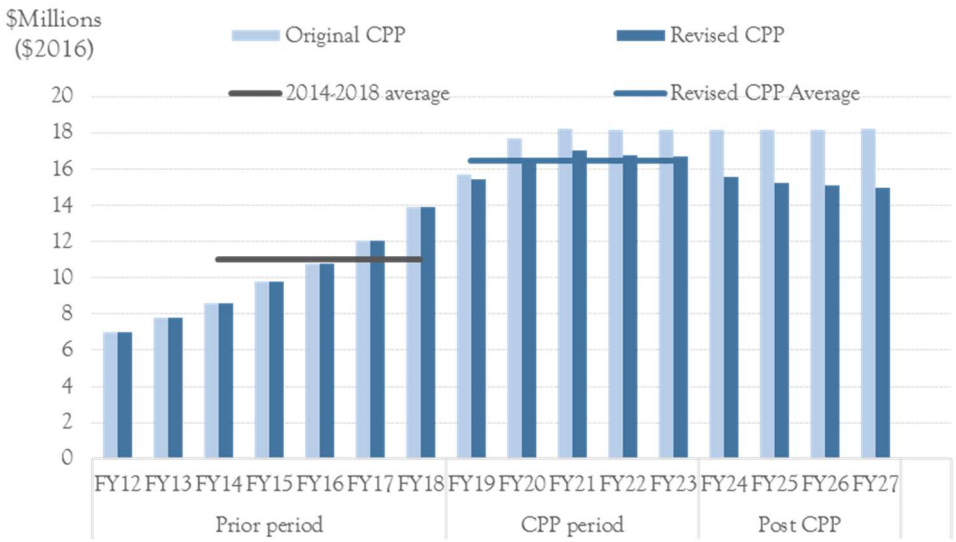
Title	Reference	Date
SONS POD	04.01.05.06	5 Feb 2017
Network Opex – SONS Model	03.04 – 26	14 Feb 2017
Verifier Question and Answer Initial Summary Response_Q0012 SONS Expenditure	Ansarada Question ID 012	25 Feb 2017
Business case for asset management strategy increase	04.01.11	28 March 2017
Business case for in-house call centre	04.01.12	28 March 2017
Business case for network evolutions activities	04.01.16	28 March 2017
Information provided following draft report		
Guidance note - relative cost of investment scenarios	04.02.05	21 April 2017
Relative cost to consumers of investment scenarios spreadsheet	04.02.06	21 April 2017
Network opex – SONS forecast model	03.09.46	8 May 2017

Assessment of method used

Expenditure trends

Powerco's historical and forecast expenditures are shown in Figure 26. Powerco proposes an increase of $27.4 million in total, $5.5 million ($2016) pa on average from historical costs, an increase of 49.8%. Powerco originally proposed total expenditure of $87.9 million over the CPP period, revising this down to $82.5 million following the draft verification report. The reductions were due to revised estimates for several step change items including establishing the call centre after Powerco prepared business cases for these items examining the longer-term benefit for customers. The 'top down' cost savings incorporated were outlined in general terms in Powerco's document 'Asset Management Capability Enhancement Business Case' (Ansarada document number 04.01.11) and in exact dollar terms in the forecast cost model (Ansarada document number 03.09.46).

Figure 26 System operations and network support – historical and forecast expenditures ($million, $2016)



Powerco's historical costs on SONS has increased steadily from FY12 to FY16, and are forecast to climb until FY21 before flattening off in real terms from FY22 to FY27.[76]

The total increase from historical expenditure of $27.4 million ($2016) comprises volume driven step changes of $5.3 million ($2016), strategy driven step changes of $12.9 million ($2016), data quality and asset management capability step changes of $6.6 million ($2016) and $1.5 million ($2016) relating to the ISO55000 compliance goal. Approximately $3.2 million ($2016) of the strategy driven step changes is attributed to 'Future Networks' operating expenditure.

Powerco forecasts its expenditure over the CPP period using the base, step and trend method. Powerco applies this method using FY16 as its base year, making some adjustments, and adding step changes. It also applies scale escalation based on the number of zone substations, which may double count the scale escalation already built into the volume-driven FTE step change.

Expenditure justification

Powerco has justified the volume-driven changes by demonstrating the link between outsourced capex and opex and required number of FTEs to manage the works. This includes contract delivery and network operations centre FTEs.

[76] Powerco's disclosed historical costs on SONS from FY12 to FY16 have been flat. Powerco adopted a new cost capitalisation policy in FY15. To ensure the historical series is consistent, Powerco adjusted FY12–FY14.

Strategy-driven changes have been justified as supporting Powerco's strategy, which supports improvements in asset management, investment decision making, a new customer contact centre among other activities not carried out now. Powerco has provided preliminary business case documentation for the asset management strategy and the customer contact centre, and provided final estimates of the net benefits in the longer term or during the CPP period. While this has undertaken some preliminary analysis of the longer term benefits we are unable to verify all of the proposed expenditure; specifically relating to the additional FTEs referred to in Powerco's forecast model as for *future networks, network analytics and investment optimisation-*, aggregate value approximately $8.9 million in Powerco's forecast model.

Key assumptions used

Key assumptions that appear appropriate include:

- a level of customer willingness to pay for a new customer contact centre
- certification of an asset management system (e.g. to ISO 55000) is an appropriate step to undertake.

Contingency factors

No contingency factors have been included in the forecast expenditures.

Interaction with other expenditure projects or programs

The quantity of new FTEs required to support delivery of externally delivered capex and opex is scaled from the uplift in each of these programs; any changes in these programs impacts the SONS volume driven forecast.

The link between the number of FTEs required within SONS to support other capex and opex programs has been well established by Powerco.

Powerco also intends to capitalise the majority (80%) of new volume driven staff because those staff will spend most of their time on capital projects, which appears reasonable.

Powerco has made an allowance in other capex and expenditure categories for top-down reductions accounting for these efficiencies.

Deliverability

Internal resourcing requirements have been considered in quantum, but not necessarily the logistics of increasing resources to the extent proposed, particularly with recruitment of staff to fill new teams that Powerco proposes establishing- future networks, investment optimisation and network analytics.

In our view, there is some risk that recruitment and training required to support the 'volume driven' increase in SONS FTEs may not occur fast enough and lead to a lag in dependent capital and operational expenditure occurring. Similarly, if the strategy-

driven FTE increases do not occur this would impact the overall expenditure to some degree.

This is not to say that such an outcome is certain – Powerco's work to date has been appropriate and has identified the requirements and preferred operation structure, however it remains a risk.

Our finding

In our view, most of Powerco's proposed SONS expenditure does not appear unreasonable, except for the proposes strategy driven step changes.

In our view, Powerco has not demonstrated that the proposed increase in SONS strategy-driven 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 and that these outweighed the $8.9 million ($2016) cost of these step changes.

Our view is based on the following observations:

- the base year expenditure appears to be reasonable
- volume driven step changes appear reasonable
- it is unclear whether the expected benefits from the strategy driven step changes outweigh the costs – although we note that Powerco had incorporate some benefits linked to these step changes in to the top-down efficiencies applied across all expenditure in FY22 and FY23
- appropriate modelling has been undertaken to determine the forecast expenditures.

Program O4: Vegetation management

Project description

The vegetation management program is to manage vegetation growing near the electricity network, including:

- inspection of affected lines and cables where the inspection is substantially or wholly directed to vegetation management
- liaison with landowners including the arrangement of access to land, issue of trim/cut notices and follow-up calls on notices
- the felling or trimming of vegetation to meet externally imposed requirements or internal policy
- administration of the database associated with notification records and agreements.

Cost estimate / expenditure forecast

Table 39 shows the forecast opex for vegetation management expenditures.

Table 39: - Expenditure forecast – vegetation management ($2016, thousands)

Item	FY19	FY20	FY21	FY22	FY23	Total
Expenditure	9,939	9,237	8,957	9,231	8,677	46,041

Relevant policies and planning standards

Vegetation management is undertaken generally in accordance with Electricity (Hazards from Trees) Regulations 2003 (Tree Regulations), which state that Powerco is responsible for the first cut, while the tree owner is responsible for the second and subsequent cuts.

Information provided

Table 40 presents the information that has been provided by Powerco in relation to the identified program.

Table 40 – Information provided – vegetation management

Title	Reference	Date
Vegetation Management Strategy – Draft	04.01.02	Dec 2016
Verifier Question and Answer Initial Summary Response _Q011 Vegetation 2....pdf	Ansarada Question ID 011_Updated	27 Mar 2017
Forecast Expenditure – Vegetation Management Model	03.04 – 28	16 Feb 2017

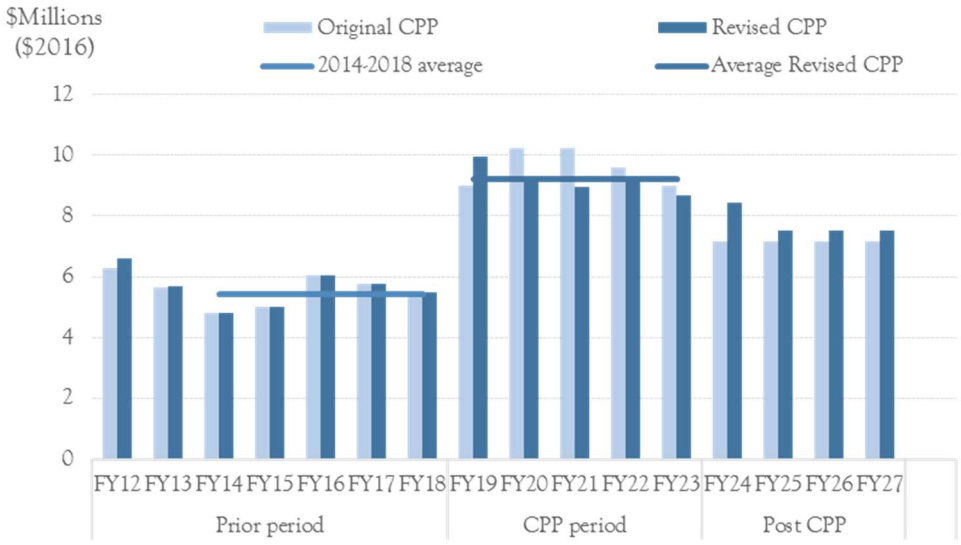
Title	Reference	Date
Tauranga cyclical vegetation management effectiveness	04.02.04.01	7 March 2017
Information provided following draft report		
Impact of second cuts in vegetation management forecast	04.02.04.07	2 May 2017
Forecast Expenditure – Vegetation Management Model	03.09.47	8 May 2017

Assessment of method used

Expenditure trends

Powerco's historical and forecast expenditures are shown in Figure 27. Forecast expenditures represent a step change of $4.2 million per year (77.1%) on average from historical costs, a total increase of $18.9 million.

Figure 27 – Vegetation management – historical and forecast expenditures ($million, $2016)

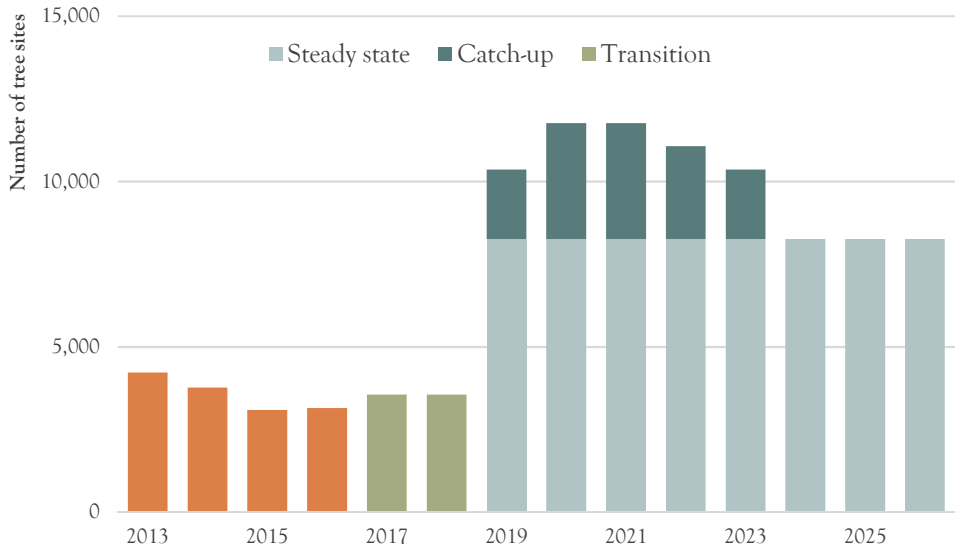


Powerco's historical costs are based on a reactive approach to vegetation management, where cutting or other vegetation management activities are undertaken only when Powerco becomes aware that a tree does not meet the clearance requirements set out in the tree regulations.

Forecast costs are based on the introduction of cyclic cutting on a three-year cycle in all areas. Cyclic cutting was introduced into one planning region and the intent is to move the remaining regions to the same basis over a five-year period. In the CPP period, the forecast costs also include expenditure to address the tree site backlog. Powerco states that $7.5 million pa is needed to reflect a three-year cutting cycle with the remainder being associated with backlog.

Figure 28 shows the forecast increase in work volumes initially proposed and as reflected in its Vegetation Management Strategy. Following discussion with the review team, Powerco refined its approach to provide a staggered start of cyclic cutting over a three year period 2019 to 2012 with catch up to address the higher volume of trees needing to be cut in the first year's cut in each area only rather than across the five year period. Powerco also included in its modelling the expected volumes of second cuts that would be paid for by tree owners and reduced its forecast expenditure accordingly.

Figure 28 – Extract from Powerco vegetation management forecast model – Volume of tree sites



Source: Powerco.

Expenditure justification

The key driver is to establish good practice with benefits including improved reliability, improved public safety, ensure proactive relations with the tree owners, improved public communications and improved efficiency. However, to us, it appears that:

- Powerco has used comparison with other EDBs to establish common practice and then this to be good practice without a review of the appropriateness of these common vegetation management practices within Powerco's network area, given the costs and benefits of doing so
- the benefits of good practice have not been quantified and are not verifiable

- the impacts (improvements) on reliability and safety outcomes have not been included in reliability[77] or safety plans, nor have any efficiencies been demonstrated.

Without establishing the benefits to be gained by the increased expenditures, the increase cannot be demonstrated to be prudent and hence required to meet the expenditure objectives.

Powerco considered three alternative options:

1. **DPP expenditure** – maintain current levels of expenditure
2. **Must do** – scale up business as usual without significant changes in strategy
3. **Enhance security and resilience** – quicker ramp up to address backlog, full LIDAR survey and aerial photography to identify the extent of clearance issues.

Forecast expenditures at historical levels would not appear prudent as this would continue the current reactive approach, which is clearly unsustainable and inconsistent with the tree regulations. Both the Must Do and Enhanced options carry a higher cost than the CPP proposal.

Key assumptions used

We consider that the following assumptions appear appropriate:

- a three-year cutting cycle should be established to meet the regulatory requirements – this is consistent with good industry practice
- a phased introduction with catch-up expenditure required to address the initially greater volume of vegetation to be addressed.

However, in our view the following assumptions do not appear supported based on the information that we have seen:

- average number of tree sites per km of overhead line is assumed to be the same across the network, based on the Tauranga region – no evidence and other regions have a different ratio of grassland vs wooded terrain making the use of the Tauranga average uncertain
- average number of tree sites per km of overhead line is assumed to remain constant over time – given that the volume of trees likely to be removed rather than cut is unknown and the volume of new trees entering the clearance zone for the first time is unknown, this assumption creates uncertainty in the forecast
- unit rates are assumed to be the same as currently tendered – no evidence that this is correct and that economies of scale cannot be realised, however we note that

[77] Powerco has now included the impacts of the forecast vegetation management expenditure in its model for unplanned interruptions, but these have not yet been reflected in a revised reliability plan.

forecast unit rates do not appear unreasonable and are lower than historical rates per tree site

- the allowance for catch up expenditure is based on an uplift of 25% above the historical time allowance per tree site. This is partially based on experiences in the trial undertaken in the Tauranga region but is uncertain
- the portion of costs associated with second cuts paid for by tree owners is assumed to be the same in 2019 to 2021 as currently experienced (1.7% of total cuts), reducing to 12% of total cuts from 2022 – the reduction is linked to improved processes and there appears to be no reason why the reduction cannot be obtained from 2019.

Based on the information presented to us by Powerco, we do not believe that the uncertainties in the forecast can be reduced. The effect of correcting for assumptions about unit rates and second cuts is expected to be a small reduction in forecast expenditures. The reduction is not considered to be material.

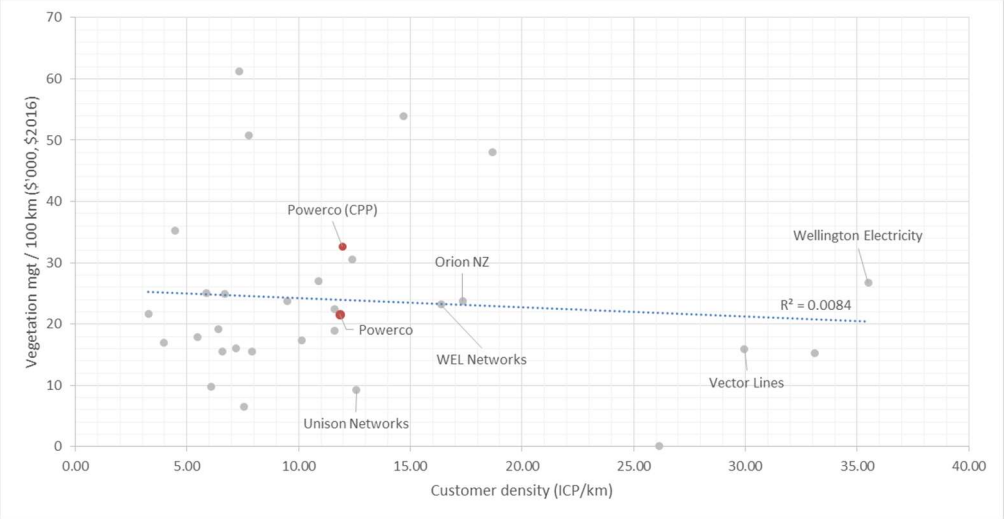
Contingency factors

No contingency factors have been included in the forecast expenditures.

Benchmarking

Benchmarking of vegetation management costs (excluding catch up expenditures) against other NZ EDBs is shown in Figure 29. The figure shows that Powerco's CPP forecast expenditure places it slightly above the average, although the range of EDB's expenditures is broad.

Figure 29 – Vegetation management – Costs per unit line length against customer density ($2016)

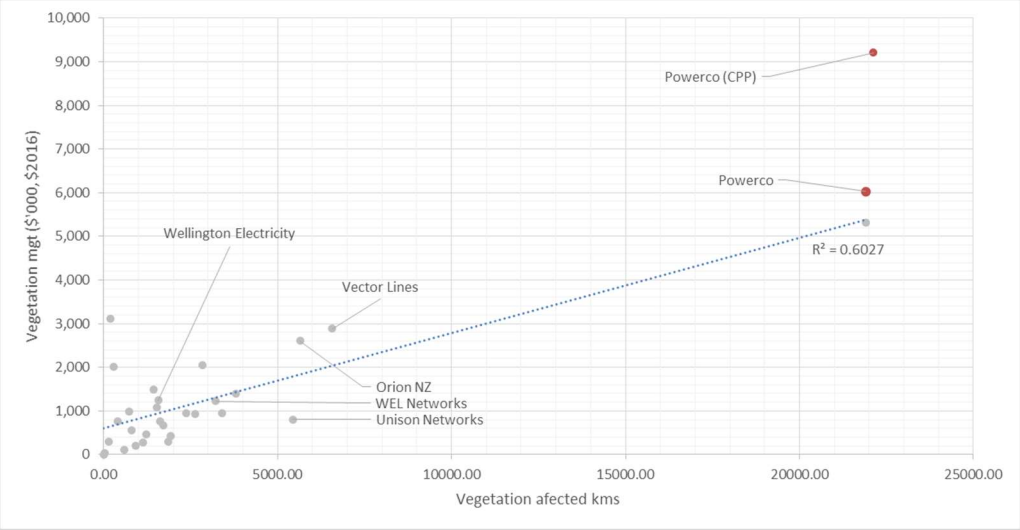


Source: Commerce Commission, Information Disclosure data base. Data is averaged over the 2013 – 2016 information disclosures. For presentation purposes, circuit line length is assumed to increase by 1%.

Additionally, EDB expenditures show little correlation to network size or whether rural or urban. Figure 30 shows the correlation to customer density is also low. This lack of correlation indicates that other factors may be affecting the benchmarking, such as specific vegetation management practices and the extent to which EDBs are compliant with the tree regulations.

Examining the length of lines affected by vegetation, Powerco reports more than five times the average, with no other EBD having similar lines affected. Although, most EDBs in the dataset are very much smaller than Powerco, and benchmarking is not expected to provide a strong indicator of relative performance, Figure 30 shows that Powerco's historical expenditure was near the average and that the CPP forecast would be 70% above.

Figure 30 – Vegetation management – Costs against vegetation affected length ($2016)



Source: Commerce Commission, Information Disclosure data base. Data is averaged over the 2013 – 2016 information disclosures. For presentation purposes, the length of line affect by vegetation is assumed to increase by 1%.

Interaction with other expenditure projects or programs

A stated benefit is a reduction in vegetation related faults and hence an improvement in safety outcomes and reliability of supply. Powerco stated in response to questioning[78] that the expenditures are not expected to materially impact reliability levels within the CPP period and that it has not taken the impact of this program into account when forecasting reliability performance. This is discussed further in section 2 on service measures, levels and quality standards.

[78] Powerco response to question Q011, item 12, Ansarada ID 2744, 27 March 2017.

Deliverability

The forecast expenditure represents a step up from historical expenditures. Powerco has indicted that the increased field activity can be provided by its external contractors, while increases in the SONS (see opex program review at O3) will also be required.

Powerco has undertaken modelling of the increased activities and has discussed this with its contractors, who are prepared to employ the additional staff required.

Even though the increased activities require additional trained labour, we do not envisage that Powerco will not be able to source the required resources.

Our finding

In our view, Powerco's proposed vegetation management expenditure does not appear unreasonable.

Our view is based on the following observations:

- transitioning to a three-year cutting cycle is consistent with good industry practice and is appropriate to meet the regulatory requirements
- appropriate modelling has been undertaken to determine the forecast expenditures.

Although there are several limitations with the proposed forecast, we do not consider that these materially affect our view above. These limitations – which are acknowledged by Powerco[79] – include:

- estimates of work volumes are uncertain, but based on best information from trials
- assumptions about unit costs do not include any economies of scale, however, it is uncertain if these can be achieved
- the portion of costs to be borne by tree owners for second cuts could be increased more quickly than forecast.

[79] Discussion between Powerco and the review team, held on 17 May 2017.

Program O5: Corporate expenditure

Program description

Provide business support services to the network, including to:

- manage customers, including consultation, contract management and pricing
- provide financial management, purchasing and transaction support, analysis, financial reporting and advice
- attract and retain people, manage skill and competency development, and manage the working environment
- lead and co-ordinate safety policies and approaches to support operational teams, including contractors
- comply with statutory requirements, including regulatory and environmental obligations.

Cost estimate / expenditure forecast

Table 41 shows the forecast opex for vegetation management expenditures.

Table 41: - Expenditure forecast – corporate services ($2016, thousands)

Item	FY19	FY20	FY21	FY22	FY23	Total
Expenditure	23,572	23,871	23,402	23,056	22,433	116,333

Relevant policies and planning standards

Corporate services are provided in accordance with several internal policies, including those relating to treasury, insurance, recruitment, remuneration, travel, learning and development, and wellness.

Information provided

Table 42 – Information provided – corporate services

Title	Reference	Date
Corporate Operating Expenditure POD	05.02.03	4 Feb 2017
Electricity Indirect Base, Step and Trend Model	03.04 – 10	14 Feb 2017
Finance Base, Step and Trend Model	03.04 – 12	14 Feb 2017
Human Resources Base, Step and Trend Model	03.04 – 13	14 Feb 2017
Health and Safety Base, Step and Trend Model	03.04 – 14	14 Feb 2017
Marketing and Communications Base, Step and Trend Model	03.04 – 15	14 Feb 2017

Title	Reference	Date
Research and Development Base, Step and Trend Model	03.04 – 16	14 Feb 2017
Legal Base, Step and Trend Model	03.04 – 17	14 Feb 2017
Regulatory Base, Step and Trend Model	03.04 – 18	14 Feb 2017
IST Base, Step and Trend Model	03.04 – 19	14 Feb 2017
Programme Office Base, Step and Trend Model	03.04 – 20	14 Feb 2017
Verifier Question and Answer Initial Summary Response_Q0010 Corporate Opex	Ansarada Question ID 010	23 Feb 2017
Verifier Question and Answer Initial Summary Response_Q0010 Corporate Opex with updated Q11	Ansarada Question ID 010_Updated	26 Feb 2017
Base, Step and Trend Consolidated Forecast Model for Verifier v24.02.17	03.04 – 73	26 Feb 2017
Information provided following draft report		
Electricity Indirect Base, Step and Trend Model	03.09.29	8 May 2017
Leadership Base, Step and Trend Model	03.09.30	8 May 2017
Finance Base, Step and Trend Model	03.09.31	8 May 2017
HR Base, Step and Trend Model	03.09.32	8 May 2017
Health and Safety Base, Step and Trend Model	03.09.33	8 May 2017
Marketing and Communications Base, Step and Trend Model	03.09.34	8 May 2017
Research and Development Base, Step and Trend Model	03.09.35	8 May 2017
Legal Base, Step and Trend Model	03.09.36	8 May 2017
Regulatory Base, Step and Trend Model	03.09.37	8 May 2017
IST Base, Step and Trend Model	03.09.38	8 May 2017
Programme Office Base, Step and Trend Model	03.09.39	8 May 2017
CPP Base, Step and Trend Model	03.09.41	8 May 2017
Corporate Opex POD Steps Supporting Material	05.01.09	18 May 2017

Assessment of method used

Expenditure trends

Total corporate services expenditure increases by $7.4 million ($2016) from the FY14 to FY18 period to the CPP period.

Powerco's historical costs on corporate services have increased materially from FY12 to FY16 (24.7% in real terms), and are forecast to stay relatively flat in real terms from FY16 to the end of the CPP period.

Powerco explains that the increase in expenditure over FY12 to FY16 is due to additional staff costs and professional advice, with the latter primarily due to one-off

legal costs and preparation for the CPP application.[80] The reason for the additional staff costs is unclear.

Powerco forecasts its expenditure over the CPP period using the base, step and trend method, although Powerco's application of this method in the supporting models differs from that described in the POD.[81] Powerco applies this method using FY16 as its base year, making some adjustments, and adding step changes. It also applies scale escalation to the share of IST costs that form part of corporate services, which has minimal impact.

Step changes from historical costs

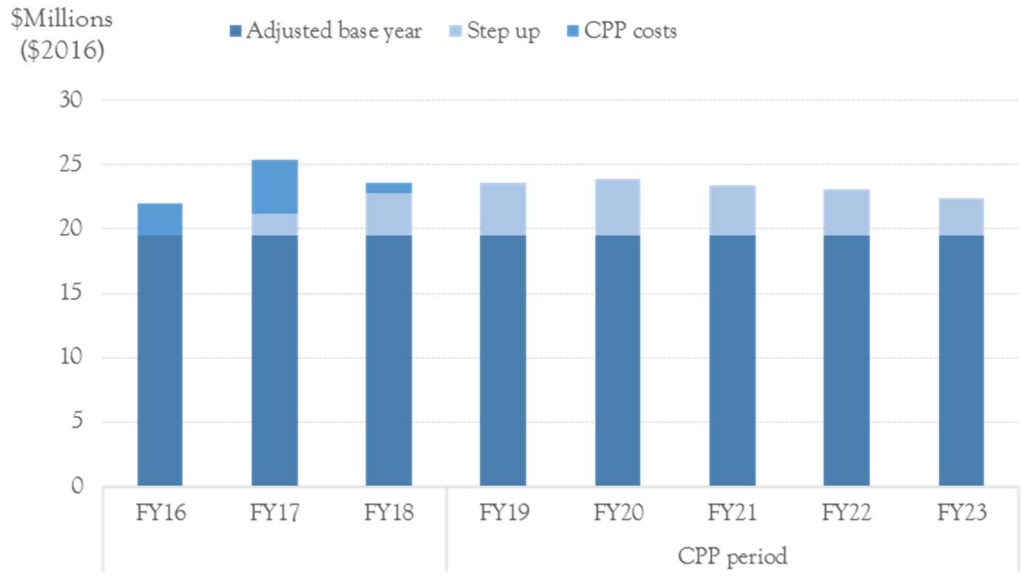
Once the costs of undertaking the CPP are removed, Powerco is proposing a step up in corporate opex of almost $3.8 million ($2016) per year above the FY16 base year or $19.0 million ($2016) over the CPP period as shown in Figure 31. The $19.0 million is made up of:

- non-recurrent expenditure – $1.4 million ($2016) for HR recruitment costs
- *plus* step changes – $18.4 million ($2016)
- *plus* output or scale changes – $0.5 million ($2016)
- *less* efficiencies resulting from the ERP solution and scale – $1.4 million ($2016).

[80] Powerco response to CPP verification question set ID011, question 4, dated 17 February 2017.

[81] See Ansarada document 05.02.03, pp 3–7.

Figure 31 – Step change in corporate opex



Source: Powerco data. The adjusted base year is calculated by taking the FY16 actual corporate opex and removing CPP costs (and any other base year adjustments). The step up is then the difference between the adjusted base year and the opex forecast, which includes step changes, non-recurrent expenditure, and output or scale changes and is net of forecast efficiencies.

The sources for the $18.4 million ($2016) in step changes are:

- adjustment to the FY16 base year expenditure to reflect a normalised version of Powerco's FY17 budget – which contributes about $11.3 million over the CPP period[82]
- specific step changes for several business units that form part of the corporate opex program – which contribute a further $7.2 million over the CPP period.[83]

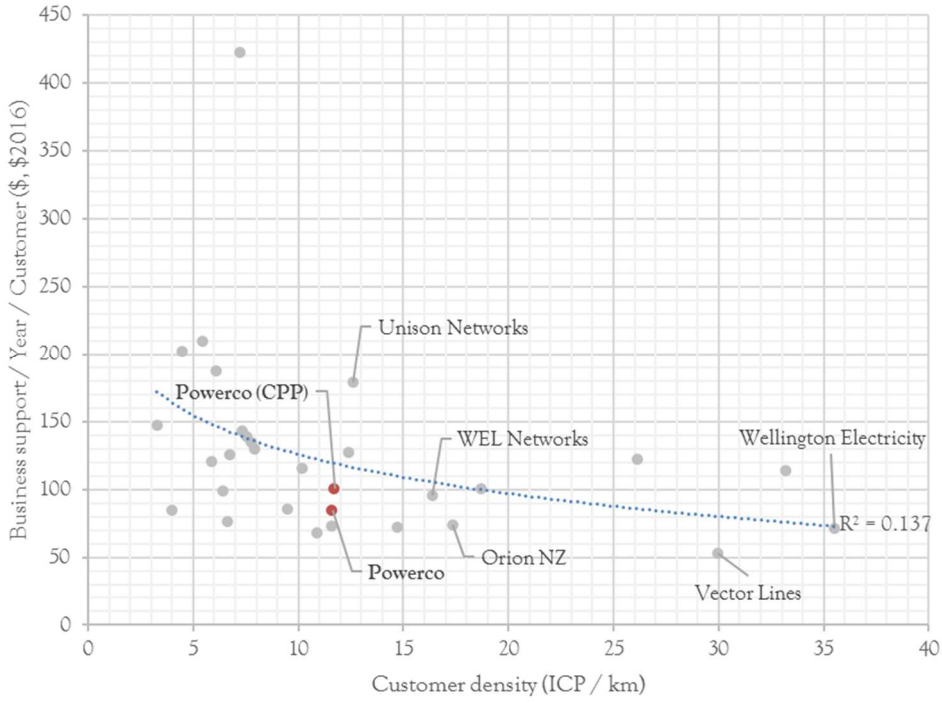
Expenditure justification

Powerco provides benchmarking that compares its actual opex against that incurred by other New Zealand EDBs. This benchmarking, along with our own benchmarking shown in Figure 25, indicates that Powerco's FY16 actual opex is an efficient base to use when applying the base, step and trend method.

[82] Calculated as the value of step changes included in FY18 above the adjusted base year ($2.3 million, $2016, ignoring CPP preparation costs, non-recurrent expenditure, and output / scale changes) multiplied by five.

[83] Calculated as the total value of step changes over the CPP period ($18.4 million, $2016) less the value of step changes attributed to the normalised version of Powerco's FY17 budget ($11.2 million, $2016).

Figure 32 – Business support services ($2016/customer) vs customer density (ICPs / km)



Source: Commerce Commission, Information Disclosure data base. Data for the 2016 information disclosures and for business support services (which largely reflects corporate services). The information disclosures do not appear to include data specifically for corporate services, as classified by Powerco. For presentation purposes, customer numbers and circuit line length are assumed to increase by 1%.

Powerco adjusted the FY16 base year to reflect Powerco's BAU FY17 budget, FY17 actuals, and business unit manager assessments to determine a 'normalised FY18 forecast'.[84] Powerco explains that the step up in expenditure from the FY16 base year is needed to:[85]

- reflect the latest available information from Powerco's business-as-usual processes, including a new leadership team position, expanded legal team, and restructure of the regulatory team
- remove the one-off and unusual expenditure levels in some business units due to staff vacancies or the restructure of the finance team
- increase the capability needed to deliver the CPP.

[84] Powerco response to CPP verification question set ID011, question 1, dated 17 February 2017.

[85] Powerco, *Corporate Opex POD Steps Supporting Material*, 18 May 2017, Ansarada document number 05.01.09.

As a result of these needs, Powerco forecasts both an increase in staff (21 FTEs) and professional services (e.g. advice and HR recruitment costs). Table 43 sets out the proposed staff increases – which contribute the vast majority of the expenditure increase over the CPP period – and the explanation for these provided by Powerco.[86]

Table 43 – Additional corporate opex FTEs

Business unit	Additional FTEs	Explanation
Communications	1	Unclear.
HR	2	Support recruitment of new staff in other areas of the business, primarily due to the increase in capital and operating activity underpinning the CPP proposal.
Finance	3.5	Support additional invoicing, fixed asset and management accounting, and payroll requirements in other areas of the business, primarily due to the increase in capital and operating activity underpinning the CPP proposal.
Legal	1.5	Deal with the increase in property and easement work, primarily due to the increase in capital and operating activity underpinning the CPP proposal.
Electricity	1	Unclear.
Commercial / Electricity	1	Support increased volumes of work across Powerco's four regions.
IST	10	Support the proposed ERP project (including training requirements and the increased staff and network activity load), the CRM and ARM implementation, and OMS.
Health and safety	1	Ensure that health and safety training and oversight is applied across the increase in capital and operating activity underpinning the CPP proposal.
Total	**21**	

It is reasonable to assume that corporate business units will need increased staff to deal with the extra activity resulting from the proposed capital and operating activity underpinning the CPP proposal. However, it is unclear to us whether the quantum of the proposed corporate opex increase is reasonable or consistent with the expenditure objective because we have not seen sufficient information to show:

- how that increased activity leads to the proposed FTE increases – this is in part because the proposed FTEs were based on management judgement and experience that we have not tested
- that the proposed salaries and on costs for these FTEs are reasonable or consistent what would be expected in the market

[86] Powerco, *Corporate Opex POD Steps Supporting Material*, 18 May 2017, Ansarada document number 05.01.09.

- the benefits resulting from or obligations met by any proposed expenditure above that needed to support the activity underpinning the CPP proposal.

Powerco also proposes HR recruitment costs of $1.4 million ($2016) needed to recruit 54 new roles over the CPP period. The method used to forecast this cost appears reasonable, incorporating assumptions for advertising, agency, and relocation costs ($26,500 per role) based on market information and HR management experience. [87]

Key assumptions used

Key assumptions that appear appropriate include:

- FY16 actual corporate opex is efficient and an appropriate base year for applying the base, step and trend method
- the one-off costs of preparing the CPP application should be removed from base year expenditure
- some increase in corporate opex is needed to support the capital and operating activity underpinning the CPP proposal
- some efficiencies are likely over the CPP period resulting from other expenditure initiatives, including the new ERP IT system – Powerco forecast a 2% efficiency saving in FY22 and 4% in FY23.

Key assumptions that do not appear supported to us based on the information that we have seen:

- the FY16 base year should be adjusted to reflect a 'normalised FY18 forecast' – insufficient evidence is provided to justify this adjustment against the expenditure objective
- real input cost escalation from FY16 is applied to forecast expenditure over the CPP period even though the FY16 base year is adjusted to reflect a 'normalised FY18 forecast' – this would only be appropriate if all costs remained in $2016, which is not clear based on the information that we have seen.

Contingency factors

No contingency factors have been included in the forecast expenditures.

Interaction with other expenditure projects or programs

There are no obvious interactions between the corporate services program and other expenditure projects or programs, except for the general efficiencies applied across the

[87] Powerco, *Corporate Opex POD Steps Supporting Material*, 18 May 2017, Ansarada document number 05.01.09, p. 4.

corporate expenditure forecast. We understand that no corporate services costs are capitalised as an overhead in the capex forecast for the CPP period.

Deliverability

The forecast expenditure represents a step up from historical expenditures. Even though the increased activities require additional trained labour (e.g. lawyers, administration staff, IT specialists, and accountants), Powerco should be able to source the required resources given that they are widely available within NZ and that Powerco appears to have successfully recruited similar resources over the FY12 to FY16 period.

Our finding

Based on our assessment of the CPP proposal, the FY16 base year does not appear inefficient when compared to similar expenditure incurred by other NZ EDBs – and so appears to be a reasonable starting point for applying the base, step and trend method. The proposed efficiencies in the last two years of the CPP period also appear appropriate, as it is realistic to assume that the corporate functions will benefit from improvements made across the business, including from the roll-out of a new ERP solution and an increase of scale over the period.

We also recognise that some step up from this start point is reasonable to align with the increase in capital and operating activity underpinning the CPP proposal, as the corporate business units are designed to support those activities. However, we have not seen sufficient evidence to justify the quantum of that step up because it is not clear to us:

- that a normalised version of the FY17 budget reflects an efficient level of expenditure for Powerco's network in its current circumstances – this could be tested, for instance, by comparing Powerco's actual FY17 expenditure (when available) against that normalised budget
- how the increase in FTEs proposed to support the CPP proposal aligns to the increase in capital and operating activity underpinning that proposal.

We also note that it may be appropriate to include the forecast cost of preparing a subsequent CPP proposal, if this is expected to be necessary following the next CPP period to give effect to or realise the benefits from the initiatives proposed for that period. Although, given that this does not form part of the CPP proposal, we have not assessed it further.

Completeness and key issues for the Commission

Most of the information provided by Powerco on forecast corporate opex was sufficient for us to undertake our verification. However, because we were not provided with sufficient justification for the proposed increase in FTEs that drive the step changes, we were unable to verify whether that corresponding expenditure satisfies the expenditure objective or was otherwise reasonable in the circumstances.

As such, we recommend that the Commission focus on this justification for the FTE increases when undertaking its own assessment of the information, especially given that the cost of these FTEs contributes a large portion of the $18 million ($2016) increase to Powerco's proposed corporate opex over the CPP period. For instance, we recommend that the Commission discuss the business cases for the additional FTEs with Powerco and / or seek further information in support of them. We also recommend that the Commission compare the normalised FY17 budget for corporate opex against Powerco's actual FY17 expenditure.

Appendix E – Reliability modelling

Overview

Powerco developed a model to forecast the reliability outcomes that may result from its proposed expenditures. In this appendix, we review the forecasting models, inputs, assumptions and approaches used to forecast those outcomes.

The unplanned reliability model provided by Powerco focuses on *un*-normalised reliability, rather than reliability normalised to remove major event days as is used in the quality standard.[88] This appears appropriate as the un-normalised model:

- includes all outages, including those caused by major storm events, so it measures how consumers really experience network reliability – and is therefore relevant for understanding the impact of Powerco's proposed expenditure
- uses proposed asset renewal and vegetation management expenditures to forecast reliability – which are expenditures that will impact on the level of outages that occur on both "normal" days and "major event days"; hence, it will predict the impact on un-normalised rather than normalised reliability.

Powerco does not appear to have modelled forecast *normalised* reliability over the CPP period, which would be relevant when assessing whether Powerco's proposed quality standard variation is realistically achievable (as required by clause G3(2) of the IM). We were therefore unable to consider forecast normalised reliability directly based on the information provided – and so we instead considered it indirectly (i.e. without assessing modelled outcomes) in sections 2.2 and 2.4.

Powerco currently reports two reliability metrics to the Commission and proposes to continue with the same metrics as part of the CPP – namely, SAIDI and SAIFI. These metrics are also reported separately for outages caused by planned and unplanned events, and are calculated as follows:

- SAIFI is calculated as the sum of the number of customers affected by a fault divided by the total number of customers on the network
- SAIDI is calculated as the sum of the number of customers affected by a fault multiplied by the duration of the fault divided by the total number of customers on the network.

As noted in section 2.4, Powerco proposes to vary its unplanned normalised SAIDI and SAIFI targets slightly to reflect more recent historical performance data, but otherwise retaining the same method used to determine the equivalent DPP targets on the

[88] SAIDI and SAIFI normalised to remove major events are included in the current DPP and Powerco's proposed CPP quality standards. This is discussed further in sections 2.2 and 2.4.

premise that drivers for reducing reliability – an increasing number of asset in poor condition – is offset by forecast expenditures for asset renewal.

Powerco also proposed to place 0% weight on planned SAIDI and SAIFI as part of its quality standard, although it does forecast that planned SAIDI and SAIFI will increase over the CPP period due to the proposed increase in planned asset renewal, growth and security, maintenance and vegetation management capex and opex activities.

The following sections discuss Powerco's approach to forecasting both planned and unplanned un-normalised SAIDI and SAIFI and the impact of key assumptions made.

Impact on expenditure forecasts

Powerco's level of forecast reliability has interdependencies with:

- targets set for reliability
- levels of reliability improvement expenditure
- the assumed balance between asset replacement and maintaining levels of reliability.

The need to increase capex and opex to maintain network performance at the same level of unplanned outages is an important premise of Powerco's justification for the CPP. As a result, any variations to the level of forecast reliability could have a direct impact on the level of expenditure required during the next period.

Relevant policies and planning standards

Powerco does not have any policies or standards specific to reliability modelling that we are aware.

Information provided

Table 44 presents the information that has been provided by Powerco relevant to reliability modelling.

Table 44 – Information provided – reliability modelling

Title	Reference	Date
Quality Note v2	04.01.07	1 Feb 17
Planned quality model v2	04.01.06	1 Feb 17
Planned SAIDI Model	04.02.03.01	2 Mar 17
NAPA FY 15-16 SAIDI SAIFI per asset analysis	04.02.03.02	2 Mar 17
Outdef 04-14 SAIDI SAIFI per asset analysis	04.02.03.03	2 Mar 17
SAIDI per asset workbook	04.02.03.04	2 Mar 17
SAIDI per asset workbook – Update 07032017	04.02.03.09	2 Mar 17

Title	Reference	Date
Planned SAIDI Model – Update 07032017 v2	04.02.03.10	2 Mar 17
Information provided after draft report		
Unplanned Regional Model 2017-4-17 - CPP - final draft(1)	04.02.03.11.01	21 Apr 17
Unplanned Regional Model Note –CPP – 21-04-17 – final draft	04.02.03.11.02	21 Apr 17
ageModelling (Crossarms) 170417 (CPP inputs)	04.02.03.11.03	21 Apr 17
ageModelling (Fuses) 170417 (CPP inputs)	04.02.03.11.04	21 Apr 17
ageModelling (Poles) 170417 (CPP inputs)	04.02.03.11.05	21 Apr 17
ageModelling (Transformers – Ground Mounted – with totals) 170417 (CPP inputs)	04.02.03.11.06	21 Apr 17
ageModelling (Transformers – Pole Mount) 170417 (CPP inputs)	04.02.03.11.07	21 Apr 17
Fault Rate Analysis - 170417	04.02.03.11.08	21 Apr 17
Reference note_Our Proposed Quality Path 17052017.pdf	04.02.03.12	17 May 17

As background, the key supporting documentation for unplanned reliability is as follows:

- **04.02.03.02 NAPA FY 15-16 SAIDI SAIFI per asset analysis** – this is the underlying data from the NAPA database that is used to calculate the SAIDI and SAIFI per asset type. It is input into the 'SAIDI per asset workbook'.
- **04.02.03.03 Outdef 04-14 SAIDI SAIFI per asset analysis** – this is the underlying data from the OutDef database that is used to calculate the SAIDI and SAIFI per asset type. It is input into the 'SAIDI per asset workbook'.
- **SAIDI per asset workbook** – this model has a lot of hard coded numbers that are extracted from other spreadsheets and databases. Adjustments are made to those numbers (SAIDI values) with comments to explain the adjustment. This is a subjective approach with limited justification for the adjustments made. We note that the majority of adjustments result in reducing the amount of SAIDI expected per asset, and therefore is likely a conservative approach.
- **04.02.03.11.08 Fault Rate Analysis – 170417** – this spreadsheet analyses the fault rates of assets. However, the key sets of numbers in the model are hard coded numbers so we are unable to verify that these are reasonable assumptions. This appears is an input into the Model Parameters tab of the Unplanned Regional Model for each of the key assets and is a key input into the resultant reliability.
- **04.02.03.11.03 ageModelling (Crossarms) 170417 (CPP inputs)** – this model uses the survivor curve and forecast replacement profile to calculate an index that represents the relative health of the network. This is used in the Unplanned Regional Model to adjust the number of faults expected to occur for the asset type. The approach taken does not appear inappropriate or unreasonable and results in a reduction of the number of faults forecast by the Unplanned Regional Model for

each of the asset classes that use this method. However, we note that the model needs to be updated to incorporate the latest asset replacement forecasts. This analysis applies to the 'ageModelling' spreadsheets used for reliability forecasting.

Assessment of forecast method used

Planned reliability

The planned SAIDI and planned SAIFI show volatility from year to year mostly due to changes in the type and volumes of asset replacement.

The forecast has been provided as two components; a base level of planned reliability that is based on the historical volumes of replacement, and an additional amount to reflect the increased replacement expenditure forecast for the CPP period.

The base level of planned SAIDI and planned SAIFI are forecast based on the historical levels incurred from FY12 to FY15, then rolled forward as a constant value with an adjustment to account for the changed mix of live line work (which does not require an interruption to consumers).

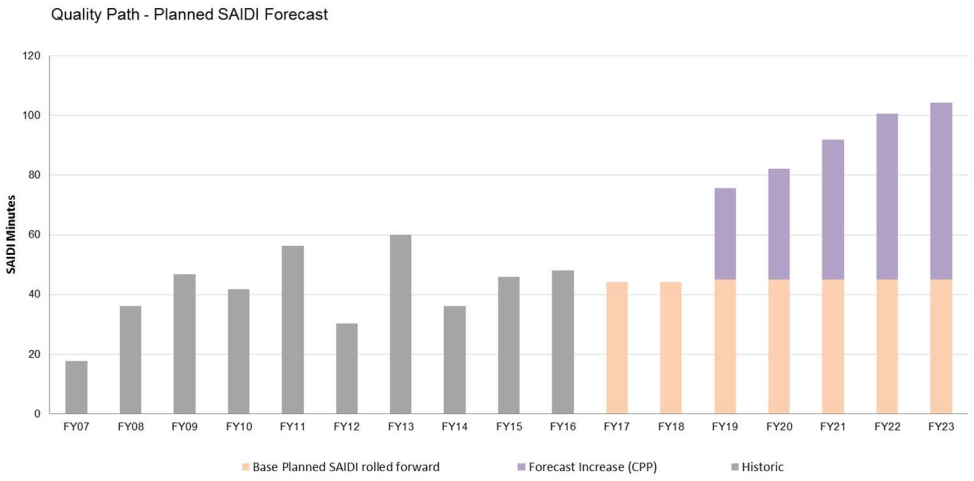
The incremental change to planned SAIDI and planned SAIFI are forecast based on the following key steps:

- the average planned SAIDI and planned SAIFI contribution per asset type for small scale and large scale projects was calculated
- the average planned SAIDI and planned SAIFI were then rolled forward for each year of the forecast, adjusted each year based on the mix of project sizes (small scale and large scale). This accounts for the increased level of asset replacement and the expectation that projects will become dominated by larger scale project and therefore result in a lower planned SAIDI and planned SAIFI impact per asset
- the additional number of assets are calculated and adjusted for the change in live line work expected during the CPP period.

The final adjusted number of additional assets was then multiplied by the adjusted amount of planned SAIDI (or planned SAIFI) incurred by the replacement the asset type. This was done at a granular level (i.e., voltage or switch type) and then summed up into asset categories.

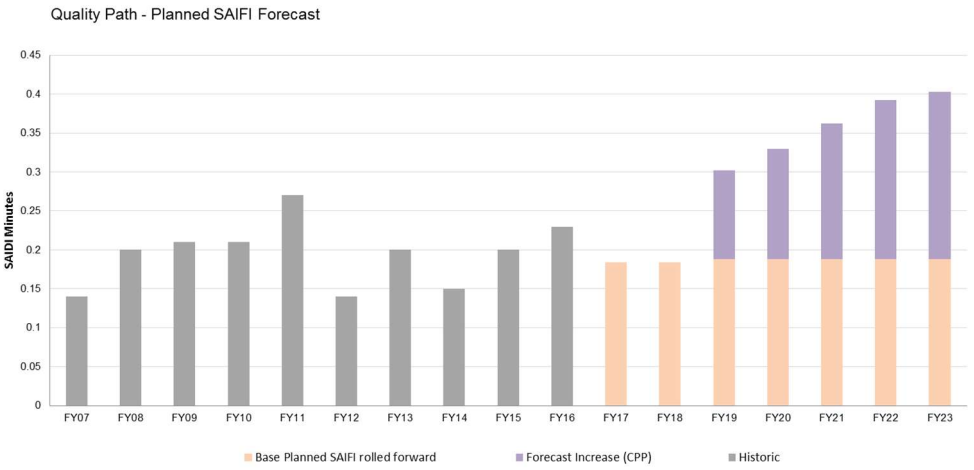
- Finally, allowances were included to account for changes to opex, new activities and network expansion.

Figure 33 – Historical and Forecast Planned SAIFI



Source: Powerco

Figure 34 – Historical and Forecast Planned SAIFI



Source: Powerco

The models and assumptions made to forecast reliability is discussed below.

Key assumptions used (planned reliability)

The proposed step changes to planned SAIDI and planned SAIFI service levels are well explained in the documents provided to us and appear appropriate for the proposed increases in renewal, maintenance and vegetation management activities, provided that the increase in renewal, maintenance and vegetation management activity is also justified and the increase is temporary to align with the increase in activity. It is reasonable to assume that a material step up in this type of activity will lead to more planned outages.

However, we note the following:

- If the volumes of work are adjusted in the final CPP, then the planned SAIDI and planned SAIFI forecasts should also be adjusted to reflect the revised volumes.
- The averaging period used for establishing the starting point in 2017 is based on a four year average (FY12 to FY15) which differs to the assumptions made in the Unplanned Model. A consistent averaging period should be used for both models and over the same time period to ensure the forecasts are consistent and built on the same basis. 2016 and 2017 should be included in the model as they are the most recent years and will most appropriately reflect any improvements in work practices or network configuration that will reduce planned outages.

Unplanned reliability

Unplanned SAIDI and unplanned SAIFI have been modelled at a category level that mostly aligns with the categories set out by the Commission for annual reporting. Each category is further split into the 14 network areas.

The model is based on historical data being used to inform the future network performance. For each category, the actual audited numbers of faults and average fault duration have been provided for 2008 to 2016 and draft numbers (not audited) for 2017.

Weighted average values for outage duration, weighted average values for the number of ICPs affected per fault and the simple average of the number of faults are calculated using the historical data and used as the starting point for reliability in 2017.

Based on the starting point calculated for 2017, different approaches are applied to the categories to forecast the unplanned SAIDI and unplanned SAIFI:

- for the categories of poles, crossarms, transformers and fuses the survivor curves and forecast replacements were used to calculate indices that represent the condition of the network. The indices, which increase due to aging assets and decrease due to asset replacement, are used to calculate the reliability performance of the category
- faults due to vegetation are forecast to remain constant from 2017 until 2019, then decrease proportionally based on the number of reactive tree sites forecast by the vegetation management model
- conductor fault rates are forecast based on the number of faults calculated for 2017 adjusted proportionally for the annual change in fault rate forecast by the conductor modelling
- the categories of 'Sub Trans', 'The rest of the equipment', 'Adverse weather' and 'The remainder' are forecast to remain constant at the number of faults calculated for 2017
- the 'Unknown' category is forecast to increase proportionally to the historical trend, with the rate set to 0.8 times the historical trend

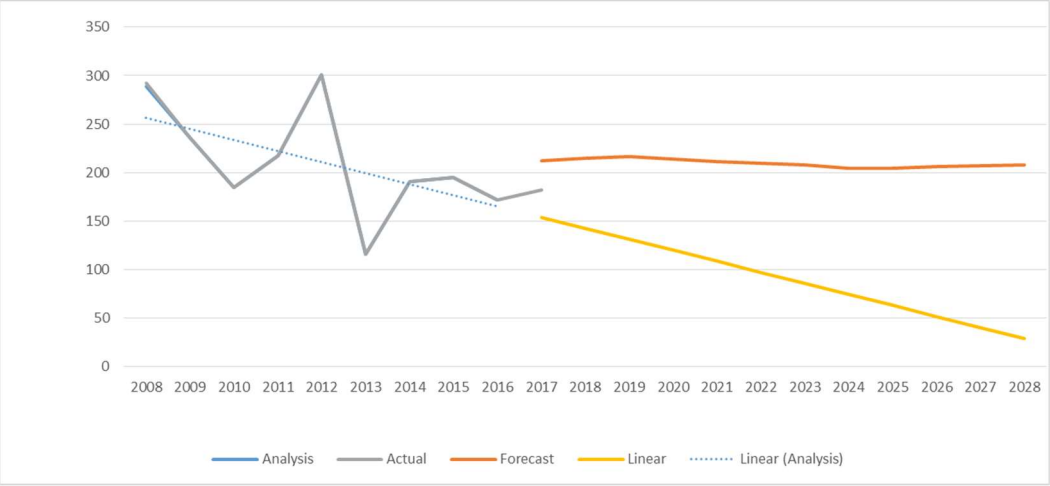
- duration is forecast to increase (or decrease) proportionally to the historical trend, moderated to a rate set to 0.2 times the historical trend.

These annual numbers of faults, ICPs affected and durations were then used to calculate unplanned SAIDI and unplanned SAIFI, with the results shown in Figure 33 and Figure 36 below.[89]

The two charts show that there is a long term improvement trend for both unplanned SAIDI and unplanned SAIFI, although there has been volatility from year to year largely caused by major weather events.

- We note Powerco's analysis does not specifically address poor performing feeders where there are few customers. In these cases, deteriorating performance (both frequency and duration of outages) can have little impact on overall unplanned SAIDI or unplanned SAIFI metrics due to the averaging over the total number of customers on the network. There is no requirement on Powerco to specifically address poor performing feeders if it is not economic to do so.

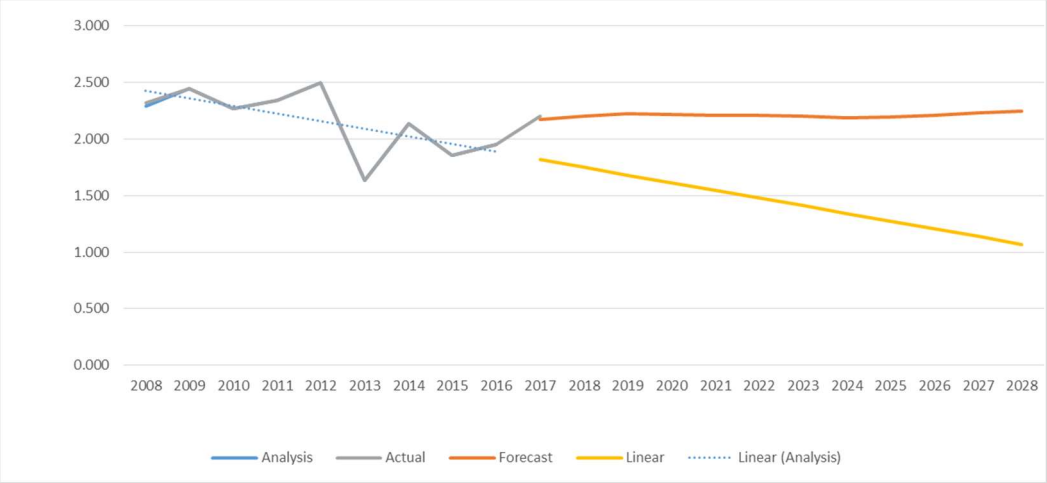
Figure 35 – Historical, trend and forecast unplanned SAIDI (un-normlised)



Source: Powerco. FSC and WSP analysis. Note: values are not normalised for weather. The data may differ from that used to measure performance and set targets as part of Powerco's quality standard.

[89] Figure 35 and Figure 36 are extracted from the unplanned reliability model. The trend line, forecast trend line and the forecast performance are all calculated within that model.

Figure 36 – Historical, trend and forecast unplanned SAIFI (un-normalised)



Source: Powerco. FSC and WSP analysis. Note: values are not normalised for weather. The data may differ from that used to measure performance and set targets as part of Powerco's quality standard.

Our review of the model identified the following issues:

- the historical data shows a distinct trend of improving reliability. The historical expenditure shows that there has been an average increase of 11% per year in replacement expenditure since 2012 and an average expenditure of $3 million per year on the reliability program. The forecast replacement expenditure for the CPP period is continuing to increase compared to historical replacement expenditure and the reliability program is forecast to continue. Therefore, with a similar mix of forecast expenditure, it would be expected for the improving trend in reliability to continue, which Powerco has not forecast.
- the modelling approach assumes flat trends of annual numbers of faults for several asset categories and the Unknown category has a strong increasing trend. These categories do not appear to reflect the increasing asset replacement expenditure, increasing preventative and corrective maintenance, improved vegetation management nor the continued implementation of the reliability program and are likely to lead to an overstatement of unplanned SAIDI and unplanned SAIFI.
- the model appears to lack suitable calibration. The charts also show an increase from the unplanned SAIDI and unplanned SAIFI averages between 2014 and 2016 (which was used in the model) and the forecasts for 2017. In the absence of an external driver, the forecast value for 2017 should be at the same level as the average. This indicates there is an issue with the calibration of the model.
- the averaging periods used for calculating the starting point in 2017 for duration and faults is based on 2014 to 2016 (inclusive) which is a three year period. However, the averaging period used for calculating the number of ICPs affected per fault is calculated using data from 2009 to 2016 (inclusive) which is an eight year period. This is likely to overstate the ICPs affected as the early years will not reflect the reliability program implemented which would have progressively reduced the number of ICPs affected by a fault and the number of faults. Changing the

averaging period to 2014 to 2016 to calculate the number of ICPs removed the step increase in the unplanned SAIDI and unplanned SAIFI forecasts seen in 2017.

- none of the averaging periods include the actual 2017 data. Although this is not audited, it is most reflective of the current state of the network and should be included.
- the duration per event is forecast to continue increasing at a rate proportional to the historical trend. This is calculated for each event category. The increasing trend reflects the response time of field crews to rectify an outage. This is not directly related to asset condition, but rather field crew efficiency/effectiveness. We note that there are other factors that may contribute to increased restoration time that Powerco cannot control directly, such as safety requirements. Additionally, this model does not appear to account for the decreasing or flat trend being forecast for several categories, which would reduce the utilisation of field crews, therefore providing extra capacity and should result in equal or improving rectification times.

The impact of the approach to modelling and the issues listed above is the forecast unplanned un-normalised SAIDI and unplanned un-normalised SAIFI starts at a higher level than would be expected based on the recent network performance and does not exhibit the long term improving trend that Powerco identified in their model, as shown in the historical data in Figure 35 and Figure 36.

The higher starting point is relevant to setting reliability targets. The trend is relevant to the level of network expenditure, be it replacement, opex or reliability specific work that is required to maintain network performance.

Key assumptions used (unplanned reliability)

In general the models provided made use of audited historical data or inputs that were consistent with other asset forecasting models and analysis.

The following sections set out the key assumptions that were applied that were not found to be appropriate or may result in an unreasonable forecast:

- the number of total network ICPs used in this model do not match the number of ICPs used in the ICP forecast model (Ansarada document number 04.02.02.02).
- different averaging periods are used in the planned model compared to the unplanned model. A consistent averaging period should be used for both models that is reflective of the frequency of major weather events to smooth out the volatility for forecasting and setting targets. Five years is common industry practice.
- the categories set out in the model largely align to the Commission definitions. However, the category 'The Remainder' is not defined by the Commission and the outage causes have not been defined, so it is not clear how the proposed capex and opex would affect the performance of this category.
- the continuation of the reliability program (capex) is not incorporated into the model. Inclusion of this program is likely to result in continuation of the improvement trend until the program is completed.

- the model generally accounts for increasing trends in historical data, but does not account for decreasing trends in the historical data. The impact of this is to overstate overall performance as can be seen in Figure 35.
- hard coded values were applied to specific categories to adjust the slope of the historical trend line: 0 (flat) was applied to the fault rates of specific categories; 0.8 was applied for the fault rate for the Unknown category; and 0.2 was applied to the durations. These values were not justified, do not appear to account for the increasing works on the network, and would impact the forecast of the model.

The impact of these assumptions, together with the approach and issues raised above regarding the implementation of the modelling, result in the forecast unplanned SAIDI and unplanned SAIFI starting at a higher level than would be expected based on the recent network performance and not exhibiting the long term improving trend shown in the historical data.

Interaction with other forecast expenditures

This forecast underpins a key part of the justification for increased expenditure to replace assets and improve operational management of the network.

If the forecast level of unplanned reliability should change, then there will be follow on effects that could include adjusting the forecast expenditure so that network reliability is maintained rather than improved.

The expenditure may be modified through changes to asset category expenditure or through adjusting reliability specific programs (such as roll out of automatic circuit reclosers) to achieve the required reliability result.

Our finding

In our view, the approach to forecasting planned SAIDI and planned SAIFI was considered to be robust and took into account a broad range of impacts on reliability. Although unlikely to have a material impact the model could be updated to reflect the latest data from 2016 and 2017 to better reflect current practice and network configuration.

The supporting models were generally considered fit for purpose, however the spreadsheet '*04.02.03.11.08 Fault Rate Analysis*' contained hard coded numbers, and the spreadsheet '*SAIDI per asset workbook*' includes hard coded assumptions based largely on subjective assessment or engineering judgement that has not been justified. Although these spreadsheets appeared to result in a reasonable output, we were unable to verify them.

In our view, the forecast of unplanned SAIDI and unplanned SAIFI is overstated – that is Powerco has forecast unplanned reliability to be worse than should be the case. The approach used to model reliability has resulted in a forecast value for 2017 of unplanned SAIDI and unplanned SAIFI that exceeds the average of recent years. It is likely that this is caused by the averaging period used in the calculation of ICPs affected

per fault. This results in a starting point of the forecast that is higher than would be expected based on historical performance. This could impact on the reliability targets set if they were to be established based on this forecast.

As discussed above, the assumption made regarding the rate of increase of faults for specific categories, and for all duration forecasts, are hard coded numbers that are not justified and are likely to minimise any improvement trend in the reliability forecast.

Additionally, the trend of the forecast is likely overstated as the proposed volumes and types of capex undertaken (asset renewals and reliability programs) would be expected to result in a reduction of unplanned SAIDI and unplanned SAIFI, in line with historical trend. Although we note that weather is an important contributor to network reliability and can result in volatility in performance from year to year, the historical trend shows an improvement in performance since 2008. No evidence has been provided to indicate why this should not be expected to continue given the proposed increase in replacement capex to arrest the decline in network condition, the increase in opex (including corrective maintenance, preventative maintenance and vegetation management) and the continuation of the reliability improvement program which reduces the impact of outages and faults.

Appendix F – Expenditure benchmarking

Overview

Benchmarking can be a useful tool for assessing whether actual and proposed expenditure is efficient relative to other networks. This appendix seeks to benchmark Powerco against other NZ EDBs, including on network characteristics, total expenditure, opex, and capex. Some benchmarking is also included in other parts of our report.

Powerco had also undertaken its own benchmarking for the CPP application, which it provided us along with earlier benchmarking undertaken by Energia.[90]

After undertaking our own benchmarking and reviewing that provided by Powerco, our key findings are that:

- Powerco's network characteristics (e.g. customer numbers, circuit length, and customer density) are unique in NZ – making it hard to draw reliable conclusions from benchmarking against other NZ EDBs[91]
- there are some anomalies in the NZ EDB benchmarking dataset that may undermine our benchmarking analysis, particularly how the EDBs have assigned data to each schedule, category and sub-category and leading to the potential for double count counting – an observation also made by Powerco[92]
- Powerco's total expenditure, opex and capex over the 2013 – 2016 period are comparable to that of other large NZ EDBs – however, the increase proposed in the CPP will increase Powerco's capex, on a per unit basis, above its peers in most cases and away from the trend line of all EDBs (although we note that this comparison is subject to significant limitations)[93]

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[90] See: Powerco, *Capex and opex benchmarking*, 2 May 2017, Ansarada document number 04.02.07; and Energia, *Powerco (Company A)–Electricity business corporate and asset management benchmarking findings*, 4 November 2014, Ansarada document number 07.04.

[91] A trend line has been added to the scatter plots to identify the level of expenditure that would currently be considered as efficient relative to the other EDBs, given the historical levels of expenditure and characteristics in the data set. This does not mean that EDBs on that line are operating efficiently, but shows that is where EDBs of similar characteristics would be expected to be found. The R2 value has been displayed to show how well the trend line fits the underlying data set. A value of zero indicates no relationship and a value of one indicates a perfect relationship.

[92] See, for instance, Powerco, *Capex and opex benchmarking*, 2 May 2017, Ansarada document number 04.02.07, p. 10.

[93] In particular, we are unable to compare Powerco's proposed expenditure to that expected to be incurred by other networks over the CPP period. We are also unable to test whether the historical expenditure undertaken by the other EDBs is efficient – and therefore is an appropriate benchmark – given those EDBs were also subject to a default price path that may have constrained expenditure.

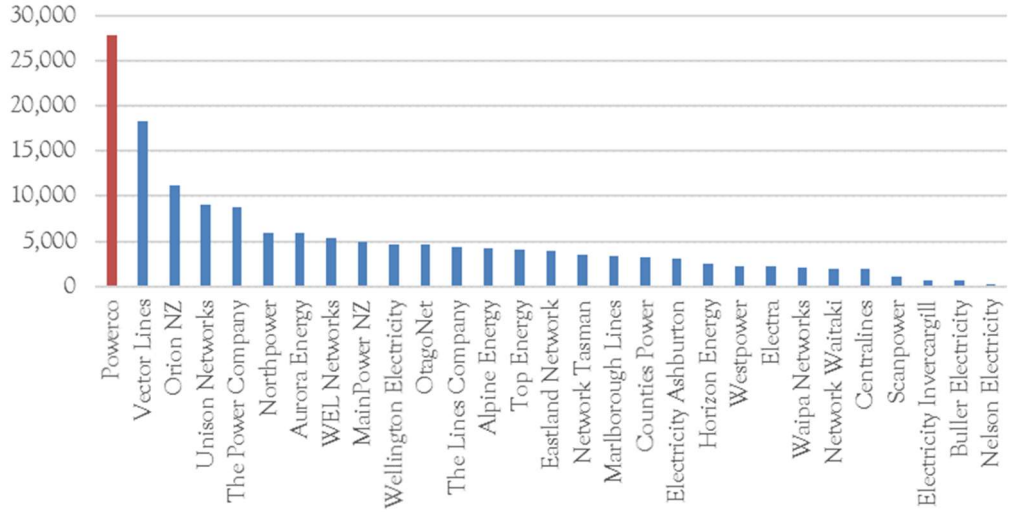
- the asset replacement and renewal expenditure is shown to have been increasing over the 2013 – 2016 period when normalised by customer density and is comparable to, but slightly higher than, other large NZ EDBs. However, the forecast increasing repex, when averaged across the CPP Period and normalised by customer density and circuit length, shows it moving significantly above its peers and away from the trend line of all EDBs
- Powerco's SAIDI and SAIFI performance is among the worst of the large NZ EDBs, but average when all smaller EDBs are considered.

We have not undertaken any economic benchmarking, such as that used by the AER, because we do not consider the NZ EDBs are sufficiently comparable to rely on the outputs of such benchmarking and there remains significant debate over the economic models that underpin the benchmarking in any case.[94] We are also not confident that adding data from electricity distribution networks operating in other jurisdictions – which is needed to apply that benchmarking – will improve the accuracy of the analysis.

Network characteristics

This section compares the network characteristics of Powerco to other NZ EDBs. The graphs that follow show that Powerco has the longest network in NZ and the second highest number of customers. Yet, despite being significantly larger than most other networks, it has average customer density reflecting that is much more rural than other large networks, such as Vector and Wellington Networks.

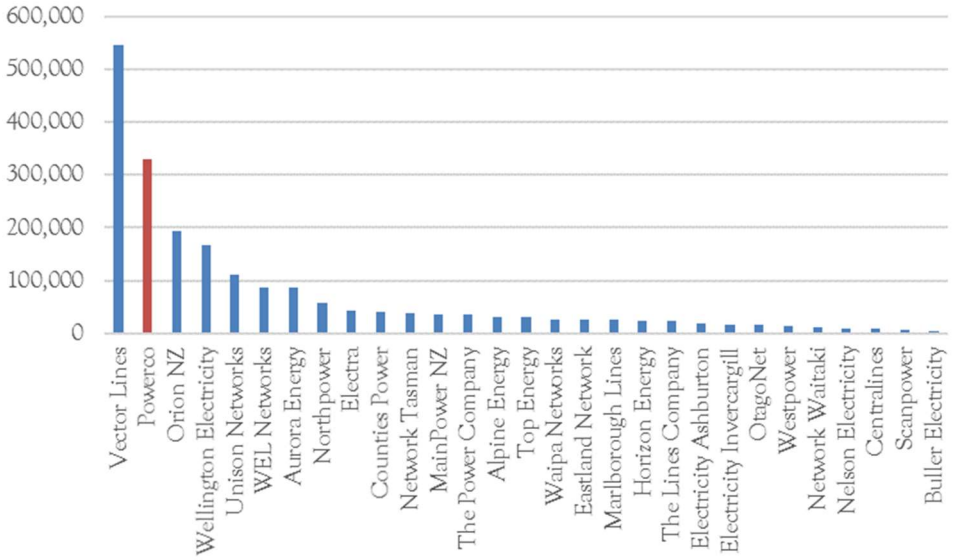
Figure 37 – Circuit length (km)



[94] See, for instance, Australian Competition Tribunal, Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, at paras [115] to [497].

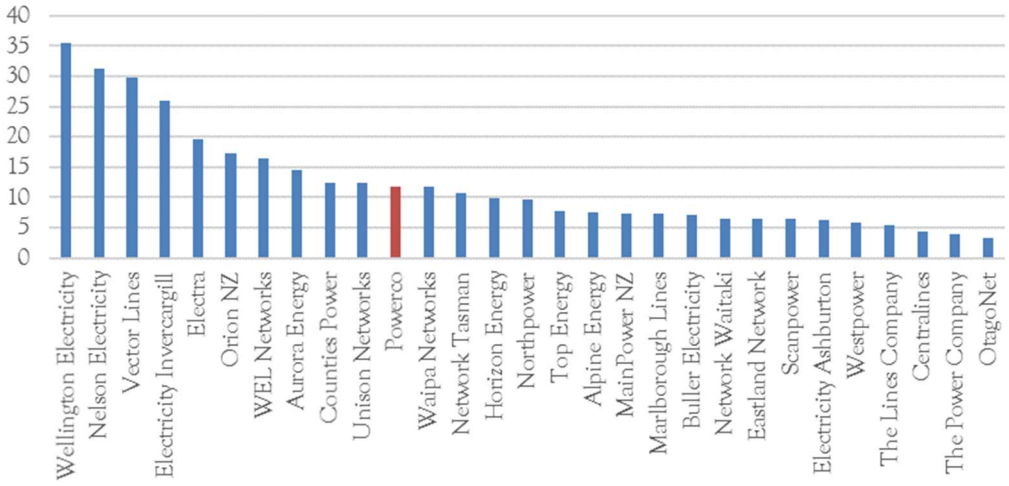
Source: Commerce Commission, Information Disclosure data base. Data is as included in the 2016 information disclosure.

Figure 38 – Customer numbers (# ICPs)



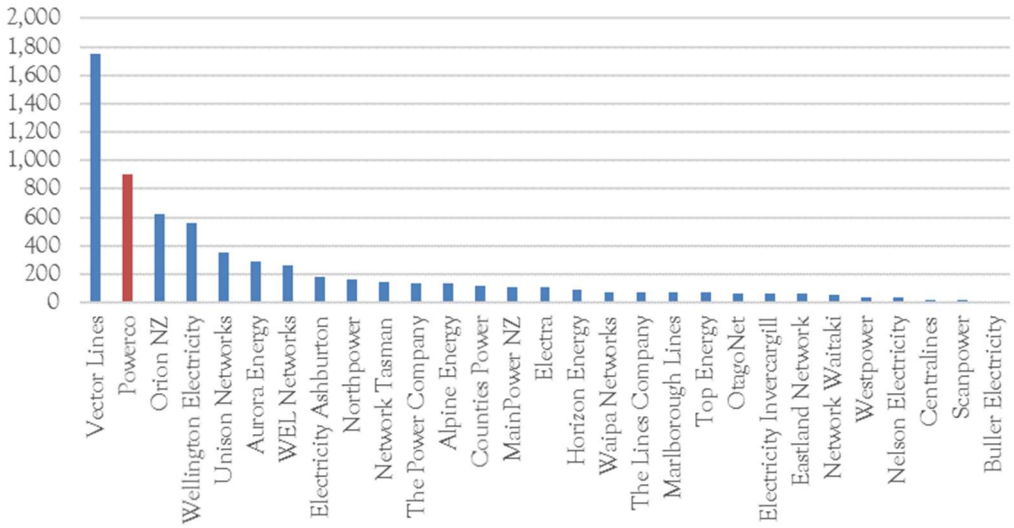
Source: Commerce Commission, Information Disclosure data base. Data is as included in the 2016 information disclosure.

Figure 39 – Customer density (ICPs / km)



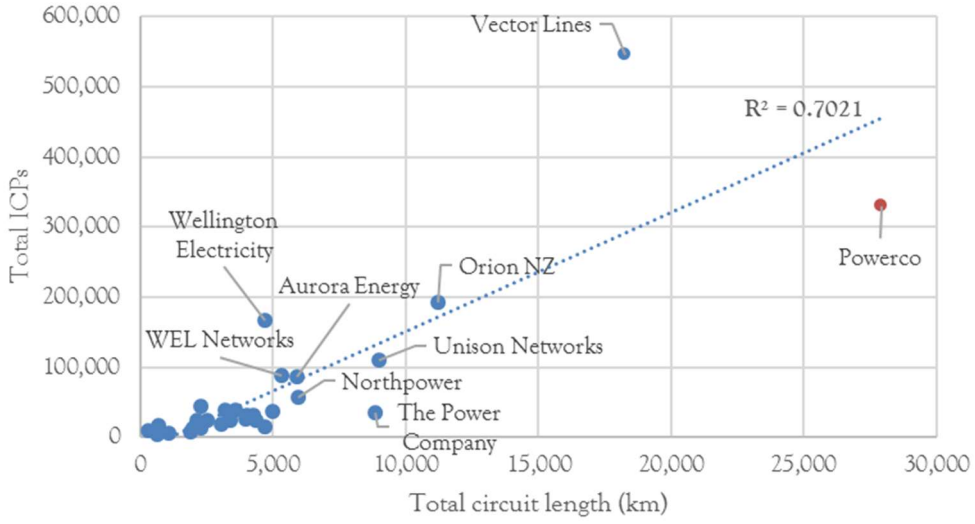
Source: Commerce Commission, Information Disclosure data base. Data is as included in the 2016 information disclosure.

Figure 40 – Maximum coincident system demand (MW)



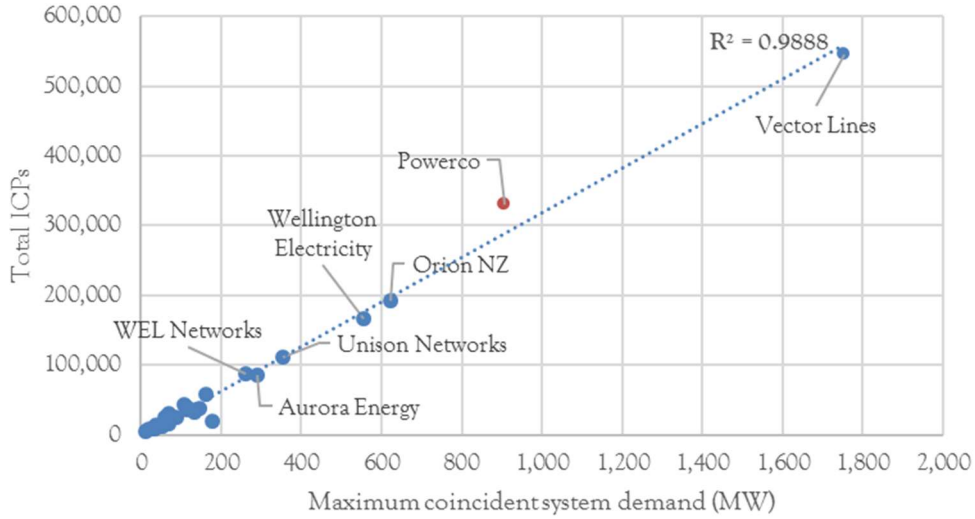
Source: Commerce Commission, Information Disclosure data base. Data is as included in the 2016 information disclosure.

Figure 41 – Circuit length (km) vs customers (ICPs)



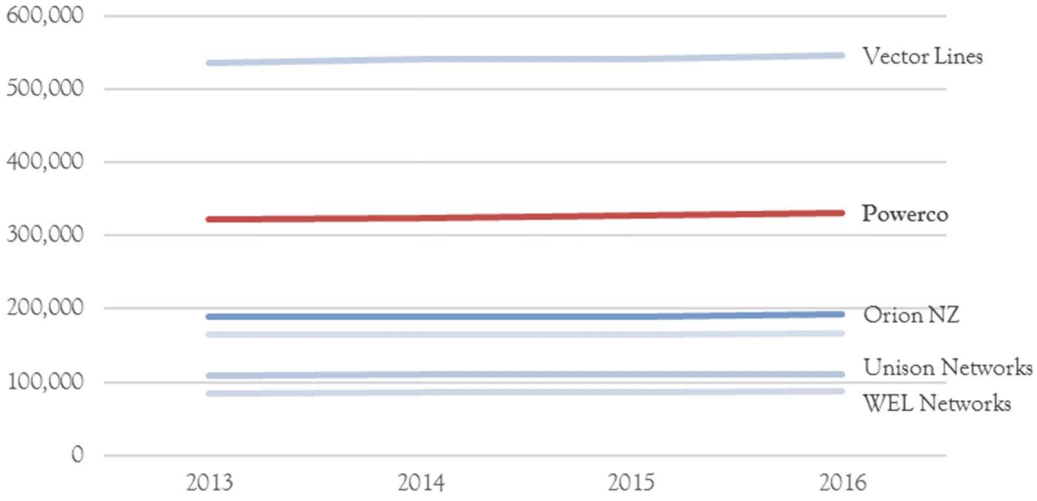
Source: Commerce Commission, Information Disclosure data base. Data is as included in the 2016 information disclosure.

Figure 42 – Maximum coincident system demand (MW) vs customers (ICPs)



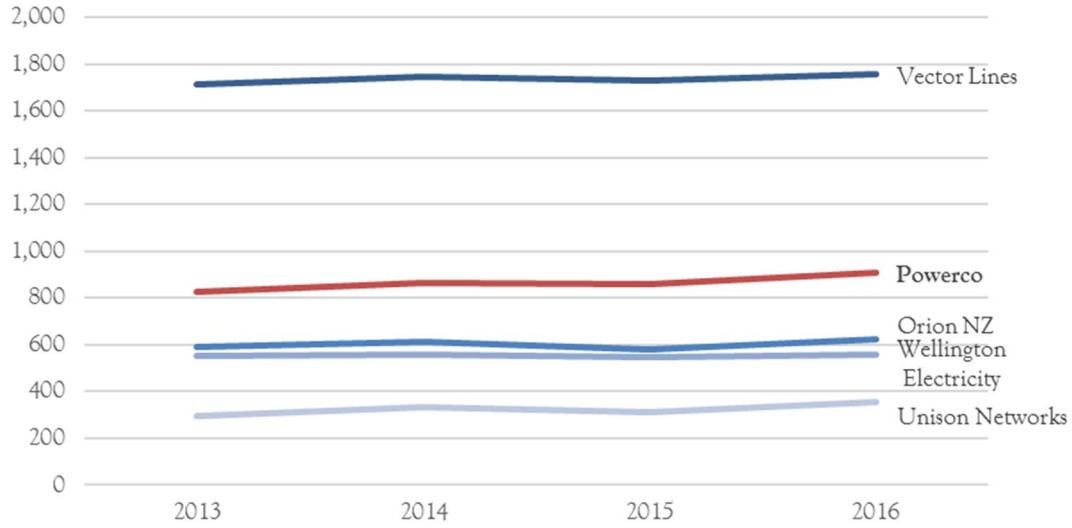
Source: Commerce Commission, Information Disclosure data base. Data is as included in the 2016 information disclosure.

Figure 43 – Customer numbers (# ICPs) for largest networks, 2013 – 2016



Source: Commerce Commission, Information Disclosure data base. Data is as included in the 2013 – 2016 information disclosure and is calculated by multiplying customer density by circuit line length.

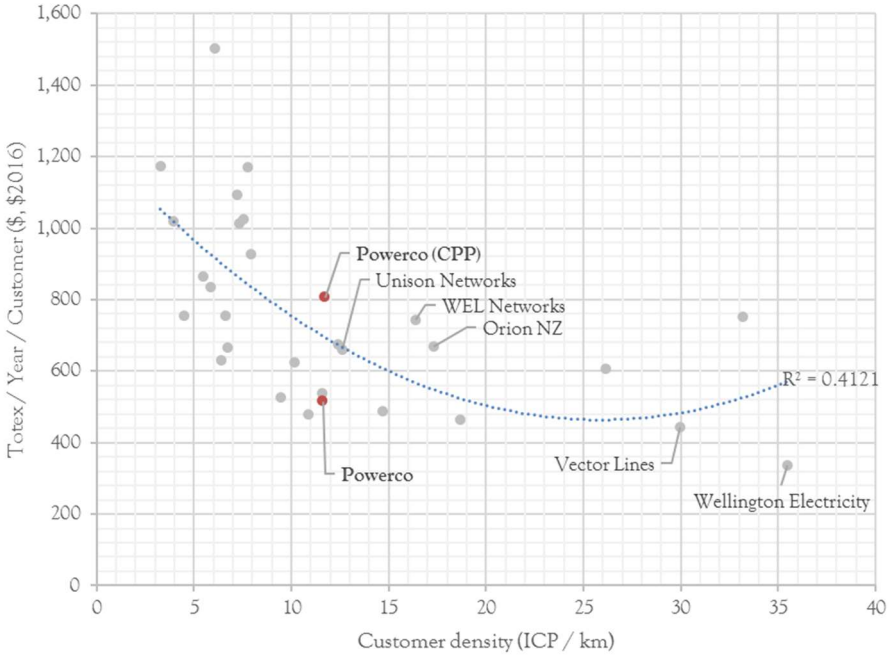
Figure 44 – Maximum coincidence system demand (MW) for largest networks, 2013 – 2016



Source: Commerce Commission, Information Disclosure data base. Data is as included in the 2013 – 2016 information disclosure. Total expenditure

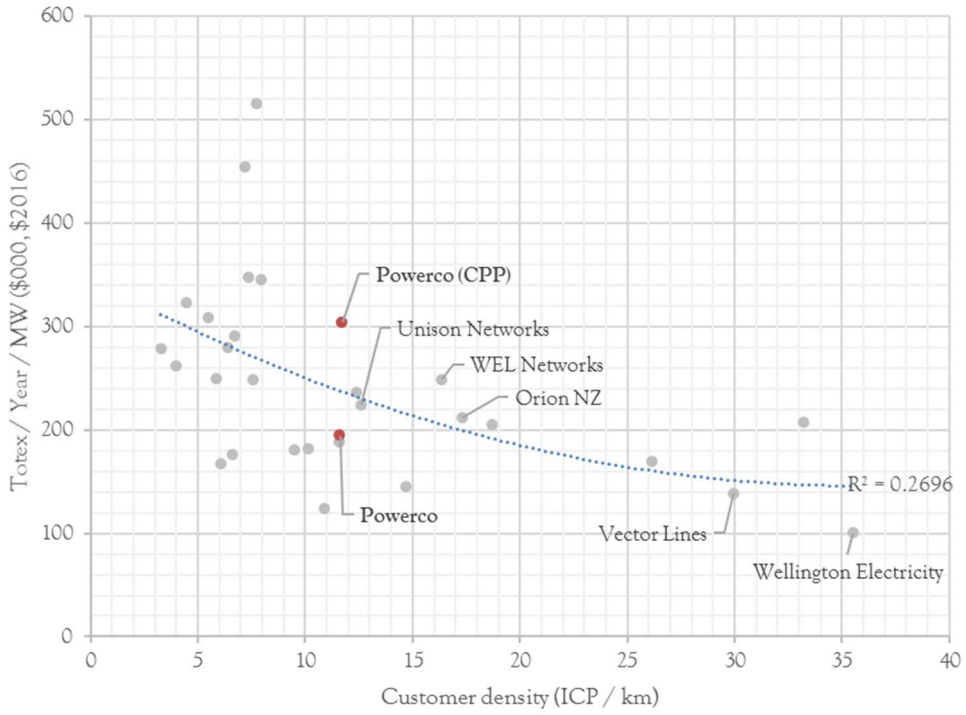
This section compares Powerco's total expenditure to other NZ EDBs. The graphs show that Powerco's total expenditure over the 2013 – 2016 period is consistent with that of the other larger networks. However, the proposed increase in expenditure – identified as 'Powerco (CPP)' – does raise its expenditure per customer and MW above those networks in most cases. The graphs also show that total expenditure per customer has increased over the 2013 – 2016 period and that Powerco has the worst SAIDI (and SAIFI) performance among the larger networks. Powerco's SAIDI and SAIFI performance is average compared to all networks.

Figure 45 – Total expenditure per year per customer vs customer density (ICPs / km)



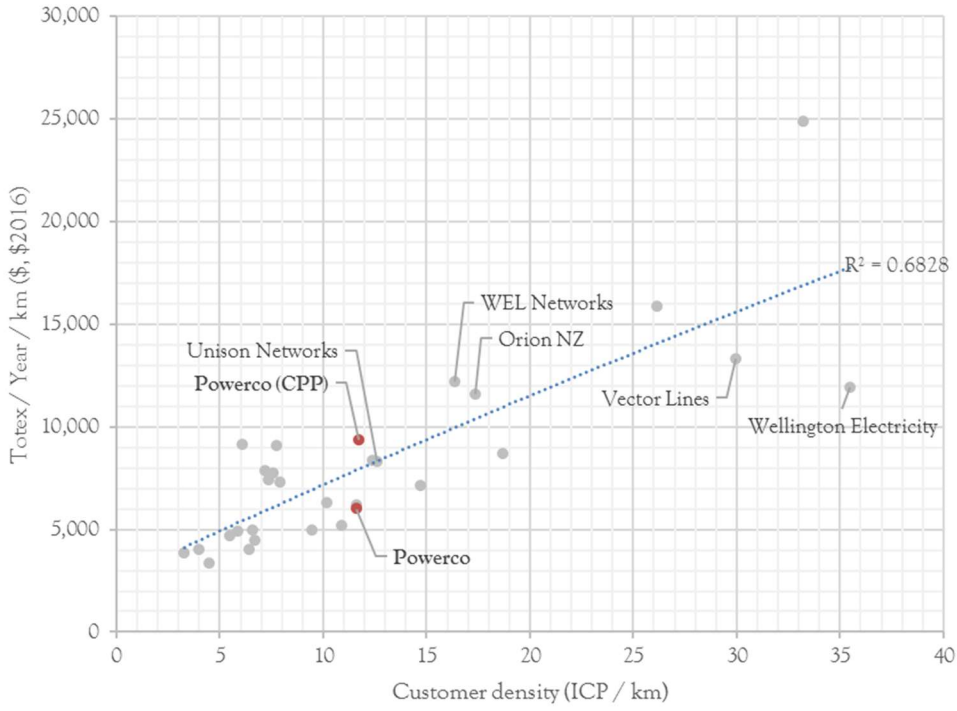
Source: Commerce Commission, Information Disclosure data base. Data is averaged over the 2013 – 2016 information disclosures. For presentation purposes, customer numbers and circuit line length are assumed to increase by 1%.

Figure 46 – Total expenditure per year per MW vs customer density (ICPs / km)



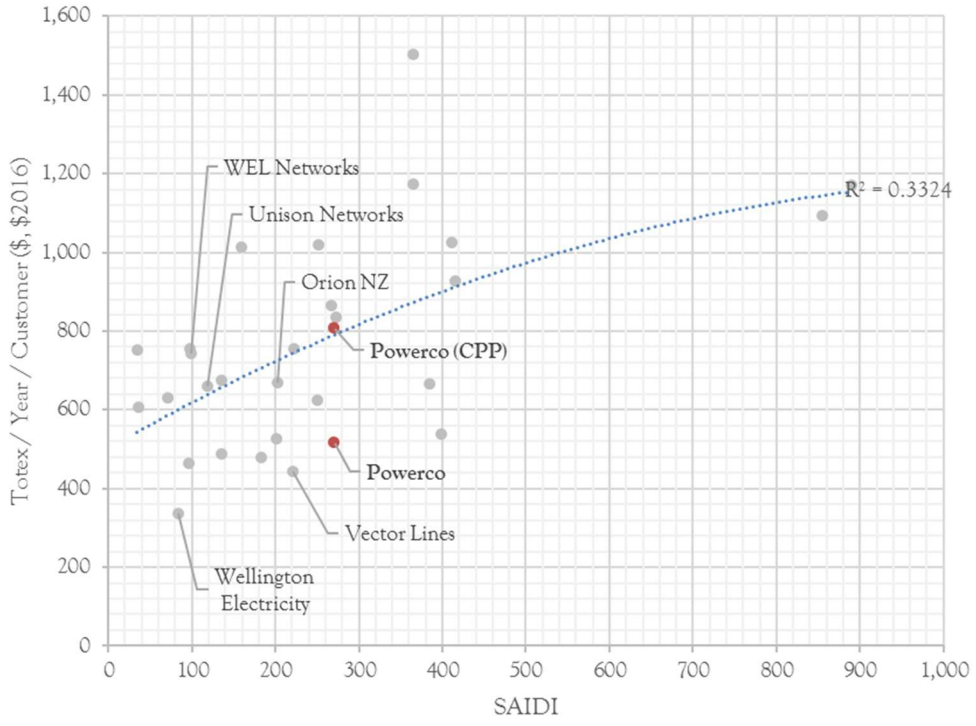
Source: Commerce Commission, Information Disclosure data base. Data is averaged over the 2013 – 2016 information disclosures. For presentation purposes, customer numbers, maximum coincident system demand and circuit line length are assumed to increase by 1%.

Figure 47 – Total expenditure per year per km vs customer density (ICPs / km)



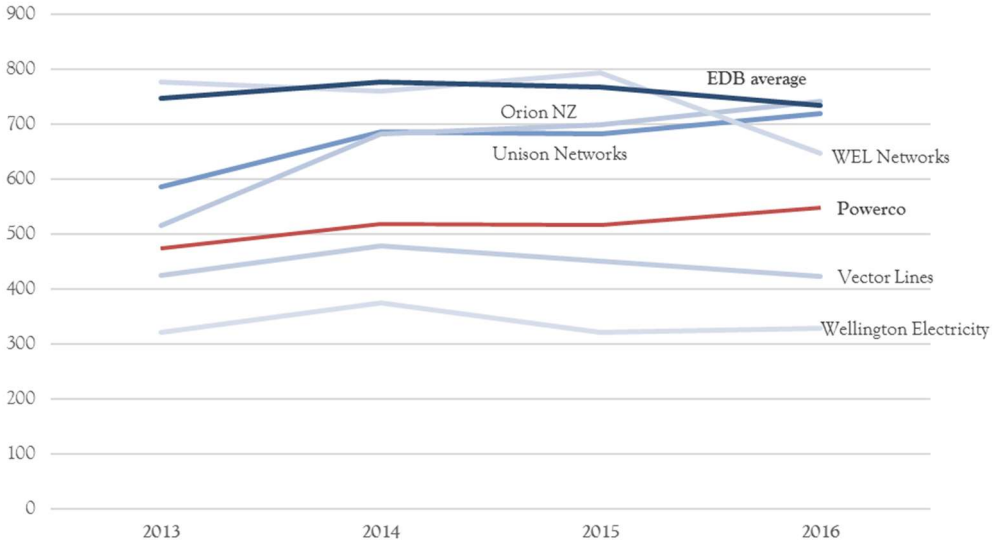
Source: Commerce Commission, Information Disclosure data base. Data is averaged over the 2013 – 2016 information disclosures. For presentation purposes, customer numbers and circuit line length are assumed to increase by 1%.

Figure 48 – Total expenditure per year per customer vs customer minutes off supply (SAIDI)



Source: Commerce Commission, Information Disclosure data base. Data is averaged over the 2013 – 2016 information disclosures. For presentation purposes, customer numbers are assumed to increase by 1%, while SAIDI is held constant.

Figure 49 – Total expenditure per year per customer, 2013 – 2016

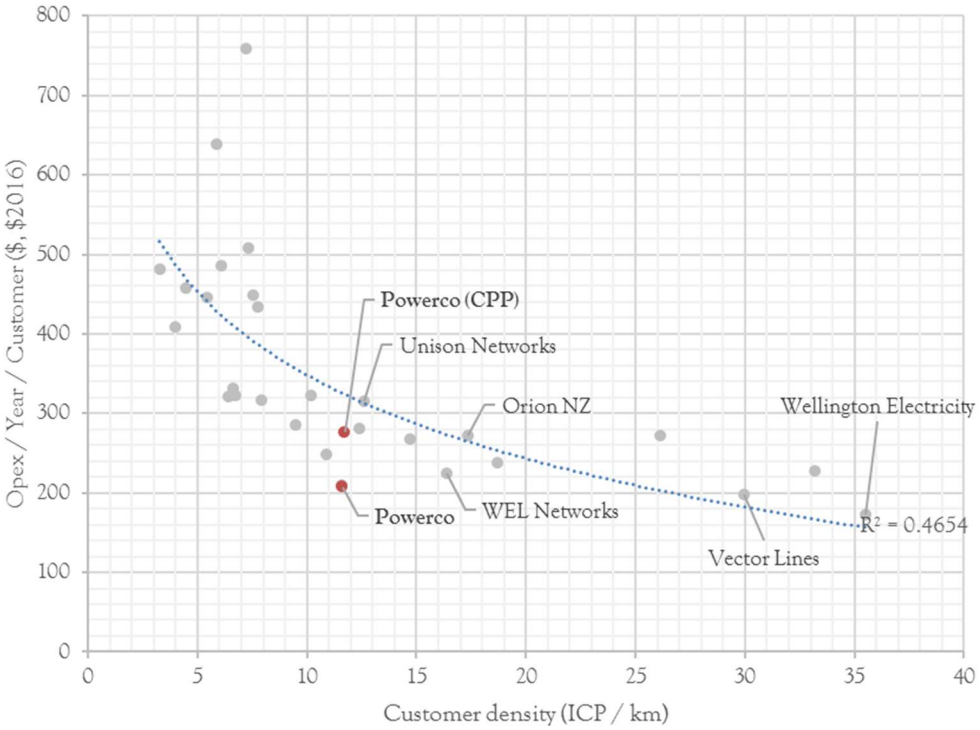


Source: Commerce Commission, Information Disclosure data base. Expenditure is in $2016.

Operating expenditure

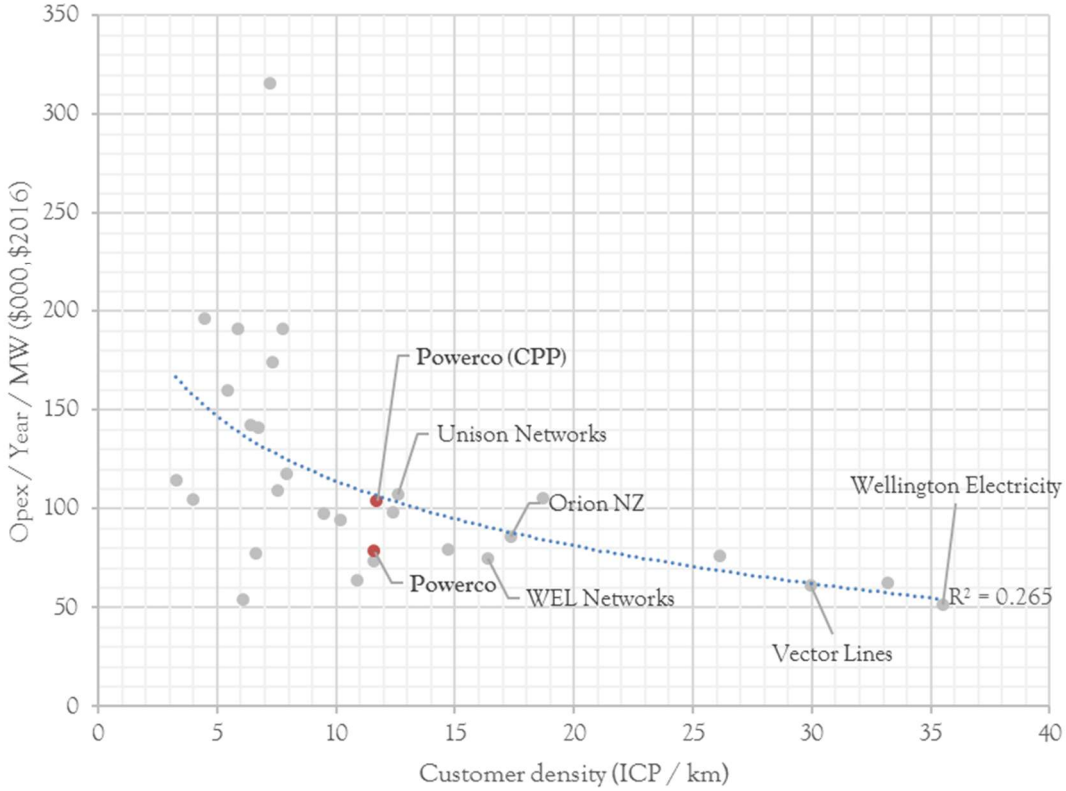
This section compares Powerco's operating expenditure to other NZ EDBs. The graphs show that Powerco's operating expenditure over the 2013 – 2016 period is consistent with that of the other larger networks. The graphs also show that the proposed increase in expenditure – identified as 'Powerco (CPP)' – remains consistent with that of other networks. The graphs also show that total expenditure per customer has increased over the 2013 – 2016 period.

Figure 50 – Opex per year per customer vs customer density (ICPs / km)



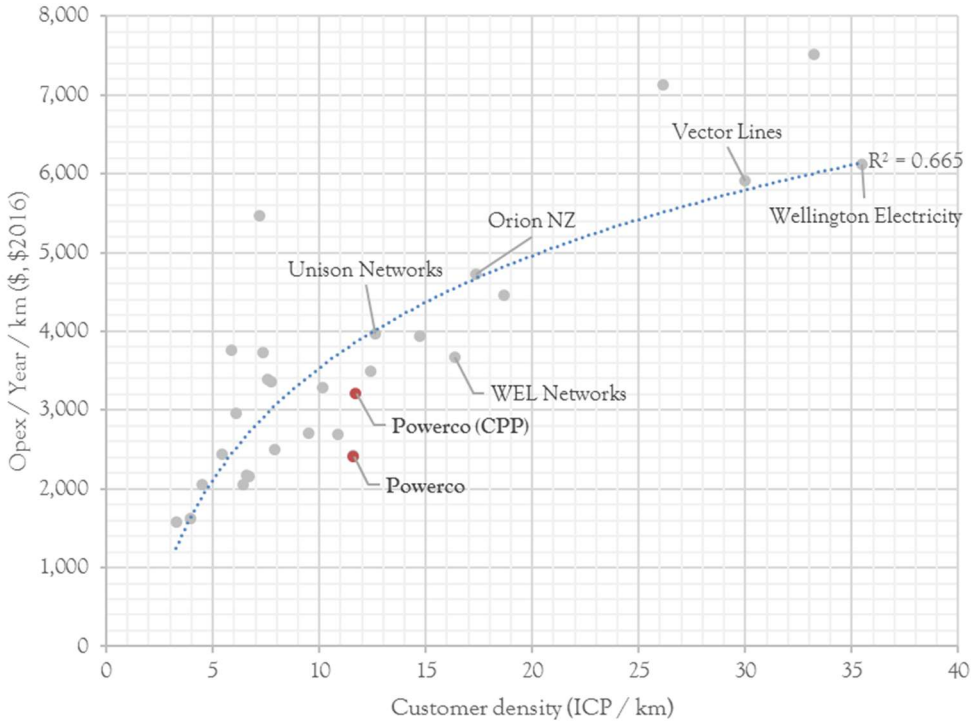
Source: Commerce Commission, Information Disclosure data base. Data is averaged over the 2013 – 2016 information disclosures. For presentation purposes, customer numbers and circuit line length are assumed to increase by 1%.

Figure 51 – Opex per year per MW vs customer density (ICPs / km)



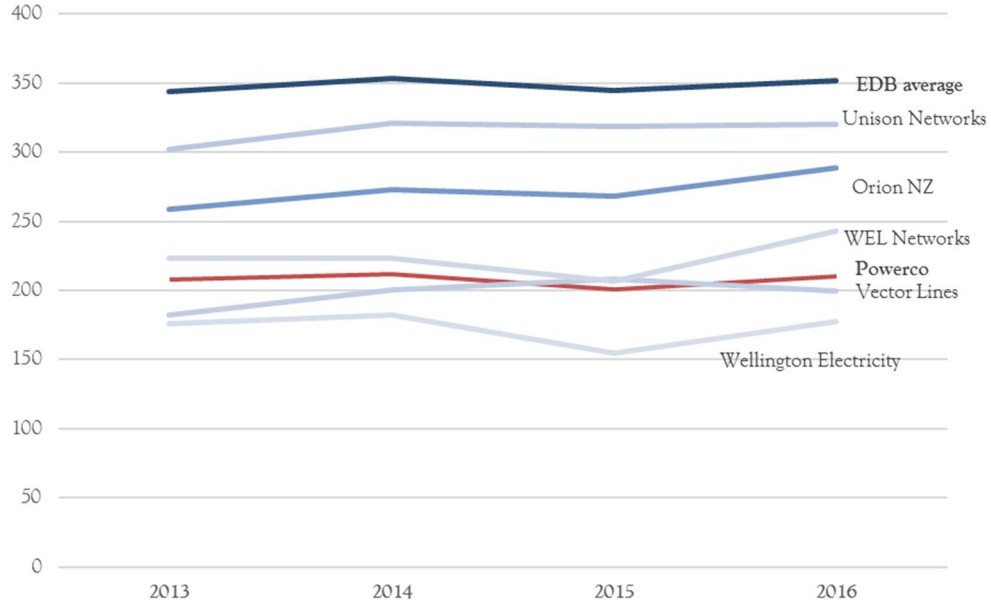
Source: Commerce Commission, Information Disclosure data base. Data is averaged over the 2013 – 2016 information disclosures. For presentation purposes, customer numbers, maximum coincident system demand and circuit line length are assumed to increase by 1%.

Figure 52 – Opex per year per km vs customer density (ICPs / km)



Source: Commerce Commission, Information Disclosure data base. Data is averaged over the 2013 – 2016 information disclosures. For presentation purposes, customer numbers and circuit line length are assumed to increase by 1%.

Figure 53 – Opex per year per customer, 2013 – 2016

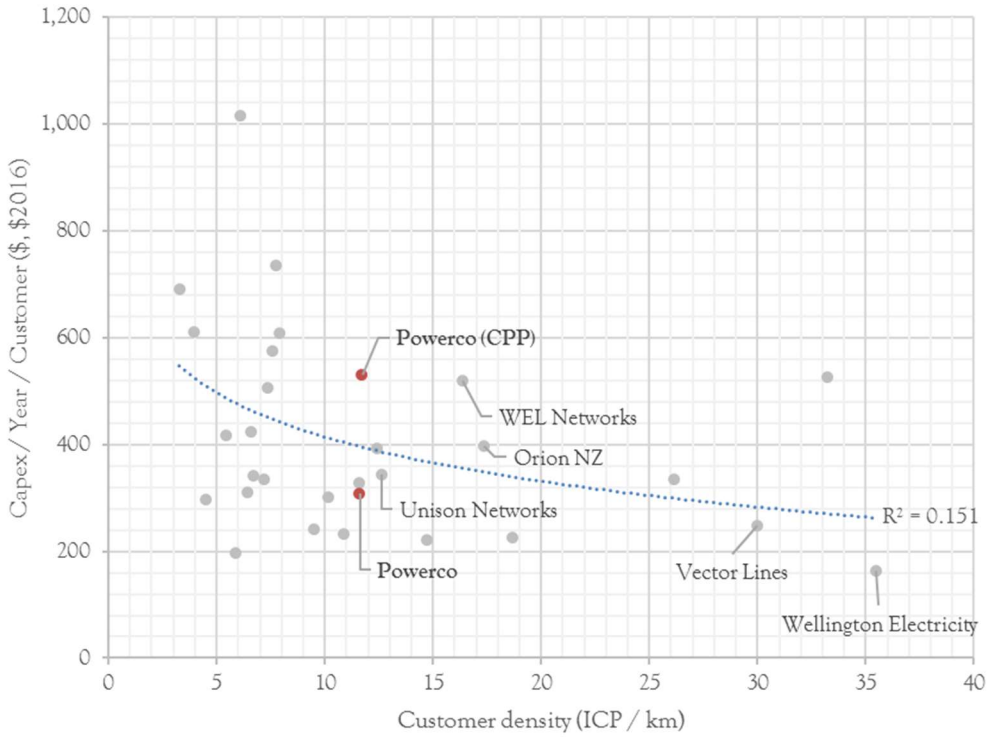


Source: Commerce Commission, Information Disclosure data base. Expenditure is in $2016.

Capital expenditure

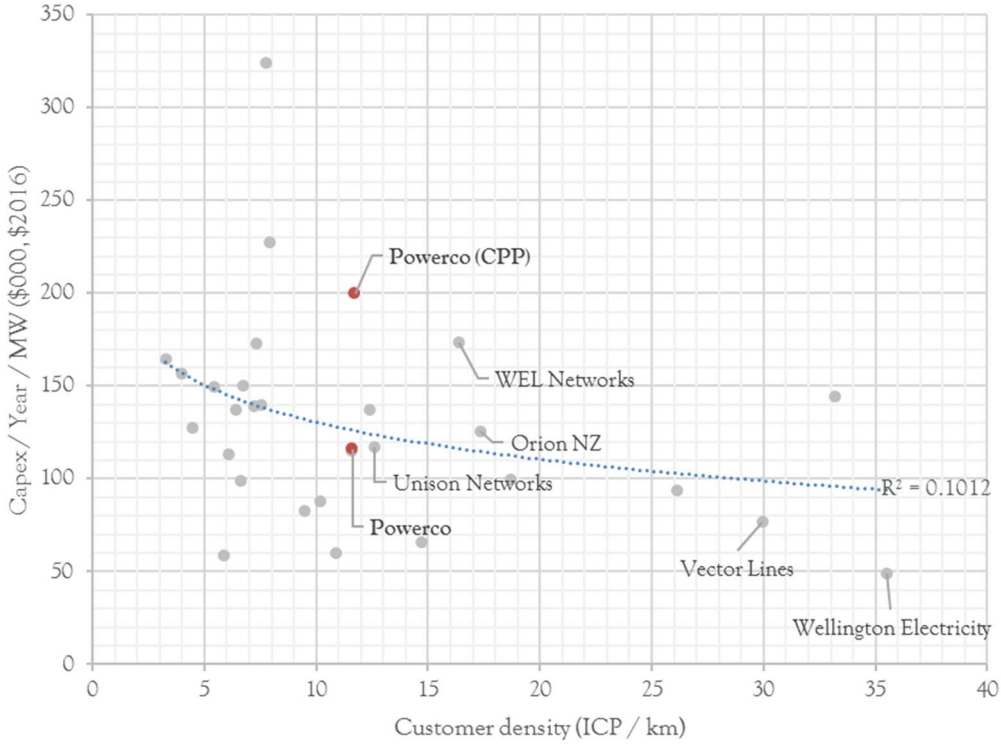
This section compares Powerco's capital expenditure to other NZ EDBs. The graphs show that Powerco's capital expenditure over the 2013 – 2016 period is consistent with that of the other larger networks. However, the proposed increase in expenditure – identified as 'Powerco (CPP)' – does raise its expenditure per customer and MW above those networks in most cases. The graphs also show that total expenditure per customer has increased over the 2013 – 2016 period.

Figure 54 – Capex per year per customer vs customer density (ICPs / km)



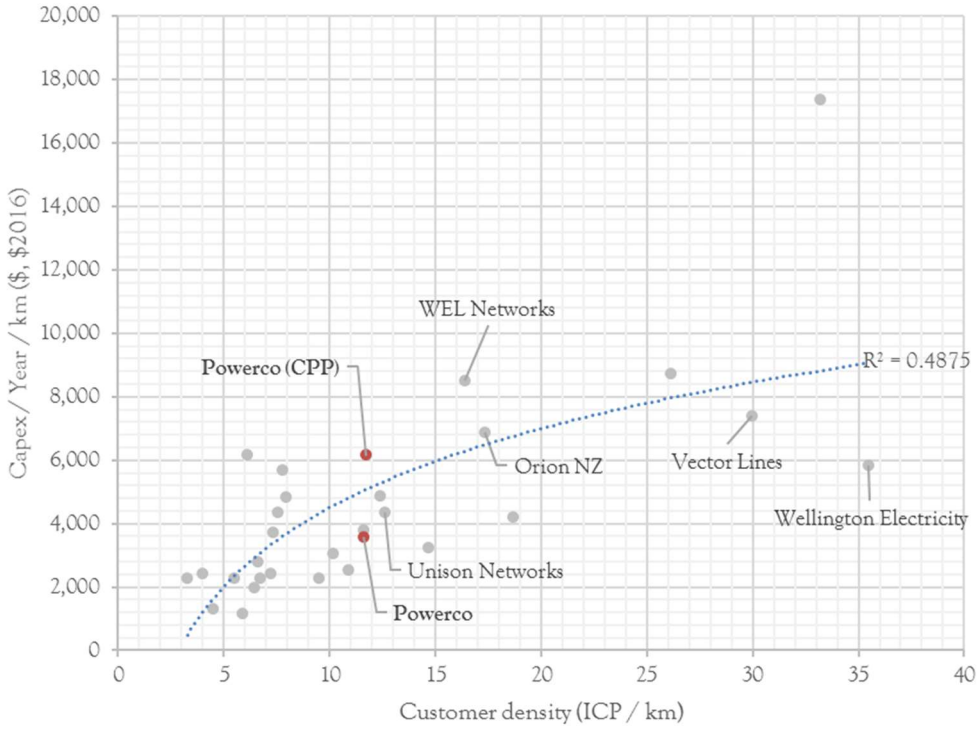
Source: Commerce Commission, Information Disclosure data base. Data is averaged over the 2013 – 2016 information disclosures. For presentation purposes, customer numbers and circuit line length are assumed to increase by 1%.

Figure 55 – Capex per year per MW vs customer density (ICPs / km)



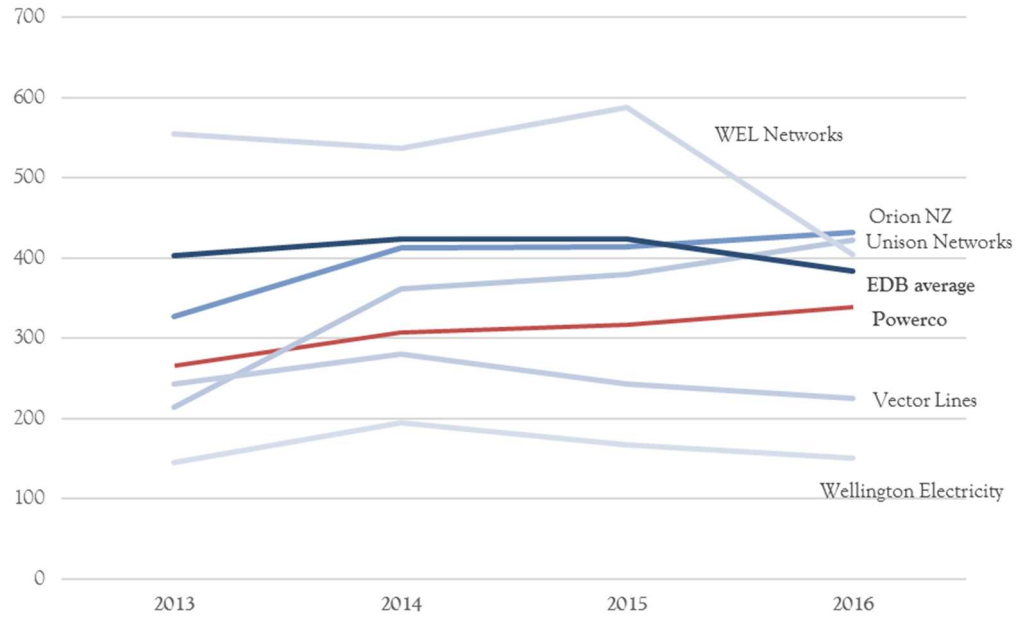
Source: Commerce Commission, Information Disclosure data base. Data is averaged over the 2013 – 2016 information disclosures. For presentation purposes, customer numbers, maximum coincident system demand and circuit line length are assumed to increase by 1%.

Figure 56 – Capex per year per km vs customer density (ICPs / km)



Source: Commerce Commission, Information Disclosure data base. Data is averaged over the 2013 – 2016 information disclosures. For presentation purposes, customer numbers and circuit line length are assumed to increase by 1%.

Figure 57 – Capex per year per customer, 2013 – 2016



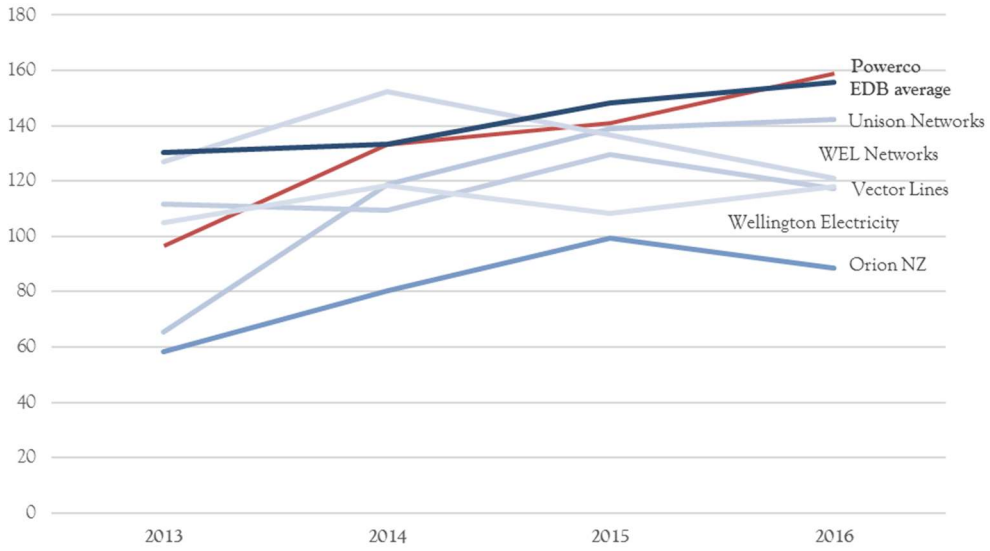
Source: Commerce Commission, Information Disclosure data base. Expenditure is in $2016.

Replacement and renewal expenditure

This section compares Powerco's replacement and renewal expenditure (repex) to other NZ EDBs. The graphs show that Powerco's replacement expenditure over the 2013 – 2016 period is consistent with that of the other larger networks, but is showing an increasing trend. The proposed expenditure in the CPP forecast is expected to continue this trend and will result in an average expenditure of $266 per customer ($2016), which would place Powerco well above its peers in the benchmarking analysis.

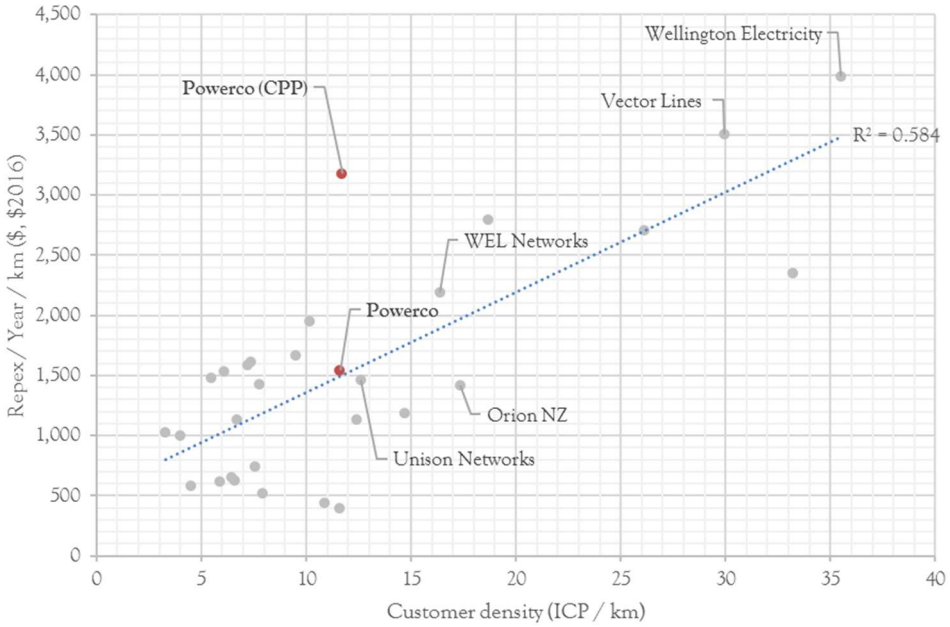
The forecast repex per year per circuit kilometre was compared against customer density to demonstrate the relationship between unit costs while controlling for rural and urban networks. The chart shows a R^2 value indicating a reasonable fit of the trend line with the data. It shows that in 2016, Powerco's repex was slightly higher than would be expected by the trend of other EDBs and the CPP forecast is moving further away from the trend line.

Figure 58 - Repex per year per customer, 2013 – 2016



Source: Commerce Commission, Information Disclosure data base. Expenditure is in $2016.

Figure 59 - Repex per year per km vs customer density.



Source: Commerce Commission, Information Disclosure data base. Expenditure is in $2016. For comparison purposes, we have used Powerco's proposed 'Renewals capex' category for the CPP period.

Appendix G – Verification certificate

I certify that:

1. the relevant parts of the customised price path proposal prepared by Powerco Limited and dated 7 June 2017 have been verified by Farrier Swier Consulting Pty Ltd and a verification report was prepared in accordance with Schedule G of the Electricity Distribution Services Input Methodology Determination 2016; and
2. the findings from this verification are documented in the report titled Powerco's *Customised Price Path Application: Final verification report for Powerco* and 7 June 2017 prepared by Farrier Swier Consulting Pty Ltd and WSP Australia Pty Limited.

This certificate is provided in accordance with the requirements of clause 5.1.3(1)(d) of the Commerce Commissions Electricity Distribution Services Input Methodology Determination 2016.

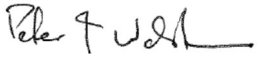
Shaun Dennison

Director

Farrier Swier Consulting Pty Ltd

I certify that:

1. WSP Australia Pty Limited assisted Farrier Swier Consulting Pty Ltd by reviewing and assessing the relevant technical aspects of the customised price path proposal prepared by Powerco Limited and dated 7 June 2017, including verifying capital and operational programs and projects; and
2. the findings from this verification are documented in the Farrier Swier Consulting Pty Ltd report titled Powerco's *Customised Price Path Application: Final verification report for Powerco* and dated 7 June 2017.



Peter Walshe

Technical Executive

WSP Australia Pty Limited