# Powerco CPP draft decision

## Advice to MEUG for Commerce Commission submission

NZIER report to MEUG

14 December 2017

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# Key points

The core issue for the assessment of the Powerco customised price path (CPP) application is whether the trade-off it strikes between reliability and increased price (due to increased capital and operation expenditure) is for the long-term benefit of consumers. Two key elements in assessing this trade-off are:

- clear understanding of the link between increased capital and operating expenditure, the reduction in network fault rates and the effect of reduced fault rates on system reliability
- comparison of the relative contribution of individual capital projects and expenditure programmes to improvement in reliability.

The Powerco CPP argued that without an increase in capital and operating expenditure network reliability would deteriorate over the next 10 years. Normalised System Average Interruption Duration Index (SAIDI) in 2027 would be 212.9 minutes – 23 percent above the average for the past 10 years under the default price path (DPP) compared with 160.9 minutes – 7 percent below the 10-year average under the CPP. The Powerco CPP does not offer an intermediate path between the CPP and DPP – a level of expenditure but maintains reliability experienced by the customer.[1]

This submission focuses on three key aspects of the draft decision and the information released by the Commerce Commission (the Commission):

- the Commission's proposed reduction in the unplanned SAIDI target, which adds a third estimate of the reliability gains that can be expected from the Powerco network investment and the implied price reliability trade-off
- Powerco's assessment of options for the major capital expenditure projects which show a wide variation in the change in reliability per dollar of capital expenditure and is based on a cost benefit comparison approach – net present value of status quo costs and benefits versus net present value of project costs and benefits over a 20-year period
- response to Commission comments on the applicability of NZIER comparison of the difference in the costs and benefits of under the CPP and DPP.

## Price quality trade-offs

The draft decision does highlight that there are three different views of the price service trade-off available to consumers:

- Powerco's CPP that delivers forecast SAIDI in 2027 that is 24 percent below forecast SAIDI under the DPP
- the verifier's report which argued that Powerco was understating the improvement in reliability that was likely to be achieved with the CPP expenditure and could only verify 91 percent of the proposed expenditure

[1] Un-normalised SAIDI was an average of 214 minutes over the past 10 years and was 196 minutes in 2017 compared with 181 minutes for normalised SAIDI in 2017.

- the Commission[2] draft decision that settles between the Powerco CPP and the verifier's report with a 27 percent improvement in reliability for 96 percent of the expenditure proposed by Powerco.

These price quality combinations are difficult to compare because they do not provide clear explanations of the assumptions used to link expenditure to fault reduction and fault reduction to improved reliability. Also, they are clustered either around the DPP or the modest variations around Powerco's CPP. However, the comments by the verifier in Appendix E[3] about the trends in Powerco network faults and Powerco's estimated SAIDI suggest that there is a middle path between the CPP and DPP that allows for a slower rate of renewal to maintain reliability at current levels rather than improve reliability.

## Powerco options analysis

A further hint of this potential middle path is provided by Powerco analysis of the options for major project upgrades by both the methodology and the results used to compare option for major projects. The methodology used in the spreadsheets:

- assumes constant fault rates for the status quo over a 20-year period (and the new capital expenditure) which does not seem to be consistent with the assertion that asset health is deteriorating over time
- calculates the value of lost load for assets with no alternative capacity[4] using the peak demand for that asset – which is likely to over-estimate the value of lost load as outages are unlikely to occur at peak periods.

The 'net benefit' of the preferred option varies widely in comparison to the capital cost and in some cases is negative – over the period the net present value of the cost of the project exceeds the net present value of the energy not served under the status quo.

(Powerco's assessment of the options is based on comparing the costs (capital and operational), and benefit (value of lost load) under each option with the estimated cost and benefits for the status quo. The net present value of costs and benefits is calculated using a discount rate of 6.6 percent. Options are ranked against the status quo based on the difference between the net present value of the option and the net present value of the status quo.)

## Comparing costs and benefits

The Commission's draft decision argues that the cost benefit analysis of the Powerco CPP is not required under the input methodology framework and can be replaced by testing Powerco's CPP against the expenditure objective. We suggest that a comparison of costs and benefits from the Powerco CPP is necessary to assess the long-term benefit of the CPP to customers as:

- the level of reliability offered to customers is being materially altered in return for a material price increase

[2] The reduction in SAIDI proposed by the Commission is less than 3 percent below the CPP SAIDI proposed by Powerco for 2023 and does not materially affect the benefit of avoiding lost load.

[3] 'Powerco's Customised Price Path Application, Final verification report for Powerco, 7 June 2017', Farrier Swier Consulting Appendix E – Reliability modelling, pages 209 to 219.

[4] The value of lost load for assets with no alternative capacity is the main driver of benefits with the value of lost load for assets with alternative capacity generally much lower.

- the options analysis by Powerco and the fault analysis by the verifier clearly indicate there are intermediate price/reliability choices available.

The Commission also critiqued the NZIER comparison of costs and benefits and stated that the Commission's sensitivity analysis showed net benefits from the Powerco CPP if NZIER assumptions were altered. We concede that the value of lost load (VoLL) price was not adjusted for inflation and that adjusting for inflation does increase the annual benefit from the CPP (from $8 million to $10 million in 2027 compared with an estimated difference in annual cost of $53 million). However, in our view the other criticisms are arguable. We respond to these in the body of the submission. Aside from not discounting cost and benefit streams (to avoid allegation of bias) we note that our method of comparing the DPP and CPP benefits is similar to the approach used by Powerco in its options analysis.

The objective of our quantitative comparison was to encourage discussion of the value of the price/reliability trade-proposed by Powerco and being assessed by the Commission on behalf of consumers.

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## Figures



## Tables

# 1. Quality path

Powerco's customised price path (CPP) argues that a 50 percent increase in capital and operational expenditure is necessary to maintain the reliability of the network. The current quality path options offered to consumers for the period 2018 to 2027 are:

- under default price path (DPP) settings, there will be a 26 percent increase in unplanned SAIDI (from 2018 levels) with planned outages remaining around current levels
- CPP settings, there will be a 5 percent decrease in unplanned SAIDI (from 2018 levels) which is partially offset by an increase in planned outages.

The quality path in the Commerce Commission's (the Commission) proposed decision is based on normalised System Average Interruption Duration Index (SAIDI) but consumer experience of reliability is better reflected by un-normalised SAIDI. While these measures have converged over time the rate of improvement in un-normalised SAIDI has been faster than that for SAIDI.

Consumers are not being offered an option to maintain the mix of planned and unplanned outages around current levels despite indicating in consultation that they do not want to pay more for additional reliability.

The two key issues for the assessment of the quality path are:

- how is the increase in expenditure linked to the improvement in reliability?
- what options are available to reduce or defer the level of expenditure in exchange for a smaller improvement in reliability?

## 1.1. Verifier comments

The verifier's report identified several issues with Powerco's forecasting of unplanned SAIDI including the following[5]:

- the long term historical trend of increasing reliability is not recognised
- upward trends in annual faults have not been adjusted for an increase in expenditure on asset renewal, maintenance and vegetation management
- the model is not suitably calibrated for recent data
- periods used for averaging overstate the number of installation connection points (ICPs) affected
- duration of outage per event is forecast to continue to increase.

The verifier concludes that these issues:

> *start 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*[6]

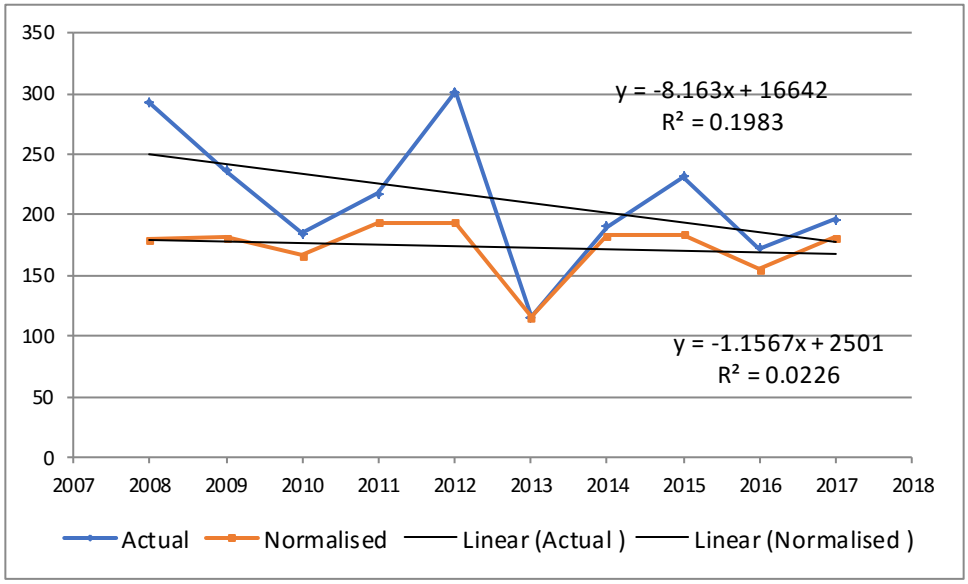
[5] The following comments are paraphrased form pages 216 to 217 of the verifier's report 'Powerco's Customised Price Path Application, Final verification report for Powerco, 7 June 2017', Farrier Swier Consulting.

[6] Verifier's report page 217.

The following chart shows data for unplanned SAIDI (un-normalised and normalised) for the years ended 31 March 2008 to 31 March 2017 with trend lines fitted to the data.

## Figure 1 Unplanned SAIDI: actual versus normalised

Annual SAIDI measured in minutes 2008 to 2017



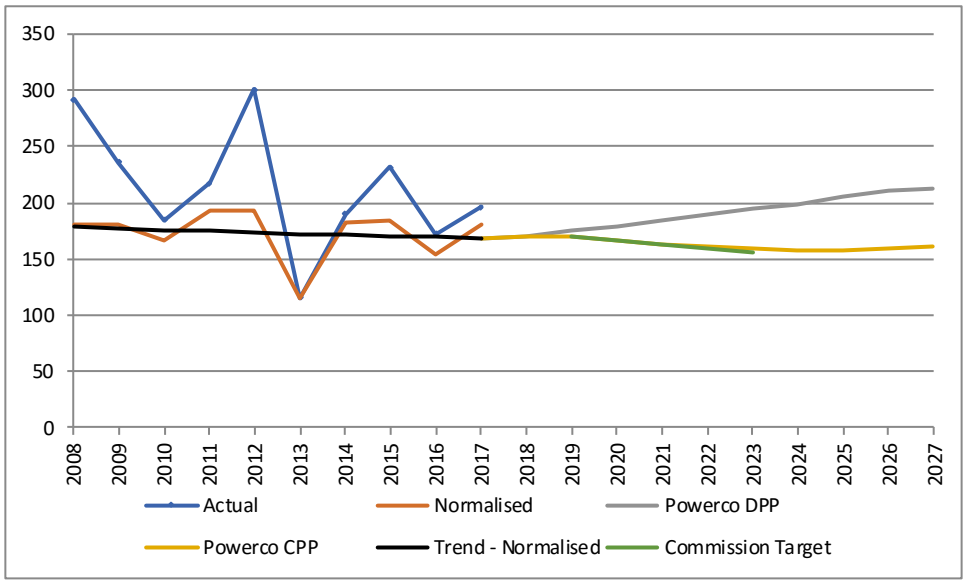

**Source: Commerce Commission**

The trendlines indicate that un-normalised unplanned SAIDI – the consumers' experience of network reliability has been improving on average by about 8 minutes per year while the normalised unplanned SAIDI has been improving by about 1.2 minutes per year.

The following chart compares the Powerco DPP and CPP forecast for unplanned SAIDI for 2018 to 2027 with normalised unplanned SAIDI for 2008 to 2017.

## Figure 2 Unplanned SAIDI: past versus predicted

Annual SAIDI measured in minutes 2008 to 2027




**Source: NZIER**

The Powerco forecasts seem to be based on normalised unplanned SAIDI and:

- seem to start with a step improvement in reliability from current levels
- effectively forecast that the recent downward trend in SAIDI (improvement in reliability) will be reversed if a DPP is followed and roughly maintained under a CPP.

The chart also includes the Commission's target for normalised unplanned SAIDI as stated in the draft decision. The Powerco CPP forecast and the Commission's target for unplanned normalised CPP are also shown in the following table.

## Table 1 Normalised unplanned SAIDI

Commerce Commission target and Powerco CPP forecast SAIDI (minutes)

| Year | Commerce Commission | Powerco | Proposed reduction |
|---|---|---|---|
| 2018 | | 169.27 | |
| 2019 | 169.59 | 170.91 | -1.32 |
| 2020 | 166.06 | 166.54 | -0.49 |
| 2021 | 162.59 | 163.05 | -0.46 |
| 2022 | 159.20 | 161.95 | -2.75 |
| 2023 | 155.88 | 160.02 | -4.13 |

**Source: NZIER**

## 1.2. Reduction in faults

The Powerco CPP shows substantial increases in both operational expenditure on elements such as preventative/corrective maintenance and vegetation management as well as capital expenditure to accelerate the replacement of assets in poor health. Both should have an immediate impact on the reduction in faults and therefore the level of outages.[7] The unanswered question in the Powerco CPP is how much and how quickly the increase in individual categories of operational expenditure and capital expenditure each contribute to the reduction in the fault rate and therefore the forecast improvement in reliability. In particular:

- to what extent does the increase in operational expenditure (vegetation management and maintenance) lower the fault rate and allow better targeting of asset replacement expenditure?
- how does the efficiency and effectiveness of fault reduction vary across asset replacement options?
- how can this be variation be used to set a priority list for capital expenditure that gives options for more choices about reliability improvements rather than the binary DPP or 'adjusted' CPP choice?

[7] Defective equipment is the largest single cause of unplanned SAIDI accounting for 41 percent of SAIDI on average over the period 2013 to 2017 but with the contribution to SAIDI falling over that period from 47 percent to below 40 percent. Powerco has proposed a 70 percent increase in vegetation management expenditure. Vegetation issues accounted for about 15 percent of the SADI outages on average over the period 2013 to 2017.

# 2. Options analysis

## 2.1. Major projects

The Commission has released Powerco's option analysis for 16 major 'growth and security' capital projects. This information provides insight into both the relative efficiency of the projects in delivering improvements in reliability and Powerco's modelling approach including the application of cost benefit analysis in its assessment of options.

The following table shows the results of Powerco's Options Analysis and Economic Evaluation Tool (OAEET) ranked in order of the net present value of the net benefit (reduction in the value of lost load due to faults) of the preferred option for each 'project'.

**Table 2 Powerco security and growth projects**

All numbers are net present value ($m) calculated at a discount rate of 6.6 percent

| Project | Status quo VoLL | Preferred option VoLL | Preferred option capital cost | Preferred option net benefit |
|---|---|---|---|---|
| Kopu-Kauaeranga | 50.7 | 4.8 | 8.5 | 39.0 |
| Palmerston North | 76.8 | 18.9 | 26.6 | 36.8 |
| Pyes Pa Capacity | 17.3 | 0.3 | 4.9 | 11.8 |
| Whenuakite | 21.3 | 7.3 | 7.1 | 8.5 |
| Whangamata | 38.5 | 22.0 | 11.8 | 8.2 |
| Tirau to Putaruru | 21.0 | 9.1 | 6.2 | 7.1 |
| Matarangi | 19.6 | 8.0 | 8.2 | 5.4 |
| Kereone to Walton | 10.3 | 3.6 | 4.5 | 3.6 |
| Putaruru GXP | 31.6 | 9.6 | 23.3 | 3.5 |
| Kaimarama-Whitianga | 15.9 | 9.4 | 5.9 | 2.7 |
| Sanson Bulls | 9.1 | 3.8 | 5.9 | 0.7 |
| Omokoroa | 9.1 | 0.2 | 10.7 | 0.5 |
| Kerepehi to Paeroa | 4.4 | 1.3 | 5.0 | -1.7 |
| Inglewood 6.6kV to 11kV | 8.7 | 7.3 | 5.5 | -3.6 |
| Moturoa - New Plymouth | 0.0 | 0.0 | 8.3 | -5.1 |
| Kopu—Tairua | 6.9 | 5.9 | 8.4 | -6.8 |

**Source: NZIER analysis of Powerco options analysis**

The main benefit from the project is the reduction in the values of lost load by reducing the fault rates of assets particularly those where there is currently no alternative capacity.

There is a wide variation in the benefits from the projects particularly relative to the capital cost. Of the 16 projects:

- five projects have a net benefit that exceeds the capital cost of the project
- a further six projects have a net benefit that is between 10 and 100 percent of the capital cost of the project
- one project has a small positive benefit
- four projects have a net cost.

The difference in the returns to each project relative to the expenditure required, suggests there is potential for priority ordering of the projects[8] in terms of their efficiency and effectiveness in improving reliability.

## 2.2. Modelling approach

Powerco has modelled the costs and benefits of the status quo and a varying number of options for each of the major growth and security projects over a 20-year period. The approach appears to have the following features:

- the main benefit is the difference in the value of lost load (VoLL) between the status quo and the other options with a secondary benefit from changes in electrical losses[9]
- VoLL is as calculated as $20 per kWh multiplied by the number of faults and the average outage duration and:
  - peak demand if there is no alternative capacity
  - peak demand adjusted by load curve if there is alternative capacity available from another asset (which reduces the lost load)
- the main option cost is the capital cost of the asset – operational expenditure is set as a percentage of the capital expenditure for each option – operating and capital costs are not modelled for the status quo
- the net present value of future costs and benefits is used to compare each option to the status quo and is calculated using a discount rate of 6.6 percent.

[8] The priority of projects may be altered by safety issues or obligations to maintain supply but this is not evident from the Options Analysis and Economic Evaluation Tool (OAEET).

[9] The value of electrical losses and the difference in the value between the status quo and the options is much smaller than the difference in VoLL. Therefore, we have not analysed the sensitivity of these values to changes in the calculation assumptions in the same detail as we have for VoLL.

Electrical losses are calculated in two steps in the OAEET. The first step is to calculate electrical losses as peak demand (expressed in amps, squared and multiplied by a constant resistance factor, to estimate the network loss in MW of capacity at peak demand. (This suggests that the change in electricity losses as demand varies will be much larger than the percentage change in demand.) The second step is to multiply the loss at peak demand expressed in MW by the number of hours in a year and a constant load loss factor to calculate annual electricity losses in MWh (and then kWh). The load loss factor seems to be the only downward adjustment in the calculation for the fact that the asset is running well below peak demand (let alone capacity) for nearly all the time covered by the electrical loss calculation.

The calculations in the OAEET are based on changes in peak demand rather than the difference between the capacity of the status quo or new assets and the peak demand.

Aside from the apparent endorsement of Powerco for the use cost benefit comparison and net present value analysis to compare capital expenditure options, we have three substantive comments on the modelling approach:

- the detail in the options analysis about fault frequency, duration and peak demand could with the addition of the estimated number of customers affected by an outage be used to calculate an indicator of the contribution of the option lowering SAIDI and the contribution of the status quo to SAIDI
- fault rates and average durations assumed for the status quo (and the options) are constant over the forecast period. The assumption of constant fault frequency and duration for the status quo over the 20-year forecast period is not consistent with the Powerco narrative that fault rates and duration are rising over time[10]
- the VoLL is based on peak demand for the circuit if there is no alternative capacity or peak demand adjusted by a load curve if there is an alternative asset. As outages are caused by a variety of factors most of which are not tightly correlated with the timing of peak demand, this approach is likely to overestimate VoLL for the status quo (and the projects).

### 2.2.1. Adjusting estimates of VoLL

In the absence of data on the timing of outages it is difficult to calculate the extent to which the OAEET projects overestimate VoLL. As an example, to illustrate a starting point for the estimation we considered the:

- share of annual SAIDI for each month in the year ended 31 March 2017 (based on the Commission's data)
- estimated peak electricity demand for Powerco for each month as a percentage of the estimated peak electricity demand for the year ended 31 March 2017 (based on half hourly electricity supply data by GXP obtained from the Electricity Authority's website).

The allocation of SAIDI and the peak demand by month is shown in the following table. Combining the two sets of data suggests that if the outages follow the same monthly pattern as SAIDI and occurred exactly at the time of peak demand for that month then the high-side estimate for the lost load would be about 86 percent of the annual peak demand.

This is described as a high-side estimate because it does not adjust for possibility that outages are unlikely to coincide with periods of peak demand during any given month.

[10] The OAEET already includes provision for year-by-by year growth in demand forecasts. A copy of these cell formulae could have been used to model changes in fault frequency and duration over the forecast period. Thu data would in turn have provided a very helpful view of Powerco's assessment of fault risk in the parts of its network that require major growth and renewal expenditure.

## Table 3 Monthly distribution of SAIDI and estimated peak demand

Monthly data as a percentage of annual total

| Month | SAIDI monthly share | Estimated monthly peak demand |
|---|---|---|
| Apr 16 | 2.7% | 87% |
| May 16 | 8.7% | 96% |
| Jun 16 | 5.9% | 96% |
| Jul 16 | 12.2% | 95% |
| Aug 16 | 5.6% | 100% |
| Sep 16 | 7.6% | 94% |
| Oct 16 | 3.0% | 87% |
| Nov 16 | 27.8% | 85% |
| Dec 16 | 4.1% | 84% |
| Jan 17 | 11.2% | 72% |
| Feb 17 | 4.4% | 76% |
| Mar 17 | 6.9% | 74% |

**Source: NZIER**

In the absence of data on the timing of outages we have tested the sensitivity of net benefits from the preferred option to changes in the assumed level of lost load. We re-estimated the benefits for the projects with the estimated VoLL set at 70 and 60 percent of the demand level used in the OAEET and obtained the results shown in the following table. These sensitivity levels are based on the following:

- the simple average of half hourly load as a percentage of the peak for 2017 over the trading periods between 6:00 am and 10:00 pm, is 69 percent of the 2017 peak[11]. We rounded this value to 70 percent for the sensitivity analysis.
- the simple average of half hourly load as a percentage of the peak for 2017 for all the trading periods is 63 percent. We rounded this value to 60 percent for the sensitivity analysis.

The change in estimated VoLL generates a negative net benefit for seven of the projects and reduces the net benefit on a further five projects to low levels compared to the capital expenditure required. The projects with negative net benefits are highlighted in the following table.

[11] The distribution of peak is slightly skewed to below the mean.

We did not re-estimate the benefits for the alternative options in each OAEET and it is possible that the change in assumed lost load may make a different option the preferred option.

## Table 4 Powerco security and growth projects

All numbers are net present value ($m) calculates at a discount rate of 6.6 percent

| Project | Preferred option net benefit | Net benefit at 70 percent VoLL | Net benefit at 60 percent VoLL |
|---|---|---|---|
| Kopu-Kauaeranga | 39.0 | 25.2 | 20.6 |
| Palmerston North | 36.8 | 19.5 | 13.7 |
| Pyes Pa Capacity | 11.8 | 6.7 | 5.0 |
| Whenuakite | 8.5 | 4.3 | 2.9 |
| Whangamata | 8.2 | 3.2 | 1.6 |
| Tirau to Putaruru | 7.1 | 3.5 | 2.3 |
| Matarangi | 5.4 | 2.0 | 0.8 |
| Kereone to Walton | 3.6 | 1.6 | 0.9 |
| Putaruru GXP | 3.5 | -3.1 | -5.3 |
| Kaimarama-Whitianga | 2.7 | 0.7 | 0.1 |
| Sanson Bulls | 0.7 | -0.9 | -1.5 |
| Omokoroa | 0.5 | -2.2 | -3.1 |
| Kerepehi to Paeroa | -1.7 | -2.6 | -2.9 |
| Inglewood 6.6kV to 11kV | -3.6 | -4.0 | -4.2 |
| Moturoa - New Plymouth | -5.1 | -5.1 | -5.1 |
| Kopu—Tairua | -6.8 | -7.1 | -7.2 |

**Source: NZIER analysis of Powerco options analysis**

# 3. Role of CBA analysis

## 3.1. Response to comments by the Commission

### 3.1.1. NZIER's cost benefit comparison

In our submission on the Powerco CPP we compared the estimated benefit of the difference in reliability between the DPP and CPP[12] to the estimated difference in consumer charges over the period for which Powerco provided reliability data (2018 to 2027). The analysis indicated that the costs to consumers of both the improvement in reliability and the increase in planned outages over the period exceeded the estimated value to consumers of the reduction in lost load.

The estimated differences in costs and benefits were presented year-by-year and were deliberately not discounted to avoid giving the impression that the analysis was a net present value of the difference between a CPP and DPP investment package. The NZIER submission was not the only submission to suggest the comparison of the costs and benefits of the expenditure reliability trade-off offered by the CPP but it did provide the most detailed attempt to quantify the costs and benefits based on data released by Powerco and the Commission.

The point of the analysis was (within the limitations of the available data) to focus attention on the:

- 'up-front cost' to consumers of the investment in reliability (increased planned outages and increased capital and operating expenditure during the CPP investment phase)
- difference between the annual cost and benefit of the projected improvement in reliability after the CPP investment phase was finished.

Our assessment that the estimated annual cost of reliability in the CPP period exceeded the estimated value of the reliability after the CPP period (2024 to 2027) along with the Powerco's forecast that the health of some network asset classes was still poor, raised questions for us about when upgrades to assets would deliver a reliability benefit that consumers valued as equal to or above the annual cost of the upgrade.

### 3.1.2. Commission's comments

In its draft decision, the Commission commented on the NZIER estimates (primarily in paragraphs 101 to 106 of the draft decision). These along with our response are summarised in the following table.

[12] The value of the difference was calculated by converting the difference in forecast SAIDI into a VoLL using data from Powerco's consultation with its consumers.

## Table 5 Commission's observations on the NZIER model

Extracts from paragraphs 100 to 106 of the Commerce Commission's Draft Decision

| Commerce Commission | NZIER |
|---|---|
| the NZIER model does not adequately take into account all of the relevant benefits that should be considered when assessing expenditure against the expenditure objective.<br>Compliance with regulatory requirements (such as replacing assets for health and safety reasons), the ability to meet future growth in customer connections and improvements in operational efficiency should all be considered in assessing the proposed expenditure against the expenditure objective. | Our analysis focused on the difference between the CPP and DPP and looked for quantifiable drivers of difference between the CPP and DPP forecasts provided by Powerco.<br>For regulatory compliance issues such as Health and Safety we would expect that they are covered under the DPP and CPP to the extent required by Powerco directors.<br>We expected that issues such as growth in customer connections and operating efficiency would be captured in the DPP and CPP forecasts. |
| the NZIER analysis only considers the potential benefits and costs over a timeframe of nine years (2018-2017). Many of the proposed investments that are part of Powerco's CPP programme are long-lived investments, and the benefits associated with these investments are likely to emerge and increase beyond the timeframe used by NZIER. | The analysis covered the period 2018 to 2027, which was the maximum period of the SAIDI forecasts provided by Powerco.<br>We accept that the assets are long-lived but the annual benefit of the assets peaks just after they are commissioned and then remains stable or declines as the assets age. |
| NZIER use a flat (i.e. real) forecast of the value of lost load (VoLL). Allowing the VoLL to increase in nominal terms has the effect of increasing the net benefits to consumers under the CPP scenario | We concede this was an error. Increasing the VoLL price at the same rate as the DPP increased the value of the annual reliability gain in 2027 from $8.6m to $10.3m. |
| NZIER assumes that opex would remain flat if Powerco remained on the DPP. This is unlikely where assets reaching the end of their useful life are not replaced.<br>related to the preceding sub-paragraph, increasing opex under the DPP is likely to result in higher planned interruptions under the DPP, as more work is required to maintain older assets | We assumed that the reliability opex trade-off was included in Powerco's DPP forecast. The verifier's comments that SAIDI was on a downward historical trend (about 1 minute per year for normalised SAIDI) in contrast to the steady increase in SAIDI forecast by Powerco seems to support this assumption. |
| NZIER has modelled reliability using Powerco's forecasts of unplanned SAIDI. Our view is that Powerco's forecasts of unplanned SAIDI are likely to understate the reliability improvements expected under the CPP. | The Commission's revised unplanned normalised SAIDI target for 2023 is about 4 minutes below the Powerco CPP target or just over 10 percent of the difference between the Powerco CPP and DPP forecast. |

**Source: NZIER**