EDB DPP reset issues paper

Comment on Commerce Commission Issues Paper

NZIER report to MEUG

14 December 2018

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Key points

The DPP process applies simple metrics to the measurement of reliability and the Issues paper proposes to continue this approach with incremental change. This simple approach hinders discussion of the following issues:

- reasons for the wide variation in the quality of service provided by EDB serving similar customer groups
- actual distribution of the inconvenience and cost of outages across customers which is masked by measures of service quality based on averages
- the capacity of EDB to materially alter the incidence and duration of outages over both the medium term and the relative effectiveness of operational and capital expenditure in changing the pattern of outages

The cost to customers of incentives for EDB to improve service quality are driven by the history of individual EDB networks but do not align well with the estimated benefit to customers of the reduction in the length of outages. The option to increase the proportion of revenue at risk from 1 percent to 5 percent or an intermediate figure does not address this mismatch. (An increase in the revenue at risk without an increase in the cap/collar range around the target SAIDI/SAIFI simply increases the cost of the incentive.)

Instead, the revenue at risk percentage set as an incentive to improve reliability and the cap/collar should be set for individual EDB so that the match the benefit to customers indicated by VoLL.

The Issues Paper includes a suggestion for incentives to EDB to reduce line losses. An assessment of the costs and benefits of this proposal would be a good opportunity to compare designs of incentive schemes.

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1. Overview

1.1. Focus

This report focuses on how the cost of incentives to improve reliability and reduce energy losses can be better aligned within the benefits to customers of shorter outages and lower line losses. The core questions for the analysis are:

- how well are the incentives aligned with potential customer benefits now?
- what simple changes would improve that alignment?
- what would a good incentive scheme look like?

1.2. Other comments

The approach proposed by the Commerce Commission is an incremental change to the building blocks methodology for the default price quality path (DPP) reset. This approach tends to roll EDB operational and capital expenditure forward on an inflation adjusted paths that are determined by recent history.

2. Reliability

2.1. Introduction

In simple terms the reliability of the network is measured using averages across all customers of the duration (SAIDI) and frequency (SAIFI) of outages with adjustments to exclude outliers or events over which EDB have limited or no control. The measures do not apply to the LV network but use outages on the HV and medium voltage networks as a proxy[1] for the reliability of the service delivered. Also, the link between changed reliability and investment in assets or level of operational expenditure is complex and difficult to quantify.

2.2. Cost benefit approach to reliability

Ideally a discussion of measures to improve service quality would begin with a comparison of consumer willingness to pay for improved service reliability and an estimate of the cost of delivering the reliability. Consumer willingness to pay would be measured by the value of lost load to the consumer or failing that surveys of consumer willingness to pay for reduce interruptions.

The cost of improving reliability could be assessed by a combination of operational and capital expenditure based on the relative efficiency and effectiveness of each of these measures in contributing to the improvement in reliability.

The difficulty with applying this model to the questions put by the Commerce Commission is that none of the linkages are transparent, easily measured and most vary widely across EDB. In particular:

- SAIDI and SAIFI measures of outages do not reflect the costs to consumers of the outages because they do not include information on the number and type of customers affected, the time of day or the value of lost load
- the relationship between the increase in expenditure (operational or capital) and the improvement in service reliability experienced by customer is difficult to measure
- the issues suggested by the Commission include a combination of increasing the incentive for EDB to improve SAIDI and SAIFI measures while also altering how these measures are applied which may reduce the reliability standards that EDB have to meet.

Our approach to considering these issues has two strands:

- consider recent data on service reliability as an indicator of the current level of reliability and direction of travel

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1 'ENA WORKING GROUP ON QUALITY OF SERVICE REGULATION, INTERIM REPORT TO THE COMMERCE COMMISSION, 1 October 2018' page 11:

Preliminary research by group members indicate that LV outages (and resulting SAIDI and SAIFI) are likely to be a substantial portion of the that seen by customers on some networks. (Given the strong coincidence with HV outages, characteristics such as customer density, network layout and number of customers will influence the contribution that LV outages make to the total for different networks.) Presently reliability measures only capture high and medium voltage (6.6 kV and up) outages, and therefore materially underreport the actual customer experience.

- discuss how the costs and benefits of proposed changes to reliability could be measured.

2.3. Who is affected by outages

As part of the last default price path reset the Commerce Commission gathered detailed information on the planned (Class B) and unplanned (Class C) interruptions over the period 2004 to 2014 that included the number of customers affected by each outage and the length of the outage[2]. This data is difficult to summarise into a simple system-wide picture because of the variation in EDB size and performance. As a starting point the data has been used to calculate the average across all EDB (weighted by the number of ICPs) over the period 2004 to 2014 for the following indicators:

- number of customers affected by an outage
- minutes lost in the outage
- contribution to SAIDI

The data is presented in bands of length of outage per customer ranging from '<= 5 minutes' through to '> 720 minutes' (more than 12 hours). SAIDI data for planned outages is weighted at 100 percent to allow consistent comparison of the effect on customers of planned and unplanned outages. (The EDB reliability incentives allocate a 50 percent weigh to planned outages.)

The key insights from the data summarised in the following charts are:

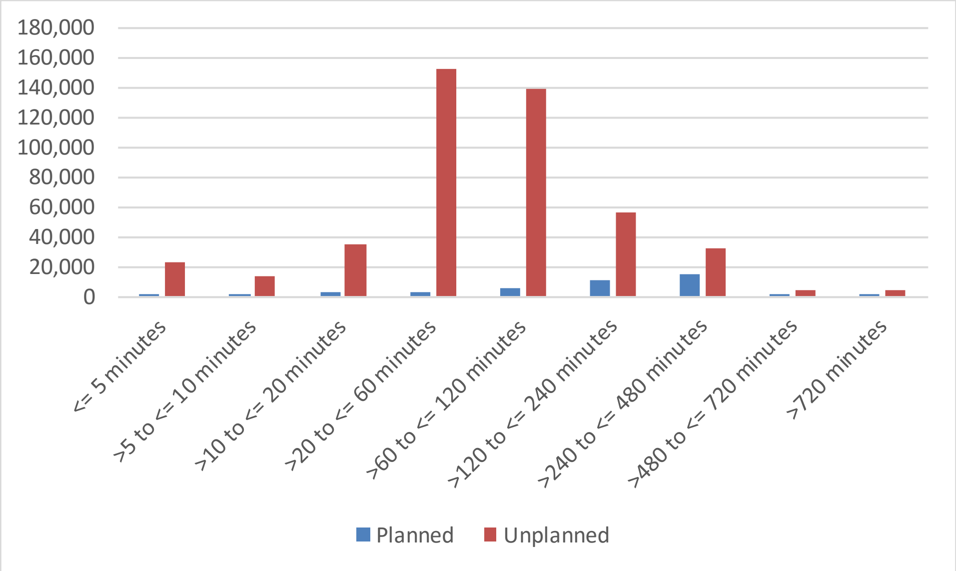
- unplanned outages are the main driver of loss of service to customers and on average they have affected about 16 times as many customers with loss of service about 7 times longer than planned outages
- most (about 62 percent) of customers affected by unplanned outages will a be without electricity for 20 to 120 minutes (see Figure 1)
- most (also about 62 percent) of the length of unplanned outages are from outages lasting 60 to 480 minutes and a further 20 percent affects much smaller groups of customers with outages of longer than 480 minutes (see Figure 2)
- about 59 percent of the contribution to total unplanned SAIDI is from outages lasting 60 to 480 minutes and a further 23 percent is from outages lasting more than 480 minutes (see Figure 3).

(The above analysis does not consider energy retailers, but they also receive a small benefit from the reduction in outages as their opportunity to sell electricity is interrupted less often. Also, the analysis in this section is based on averages but the severity of the impact on customers and energy retailers will be materially altered by the timing of outages particularly for outages shorter than 4 hours.)

2 This data was collected by the Commerce Commission for the 2014 EDB DPP reset and covered the period 1/4/2004 to 31/3/2014 for the 16 EDB covered by default price quality path. Orion was on a CPP at the time.

Figure 1 Number of customers affected by netwok ouatges

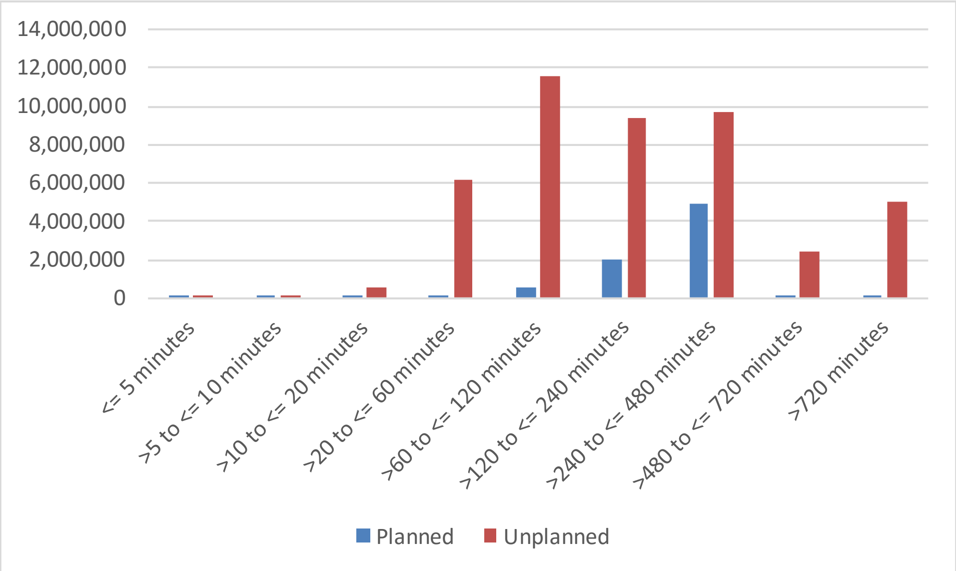
Average number per year for the period 2004 to 2014 over 16 EDB



Source: NZIER analysis EDB Interruption data 01/04/2004 to 31/03/2014

Figure 2 Length of outage in customer minutes

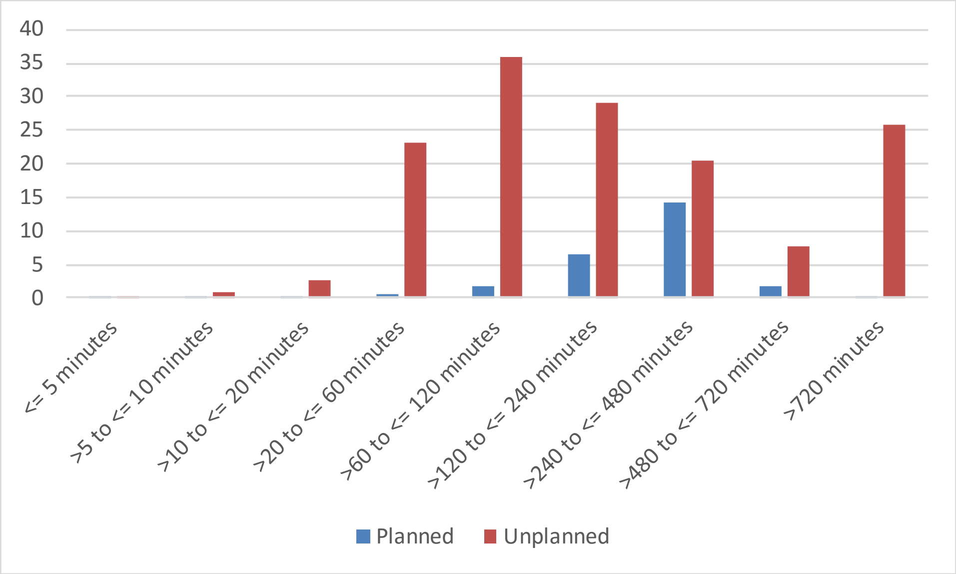
Average outage length per year for the period 2004 to 2014 over 16 EDB



Source: NZIER analysis EDB Interruption data 01/04/2004 to 31/03/2014

Figure 3 Contibution of outages to SAIDI

Average contribution per year for the period 2004 to 2014 over 16 EDB



Source: NZIER analysis EDB Interruption data 01/04/2004 to 31/03/2014

This analysis suggests network SAIDI is driven by a combination of two different types of outage:

- large groups of customers with short outages
- a small group of customers with protracted outages.

This suggests two implications for the consideration of EDB responses to reliability issues:

- the value customers attach to avoiding long outages is likely to be higher than for short outages (in addition to the difference in values for different customer segments)
- strategies available to EDB to reduce SAIDI should be a combination of preventing outages and reducing the duration of outages when they occur.

The data does not include the location or the time of the outage of classify the number of customers by connection type. Therefore, it is not possible to assess whether the outages are affecting the same or different groups of customers or to infer the volume of energy not delivered and the value the customer might attach to this loss of service – all useful elements in developing a cost benefit analysis of reliability measures.

The Commerce Commission has apparently requested[3] an update of this 'quality of service data' but the results are not yet available. Analysis of this data would inform the discussion of the review of EDB reliability standards.

A sample of the data for individual EDB is presented in Appendix A. These tables show variation in average outage rates across EDB. There has also been wide variation in outage rates for individual EDB over time. In the time available I have not been able to

3 See:' Default price-quality paths for electricity distribution businesses from 1 April 2020, Issues paper, 15 November 2018' Table 6.1, page 53

assess whether these changes represent fluctuations or a trend. However, these would be worthwhile questions to consider in the discussion of proposed changes in measurement of reliability and the setting of incentives to improve reliability.

2.4. Ability of EDB to influence reliability

The effectiveness of an EDB incentive to improve reliability depends on part their capacity to influence drivers of reliability. The linkages between network reliability and EDB expenditure (capital and operational) are complex with variable lags. However, the EDB reporting on the causes of outages (shown in the following table) provides a rough indication of cause of outages that they can influence.

Table 1 Cause of outages as measured by SAIDI

Average of SAIDI for selected causes as a percentage of average SAIDI over 2013 to 2018

EDB	Total Unplanned	Defective Equipment	Vegetation	Defective Equipment & Vegetation
	(SAIDI minutes)	(Share of Total Unplanned)		
Alpine Energy	261.43	13.8%	2.7%	16.5%
Aurora Energy	110.22	21.9%	22.1%	44.1%
Centralines	70.13	25.4%	26.0%	51.3%
EA Networks	226.63	20.2%	6.0%	26.2%
Eastland Network	494.67	9.4%	14.8%	24.1%
Electricity Invercargill	24.58	74.0%	0.0%	74.0%
Horizon Energy	301.84	24.3%	4.9%	29.2%
Nelson Electricity	19.80	36.1%	2.9%	39.0%
Network Tasman	108.79	18.7%	1.3%	20.0%
OtagoNet	209.77	45.9%	10.7%	56.5%
Orion NZ	148.47	20.2%	6.1%	26.4%
Powerco	208.74	42.2%	14.6%	56.8%
The Lines Company	184.01	41.0%	15.8%	56.7%
Unison Networks	125.34	12.4%	19.2%	31.6%
Vector Lines	196.59	48.5%	20.9%	69.3%
Wellington Electricity	78.21	20.4%	6.1%	26.5%

Source: EDB Information Disclosures

The root causes shown in the table above suggest that most of the EDB on a DPP can influence less than 30 percent of the level of outages and the remainder can influence at best 70 percent of outages through better management of equipment and vegetation. The data of the cause of the outages does not provide any indication of the amount of additional expenditure on vegetation management

2.5. Reliability incentive

The 2015 to 2020 DPP reliability incentive for EDB is set at 1 percent of maximum allowable revenue and allocated evenly between achievement of SAIDI and SAIFI targets for unplanned and planned outages. (The incentive for planned outages is set at 50 percent of the incentive for an unplanned outage.) The SAIDI and SAIFI targets are set individually for each EDB based on the average and standard deviation of SAIDI and SAIFI over the reference period 2004 to 2014.

Although the incentive is based on a simple set of rules for EDB, the wide difference in historical performance of EDB leads to a wide variation in quality standards and the range over which the incentive for individual EDB. Accordingly, the implied average cost to customers of achieving improved reliability varies widely across EDB.

The value that customers place on increased reliability will be based on what they use electricity for and their ability to temporarily substitute other sources of energy for electricity. These preferences are unlikely to vary across EDB in the same way as EDB network reliability. Therefore, there is a potential mis-match between the cost to customers of incentive driven changes in reliability and the value customers attach to the change in reliability.

To illustrate this, the following table converts the revenue at risk for changing SAIDI (shortening the length of an outage) into an implied average cost per MWh of energy delivered[4]. This cost can be compared to estimates of customer benefits of shortening an outage such as the $16,428 per MWh for residential customers and $39,723 per MWh for business customers presented by Powerco as part of its CPP application[5].

The estimated cost of the change in SAIDI varies from a minimum of $3,005 per MWh (less than 20 percent of the Powerco estimate of residential customer VoLL) to $21,381 per MWh (30 percent above the Powerco estimate or residential customer VoLL). For nearly all the EDB the incentive is lower than the Powerco estimate of residential customer VoLL.

However, if the incentive was increased from 1 percent to 5 percent (an option raised in the Issues paper) the cost of reducing SAIDI would be above the benefit to residential customers for all EDB except for Alpine Energy. (This calculation only applies to shortening an outage and does not allow for the component of the incentive earned by reducing the frequency of outages.)

4 The $/MWh cost of the reliability incentive is estimated by dividing the SAIDI incentive rate ($/SAIDI) by dividing average energy delivered per minute. Average energy delivered per minute is calculated as total energy delivered in 2015 divided by the number of minutes in a year

5 'Customised price-quality path (CPP), Consultation Report, 12 June 2017' p20

Table 2 VoLL equivalent of SAIDI reliability incentive

Quantities measured in units stated in each column

EDB	SAIDI incentive rate[1]	Average energy delivered[2]	VoLL comparator
	($ per SAIDI minute)	(MWh per minute)	($ per MWh)
Alpine Energy	7,134	1.48	4,830
Aurora Energy	31,741	2.37	13,376
Centralines	2,462	0.20	12,357
Eastland Network	3,560	1.18	3,005
Electricity Ashburton	9,080	0.53	17,060
Electricity Invercargill	9,620	0.49	19,620
Horizon Energy	4,285	0.98	4,388
Nelson Electricity	5,664	0.27	21,285
Network Tasman	8,100	1.13	7,185
OtagoNet	4,084	0.78	5,265
Powerco	57,526	8.50	6,764
The Lines Company	6,830	0.62	10,962
Top Energy	2,619	0.61	4,295
Unison Networks	45,378	2.96	15,345
Vector Lines	242,885	15.90	15,275
Wellington Electricity	95,091	4.45	21,381

Notes:

1. 'Default price-quality paths for electricity distributors from 1 April 2015 to 31 March 2020, Quality standards, targets, and incentives, Date of publication:28 November 2014', 'Table 8.2: Implied incentive rates by electricity distributor', page 39
2. 'EDB Information Disclosure, 9e(ii): System Demand, Total energy delivered to ICPs'

Source: NZIER

The reliability incentive is not based on customer expectations of service quality or willingness to pay for improved reliability. If the incentive was fully effective, then at best EDB would be expected to lift their individual SAIDI and SAIFI reliability measures to one standard deviation above their long run historical average. The size of the improvement for 1 percent of their revenue would depend on how widely their reliability performance varied over the reference period.

Cap and collar incentives that are customised for individual EDB based on averages and variances over a reference period are simple to define and calculate but do not consider or reflect customer preferences let alone the benefits to customers of the incentive.

2.6. Commerce Commission questions

The comments on the incidence of outages and cost of reliability incentives in the previous sections are the basis for the comments on the Commerce Commission questions about quality standards in the following tables.

Table 3 Quality standards relating to reliability

Question	Comment
X20 We invite views as to whether planned interruptions should be assigned a lower weighting or be treated as a separate quality standard	Planned interruptions should be treated as a separate quality standard as their impact and characteristics are different from unplanned interruptions. (Planned interruptions affect fewer customers or longer periods than unplanned interruptions).
X21 We are considering whether the buffer between the SAIDI and SAIFI limits and the SAIDI and SAIFI historical average should change.	Discussion of these issues needs to be informed by an update of the reference dataset so the impact of the proposed change on reliability levels can be compared.
X22 We considering the appropriateness of updating the reference period to the most recent 10 years, and we are open to suggestions as to the best means of doing this. We are also considering removing the most extreme years from the reference dataset.	
X23 We are considering alternative approaches to determining a quality standard contravention.	
X24 We are considering additional reporting requirements for DPP3 when an EDB contravenes its quality standard. This would assist our understanding of the reasons for the contravention, the state of its network, and the responses it has taken to address the worsening reliability performance.	Supported.

Source: NZIER

Table 4 Quality incentive scheme

Question	Response
X25 We consider that a cost-quality trade-off between distributors and consumers is still relevant. However, we are seeking views on the value of the revenue-linked incentive scheme for SAIDI and SAIFI.	As discussed in detail in section 2.5 above the cost of the incentive is not aligned with the benefit to the consumer. An incentive based on the VoLL is more likely to ensure the incentive reflects the benefit of improved reliability to consumers than a uniform percentage of maximum allowable revenue. Further analysis is required of the costs and benefits of reducing the frequency of unplanned outages and how this incentive combines with the incentive to reduce SAIDI.
X26 We are seeking views on raising the total revenue at risk from 1% to up to 5%.	As illustrated in Table 2 above, the cost of the current incentive for shortening an outage is below the estimated benefit to customers for most EDB. Increasing the incentive by a factor of five would lift the cost of the incentive for shortening an outage above the benefit for residential customers for all EDB except Alpine Energy.
X27 We are seeking views on widening the SAIDI and SAIFI cap and collar band from one standard deviation to up to two standard deviations from the historical average. We also consider that the caps applicable to the incentive scheme should be consistent with the limits applicable to the quality standard.	Setting the cap and collar based on the standard deviation for each EDB means that for EDB with historically stable reliability measures the incentive is absorbed over a narrow range of changes in reliability while for EDB with historically volatile reliability measures the same incentive is spread over a much wider range of reliability outcomes. If the objective of the incentive is to improve reliability at a cost less than the benefit to consumers it may be more useful to consider alternatives such as EDB nominating caps above the one standard deviation limit and collars that are closer to the average than the cap.
X28 We are considering the option of explicitly setting the incentive rate, for example, with reference to the value of lost load (VoLL).	Supported subject to consultation on how VoLL would be estimated.
X29 We are considering whether to include notifications of planned interruptions and new connection measures within the quality incentive scheme.	This should be considered along with other options such as including a service standard in the Electricity Authority's proposed Default Distribution Agreement along with non-performance penalties paid to affected consumers.

Source: NZIER

Table 5 Normalisation

Question	Response
X30 We are considering whether to continue using the 23rd highest daily unplanned SAIDI and SAIFI, assuming a 10-year reference period, for the boundary values.	Discussion of these issues needs to be informed by an update of the reference dataset so the impact of the proposed change on reliability levels can be compared.
X31 If feasible, we will consider identifying an unplanned major event day based on a rolling 24-hour period. We will also consider the practicality of aggregating multi-day events attributable to extreme weather events and disasters.	These issues need more detailed analysis. As discussed in section 2.3 customers experiencing outages longer than 4 hours account for 23 percent of SAIDI (and customers experiencing outages longer than 6 hours account for 18 percent of outages). I have not been able to establish how many of the long outages in the 2004-2014 data set are related to severe weather events or how the number of these outages has changed over 2015 to 2018.
X32 We invite views on what actions should be taken when a major event day is triggered. Our starting point is that we should retain the replacement of any major SAIDI or SAIFI event day with the applicable boundary value. This ensures there is a limit on how much risk an EDB is exposed to during a major event without removing it completely.	

Source: NZIER

3. Reduction of losses

3.1. Introduction

The issues paper includes a discussion of the potential for incentives for EDB to reduce line losses possibly using a cap and collar analysis. The potential to reduce losses arises from three types of equipment investment (capacitors, conductors and transformers). The consideration of this proposal is a good opportunity for the Commerce Commission to analyse the following questions:

- benefits (and costs) of the incentive to customers
- link between EDB investment and change in performance
- approaches to incentive design (other cap/collar tailored to individual EDB) that are based on reaching a standard rather than incremental change to historical performance

3.2. Benefit to customers?

In contrast to the increased system reliability incentives discussed above:

- the value of the benefit from reduced line losses is easy to quantify both in aggregate and by customer group (based on their use of high, medium and low voltage parts of the network)
- electricity users do not benefit directly from reduction in line losses but are dependent on their energy retailer passing on the value of reduced line losses to then through lower energy prices. (At best the benefit to the consumer is the cost to the retailer of the line losses.)[6]

The Issues Paper notes that the line losses for 2018 represents about $140 million (see quote in section 3.4 below). However, the amount of this cost that could be reduced by using cap and collar incentives along the same lines as the reliability incentive is probably less than 10 percent of this amount.

3.3. EDB investment and line losses

The type and level of EDB investment required to reduce line losses will depend on both the health of the network assets and the mix and density of electricity users. The EDB information disclosures provide an indication of the variation in network density across EDB but very little guidance on how well assets are matched to load or how investment to reduce line losses could co-ordinated efficiently with the replacement of conductors and transformers[7].

6 Analysis of the variation in energy retailer price plans driven by EDB price differences would be a useful contribution to the assessment of the likelihood that line-loss reduction benefits will be passed-on to electricity users particularly if they vary widely across EDB. Arguably, the price reduction that electricity users and regulators could expect to see from line loss reductions is easiest to identify if all EDB are achieving the same percentage reduction in line losses across all electricity user groups. The more variation in line loss reduction that there is across EDB and customer groups the harder it is to define and monitor the expected price reduction for

7 Also, there does not seem to be any simple indicator of how the investment required to reduce line losses increases as the average rate of line loss falls.

3.4. Historical cap and collar approach?

The following table shows the average and standard deviation for line losses for individual EDB subject to DPP (or CPP) over 2013 to 2018. The weighted[8] average line loss over the period is 4.75 percent and the variation in line losses between EDB is much wider than the variation in line losses for each EDB over 2013 to 2018.

The following table gives an indication of the potential value of line loss reductions if the reliability incentive approach (one standard deviation around the historical mean for each EDB) was combined with the comments in the issues paper about the value of line losses quoted below[9]:

> *According to information disclosure data, aggregate distribution line losses reported by the non-exempt EDBs for the year to 31 March 2018 were 1,576 GWh, representing 4.7% of electricity entering the EDB networks. Although this is slightly lower than the losses reported by the ENA (5.4% in 2011), this represents a significant monetary amount (annual $137 million, based on a wholesale price of $87/MWh).[187]*
>
> *187 The average wholesale price over the 12 months to 31 March 2018 reported at: https://www.emi.ea.govt.nz/Wholesale/Reports/W_P_C*

The 'reliability incentive approach' calculates the benefit from reducing line losses by one standard deviation of the line loss rates over 2013 to 2018.

As a comparator to the 'reliability incentive approach' the table also includes an incentive based on the following simple rule - If average line losses for an individual EDB are:

- at or below the average for all EDB no reduction in line losses
- above the average for all EDB the incentive is set the value of a reduction in line losses at 30 percent of the difference between the average for the EDB and the average for all EDB subject to DPP (or CPP).

The incentives under both approaches are estimated to be about $10 million but for the comparator affect only 10 out of 17 EDB.

8 For this example, the weighted average line loss is calculated as the simple average of line losses over 2013-18 for each EDB weighted by the simple average of the energy delivered by each EDB over 2013 to 2018.

9 See: 'Default price-quality paths for electricity distribution businesses from 1 April 2020, Issues paper, 15 November 2018', page 137 paragraph F24.

Table 6 Incentives to reduce line losses for EDB

Comparison of incentives based on 'one standard deviation' with 'reduction toward DPP average'

EDB	Electricity entering system (Average GWh)	Electricity loss ratio (Average)	Electricity loss ratio (One standard deviation)	Value of reducing loss ratio by one standard deviation ($m)	Value of reducing loss ratio by 30percent if above DPP average ($m)
Alpine Energy	787	3.61%	1.7%	1.16	0.00
Aurora Energy	1,358	6.14%	0.7%	0.86	1.64
Centralines	115	8.35%	0.7%	0.07	0.25
EA Networks	611	7.34%	2.0%	1.09	1.17
Eastland Network	304	8.10%	1.4%	0.38	0.64
Electricity Invercargill	273	5.40%	0.2%	0.04	0.16
Horizon Energy	551	4.73%	0.4%	0.18	0.00
Nelson Electricity	146	3.78%	0.3%	0.04	0.00
Network Tasman	639	5.66%	0.5%	0.26	0.51
Orion NZ	3,236	4.19%	0.1%	0.21	0.00
OtagoNet	435	4.46%	0.7%	0.27	0.00
Powerco	4,809	5.55%	0.5%	1.92	3.35
The Lines Company	374	7.59%	1.2%	0.40	0.74
Top Energy	358	9.54%	0.6%	0.20	0.89
Unison Networks	1,661	4.94%	0.5%	0.66	0.29
Vector Lines	8,684	3.77%	0.2%	1.47	0.00
Wellington Electricity	2,453	4.27%	0.4%	0.79	0.00

Source: NZIER

Appendix A Interruption data

A.1 Introduction

The following tables include the data for the 16 individual EDB used in Figure 1, Figure 2 and Figure 3. The data shown in the charts is the weighted average row at the bottom of each table and the weights are the number of ICP shown in the second column of the table.

Table 7 Number of customers affected by planned netwok outages

Average number per year for the period 2004 to 2014 over 16 EDB

EDB	ICP	<= 5 minutes	>5 to <= 10 minutes	>10 to <= 20 minutes	>20 to <= 60 minutes	>60 to <= 120 minutes	>120 to <= 240 minutes	>240 to <= 480 minutes	>480 to <= 720 minutes	>720 minutes
Alpine Energy	30,079	511	58	220	1,234	701	1,361	2,896	77	8
Aurora Energy	80,157	360	123	271	1,418	1,479	2,313	1,524	48	5
Centralines	8,023	50	30	121	371	210	280	987	27	2
Eastland Network	25,236	265	263	376	1,545	2,037	2,243	2,027	159	58
Electricity Ashburton	17,049	6	18	52	358	404	1,008	3,021	94	10
Electricity Invercargill	17,071	0	7	17	24	18	74	155	2	0
Horizon Energy	24,292	11	55	167	445	670	1,176	495	24	5
The Lines Company	22,423	1,515	713	561	1,546	2,004	2,594	3,217	163	14
Nelson Electricity	8,975	171	10	5	97	133	217	252	2	0
Network Tasman	35,751	842	644	224	805	1,159	2,096	3,057	23	0
OtagoNet	14,696	123	46	147	496	1,130	3,089	5,057	20	5
Powerco	313,246	453	799	871	6,718	8,428	13,292	20,876	985	22
Top Energy	30,056	295	754	367	1,453	1,195	2,350	1,682	2,573	47
Unison Networks	107,109	2,007	1,041	1,502	3,732	4,404	6,654	5,308	121	31
Vector Lines	518,947	1,395	1,656	2,203	3,931	4,552	11,256	10,992	311	23
Wellington Electricity	162,147	58	52	89	221	369	476	180	20	0
Total for DPP EDB	**1,415,258**	**8,062**	**6,267**	**7,192**	**24,394**	**28,891**	**50,478**	**61,725**	**4,647**	**230**
Weighted average		**861**	**927**	**1,179**	**3,466**	**4,162**	**8,040**	**9,528**	**410**	**19**

Source: NZIER analysis EDB Interruption data 01/04/2004 to 31/03/2014

Table 8 Length of planned outage in customer minutes

Average outage length per year for the period 2004 to 2014 over 16 EDB

EDB	ICP	<= 5 minutes	>5 to <= 10 minutes	>10 to <= 20 minutes	>20 to <= 60 minutes	>60 to <= 120 minutes	>120 to <= 240 minutes	>240 to <= 480 minutes	>480 to <= 720 minutes	>720 minutes
Alpine Energy	30,079	1,697	389	3,301	50,163	67,937	237,540	1,063,884	38,721	10,542
Aurora Energy	80,157	1,044	897	4,096	59,480	127,914	414,369	500,423	25,094	7,331
Centralines	8,023	126	213	1,884	12,952	19,415	49,722	354,261	13,889	2,212
Eastland Network	25,236	558	1,921	5,871	65,364	188,841	395,668	667,712	87,493	78,357
Electricity Ashburton	17,049	28	125	838	15,012	35,227	175,136	1,121,686	49,906	8,896
Electricity Invercargill	17,071	0	49	241	1,219	1,619	13,318	51,901	907	0
Horizon Energy	24,292	17	426	2,655	18,718	60,818	217,902	162,760	12,971	3,843
The Lines Company	22,423	4,546	5,389	8,863	61,786	178,989	444,404	1,063,040	88,283	15,148
Nelson Electricity	8,975	586	69	83	3,801	10,878	35,932	83,026	1,187	0
Network Tasman	35,751	3,188	4,830	3,474	31,238	102,511	368,342	969,810	11,771	400
OtagoNet	14,696	519	405	2,291	19,849	103,247	579,663	1,572,573	10,757	4,654
Powerco	313,246	1,278	5,247	13,710	268,031	771,402	2,400,362	6,985,503	518,808	24,947
Top Energy	30,056	688	5,068	6,183	53,158	111,530	433,915	634,827	1,345,228	52,923
Unison Networks	107,109	5,073	8,078	23,462	145,335	391,059	1,192,564	1,669,645	63,403	79,178
Vector Lines	518,947	3,129	12,665	34,672	156,182	413,411	2,075,867	3,378,954	164,070	23,223
Wellington Electricity	162,147	153	448	1,495	9,025	32,284	81,344	61,790	10,193	182
Total for DPP EDB	**1,415,258**	**22,632**	**46,219**	**113,119**	**971,312**	**2,617,084**	**9,116,048**	**20,341,795**	**2,442,682**	**311,836**
Weighted average		**2,115**	**6,892**	**18,555**	**137,945**	**378,212**	**1,465,712**	**3,072,053**	**216,060**	**23,695**

Source: NZIER analysis EDB Interruption data 01/04/2004 to 31/03/2014

Table 9 Contibution of planned outages to SAIDI (rated at 100 percent rather than the 50 percent)

Average contribution per year for the period 2004 to 2014 over 16 EDB

EDB	ICP	<= 5 minutes	>5 to <= 10 minutes	>10 to <= 20 minutes	>20 to <= 60 minutes	>60 to <= 120 minutes	>120 to <= 240 minutes	>240 to <= 480 minutes	>480 to <= 720 minutes	>720 minutes
Alpine Energy	30,079	0.06	0.01	0.11	1.68	2.24	7.88	35.18	1.29	0.35
Aurora Energy	80,157	0.01	0.01	0.05	0.75	1.60	5.14	6.14	0.31	0.09
Centralines	8,023	0.02	0.03	0.23	1.57	2.38	6.11	43.76	1.72	0.27
Eastland Network	25,236	0.02	0.08	0.23	2.58	7.44	15.62	26.31	3.45	3.07
Electricity Ashburton	17,049	0.00	0.01	0.05	0.89	2.06	10.32	66.17	3.10	0.56
Electricity Invercargill	17,071	0.00	0.00	0.01	0.07	0.10	0.78	3.01	0.05	0.00
Horizon Energy	24,292	0.00	0.02	0.11	0.77	2.51	9.01	6.70	0.53	0.16
The Lines Company	22,423	0.19	0.22	0.40	2.81	8.37	20.80	48.40	4.02	0.62
Nelson Electricity	8,975	0.06	0.01	0.01	0.43	1.22	4.02	9.26	0.13	0.00
Network Tasman	35,751	0.09	0.13	0.10	0.87	2.86	10.28	26.88	0.32	0.01
OtagoNet	14,696	0.04	0.03	0.16	1.35	7.06	39.63	107.07	0.73	0.31
Powerco	313,246	0.00	0.02	0.04	0.86	2.45	7.61	22.02	1.65	0.08
Top Energy	30,056	0.02	0.16	0.20	1.76	3.80	14.57	21.24	43.67	1.76
Unison Networks	107,109	0.05	0.07	0.22	1.35	3.65	11.15	15.57	0.59	0.74
Vector Lines	518,947	0.01	0.02	0.07	0.30	0.79	3.94	6.39	0.31	0.04
Wellington Electricity	162,147	0.00	0.00	0.01	0.06	0.20	0.50	0.38	0.06	0.00
Total for DPP EDB	**1,415,258**	**0.57**	**0.83**	**1.99**	**18.09**	**48.72**	**167.35**	**444.48**	**61.94**	**8.08**
Weighted average		**0.02**	**0.03**	**0.08**	**0.69**	**1.85**	**6.43**	**14.27**	**1.70**	**0.22**

Source: NZIER analysis EDB Interruption data 01/04/2004 to 31/03/2014

Table 10 Number of customers affected by unplanned netwok outages

Average number per year for the period 2004 to 2014 over 16 EDB

EDB	ICP	<= 5 minutes	>5 to <= 10 minutes	>10 to <= 20 minutes	>20 to <= 60 minutes	>60 to <= 120 minutes	>120 to <= 240 minutes	>240 to <= 480 minutes	>480 to <= 720 minutes	>720 minutes
Alpine Energy	30,079	2,192	778	1,797	14,918	9,790	5,507	3,553	622	1,774
Aurora Energy	80,157	8,576	8,860	17,204	38,106	20,813	9,099	2,220	886	349
Centralines	8,023	8,559	3,439	6,104	7,963	2,948	824	111	24	75
Eastland Network	25,236	2,580	6,233	11,208	32,342	16,588	6,770	2,808	623	722
Electricity Ashburton	17,049	221	323	1,293	11,330	10,419	2,404	1,060	216	1,362
Electricity Invercargill	17,071	1,169	984	3,049	6,801	1,156	335	137	82	0
Horizon Energy	24,292	1,870	2,646	5,144	16,569	14,596	5,918	1,225	333	410
The Lines Company	22,423	14,654	9,012	7,227	14,326	10,302	6,319	2,378	459	537
Nelson Electricity	8,975	208	86	42	3,217	1,108	650	14	0	1
Network Tasman	35,751	648	881	1,660	18,061	13,713	7,097	2,361	333	47
OtagoNet	14,696	3,629	2,310	3,710	10,124	7,940	3,792	1,259	637	103
Powerco	313,246	43,957	51,371	82,734	248,558	180,469	75,000	29,617	6,601	10,230
Top Energy	30,056	11,015	7,405	24,211	56,412	39,176	19,667	10,151	1,692	1,216
Unison Networks	107,109	41,662	13,827	23,154	76,463	29,849	12,480	4,526	729	891
Vector Lines	518,947	53,453	29,789	41,431	229,418	219,176	86,506	27,540	5,422	5,908
Wellington Electricity	162,147	7,991	2,516	6,213	33,257	33,336	9,191	2,145	584	1,591
Total for DPP EDB	**1,415,258**	**202,384**	**140,460**	**236,179**	**817,864**	**611,378**	**251,560**	**91,103**	**19,241**	**25,215**
Weighted average		**34,595**	**24,685**	**38,065**	**154,342**	**129,910**	**51,951**	**17,855**	**3,713**	**4,811**

Source: NZIER analysis EDB Interruption data 01/04/2004 to 31/03/2014

Table 11 Length of unplanned outage in customer minutes

Average outage length per year for the period 2004 to 2014 over 16 EDB

EDB	ICP	<= 5 minutes	>5 to <= 10 minutes	>10 to <= 20 minutes	>20 to <= 60 minutes	>60 to <= 120 minutes	>120 to <= 240 minutes	>240 to <= 480 minutes	>480 to <= 720 minutes	>720 minutes
Alpine Energy	30,079	6,459	5,044	28,184	592,450	820,484	962,960	1,092,195	354,943	4,688,718
Aurora Energy	80,157	21,940	72,141	259,815	1,456,561	1,703,088	1,447,770	700,700	513,606	360,922
Centralines	8,023	21,777	25,835	97,370	278,651	239,049	136,244	38,301	13,091	94,940
Eastland Network	25,236	10,216	51,192	169,332	1,152,589	1,337,808	1,164,313	923,650	342,605	867,962
Electricity Ashburton	17,049	902	2,522	19,853	458,177	862,821	385,320	358,306	119,880	3,792,396
Electricity Invercargill	17,071	4,443	8,304	46,313	251,244	94,986	50,433	38,259	39,686	1,117
Horizon Energy	24,292	7,956	21,662	76,074	651,003	1,228,948	962,256	391,999	210,089	476,051
The Lines Company	22,423	36,576	73,774	99,396	526,497	902,430	1,055,129	777,894	254,725	618,237
Nelson Electricity	8,975	539	681	723	148,621	85,750	118,335	4,919	0	3,055
Network Tasman	35,751	1,921	6,635	21,832	735,584	1,138,902	1,126,461	703,919	180,911	61,409
OtagoNet	14,696	12,702	17,864	57,719	393,363	675,266	612,050	429,601	337,626	169,812
Powerco	313,246	133,090	410,837	1,244,106	9,986,253	14,901,000	12,319,280	9,368,070	3,807,477	13,503,151
Top Energy	30,056	32,344	57,702	366,878	2,099,730	3,336,011	3,267,372	3,334,034	967,949	1,514,217
Unison Networks	107,109	98,163	98,259	339,577	2,785,179	2,446,453	2,065,349	1,555,588	422,806	1,220,135
Vector Lines	518,947	143,388	247,497	646,332	9,571,715	18,317,831	13,962,335	8,713,920	3,083,993	7,491,001
Wellington Electricity	162,147	23,174	21,017	90,388	1,430,388	2,779,203	1,523,062	669,424	351,737	1,679,572
Total for DPP EDB	**1,415,258**	**555,591**	**1,120,966**	**3,563,893**	**32,518,005**	**50,870,031**	**41,158,668**	**29,100,780**	**11,001,126**	**36,542,695**
Weighted average		**2,115**	**6,892**	**18,555**	**137,945**	**378,212**	**1,465,712**	**3,072,053**	**216,060**	**23,695**

Source: NZIER analysis EDB Interruption data 01/04/2004 to 31/03/2014

Table 12 Contibution of unplanned outages to SAIDI

Average contribution per year for the period 2004 to 2014 over 16 EDB

EDB	ICP	<= 5 minutes	>5 to <= 10 minutes	>10 to <= 20 minutes	>20 to <= 60 minutes	>60 to <= 120 minutes	>120 to <= 240 minutes	>240 to <= 480 minutes	>480 to <= 720 minutes	>720 minutes
Alpine Energy	30,079	0.21	0.17	0.95	19.74	27.00	31.68	35.90	11.58	155.90
Aurora Energy	80,157	0.27	0.90	3.25	18.27	21.30	18.01	8.64	6.42	4.43
Centralines	8,023	2.72	3.23	12.37	35.07	29.76	17.06	4.93	1.61	11.52
Eastland Network	25,236	0.40	2.03	6.71	45.67	53.24	46.15	36.50	13.56	34.38
Electricity Ashburton	17,049	0.05	0.15	1.20	26.66	50.48	22.16	20.50	7.03	226.17
Electricity Invercargill	17,071	0.26	0.49	2.71	14.69	5.56	2.97	2.22	2.34	0.06
Horizon Energy	24,292	0.33	0.89	3.13	26.81	50.62	39.57	16.22	8.63	20.00
The Lines Company	22,423	1.67	3.45	4.58	23.50	41.22	47.69	35.09	11.96	27.62
Nelson Electricity	8,975	0.06	0.08	0.08	16.55	9.59	13.13	0.54	0.00	0.34
Network Tasman	35,751	0.05	0.19	0.61	20.61	31.91	31.44	19.87	5.08	1.69
OtagoNet	14,696	0.87	1.22	3.92	26.82	45.92	41.61	29.18	22.92	11.54
Powerco	313,246	0.43	1.32	3.98	31.97	47.59	39.31	29.84	12.10	43.06
Top Energy	30,056	1.07	1.93	12.15	69.83	111.29	108.12	110.61	32.41	50.94
Unison Networks	107,109	0.92	0.92	3.19	26.11	22.95	19.27	14.51	3.96	11.28
Vector Lines	518,947	0.28	0.48	1.25	18.56	35.46	26.97	16.75	5.98	14.48
Wellington Electricity	162,147	0.14	0.13	0.56	8.80	17.13	9.35	4.10	2.14	10.21
Total for DPP EDB	**1,415,258**	**9.75**	**17.57**	**60.64**	**429.65**	**601.03**	**514.49**	**385.42**	**147.72**	**623.62**
Weighted average		**0.40**	**0.80**	**2.53**	**23.05**	**36.04**	**29.08**	**20.51**	**7.78**	**25.86**

Source: NZIER analysis EDB Interruption data 01/04/2004 to 31/03/2014