PATHWAY TO QUALITY

QUALITY OF SUPPLY AND INCENTIVES WORKING GROUP REPORT

FEBRUARY 2014

EXECUTIVE SUMMARY

Timing and scope of the review

In 2013, the Commerce Commission (the Commission) signalled an intention to review the quality framework as part of the Default Price Path (DPP) reset for the second regulatory control period (RCP2[1]). The Electricity Networks Association (ENA) Board identified an opportunity to assess the need for refining the current arrangements and to ensure that the regulatory regime is developed in a way that creates a long term incentive for Electricity Distribution Businesses (EDBs or distributors) to deliver services that reflect the outcomes sought by consumers. Accordingly, in July 2013, the ENA Board established the Quality of Supply and Incentive (QoSI) Working Group[2] (the Working Group) in agreement with the Commission, to review possible refinements to the current network performance metrics used for price-quality regulation. Representatives from the Commission and the Electricity Authority (EA) have attended Working Group meetings in the capacity of observers.

The Working Group had a broad remit to review the following:

- The service characteristics that consumers value the most;
- The cost quality trade-off sought by customers i.e. what level of service do customers value both now and going forward;
- The means to measure the aspects of quality that are important to consumers;
- The benchmark[3] against which performance can be measured (the quality path);
- The normalisation of data and identification of exclusions of extreme events that are "largely" outside the control of EDBs so as to enable the identification of the underlying longer term trends in performance;
- Incentives that align with the quality cost trade-off;
- The availability and disclosure of information; and
- Implementation considerations for:
    a) the DPP for RCP2; and
    b) longer term post 2020 (RCP3[4] and beyond).

Note that the focus of the Working Group has been on quality aspects of a DPP (not CPP) although some of the observations and suggestions are also relevant under a CPP.

Process followed

The material in this paper has been developed from a combination of direct analysis undertaken by the Working Group members, a review of international practices, feedback from consumer surveys

[1] RCP2 spans 1 April 2015 to 31 March 2020.
[2] For Working Group members please refer to Section 1.
[3] "Benchmark" is utilised in this report to refer to the performance standard being sought from a particular company. It does not refer to performance benchmarking between companies nor a comparison of their relative performance.
[4] RCP3 is assumed to span 1 April 2020 to 31 March 2025.

undertaken by EDBs and through direct discussions with consumer representatives. In November 2013, a public stakeholder seminar was held to present the Working Group's preliminary conclusions. The seminar was well attended by over sixty delegates representing a broad spectrum of stakeholder interests. A number of observations on the process are highlighted:

- In light of the time constraint, it was necessary to develop a number of "informed" working assumptions on the relative value that consumers place on different output measures. It is recommended that the Commission consult further on this area as part of the DPP reset.
- During the next regulatory period, as an extension to the Working Group terms of reference, the ENA intends to put in place a longer term initiative to explore (and quantify) value preferences of different consumer groups.

Recommendations / Issues / Suggestions for further consideration

The conclusions and recommendations reached from this work regarding the regulatory quality regime for the DPP cover three areas:

- General observations;
- Recommendations for the DPP Reset (RCP2); and
- Suggestions / development opportunities for RCP3 and beyond.

Each or these are described below.

General observations

The following are the general observations and conclusions from the Working Group's deliberations to date:

- Having an agreed definition of what is meant by "quality" is important – the Working Group's working definition was that "quality" was broader than just reliability and extended to wider measures of customer services.
- Further work is recommended to confirm the Working Group's assessment of consumer value preferences with respect to quality outcomes.
- A working assumption was that the intention of the quality standard under a DPP is to identify material deterioration in the performance of the network. This is important when considering such things as the data set used to determine targets around agreed measures and it is noted that there is no specific requirement (under the Input Methodologies) for the quality path to be defined in this way.
- The Working Group identified that the highest valued aspects of the service provided to consumers fall into three broad categories:
    a) Reliability and resilience - quantitative measures utilised to reflect the level and duration of interruptions experienced by customers;
    b) Customer service - the qualitative aspects of the service provided by EDBs; and

c) Power quality - quantitative measures that demonstrate power quality falls within statutory limits.

- Three aspects of reliability and resilience most highly valued by consumers relate to:
  - Duration of interruptions;
  - The number of interruptions; and
  - The time it takes to respond to a power cut.
- At a general level SAIDI[5] and SAIFI[6] should be retained as core measures of "quality" as of the measures currently available they best reflect what customers' value most highly.
- International incentive regimes have evolved from pass / fail arrangements, similar to what NZ currently utilises, to more sophisticated incentive based regimes. NZ should learn from aspects of both the UK and Australian frameworks in order to expedite the development of our regulated quality framework.
- The basis on which EDB performance could be incentivised is a critical aspect of the quality regime. If an incentive mechanism is appropriate and practical the services delivered to consumers will more likely reflect the outcomes sought - if not then there is potential of perverse results. There are also many options for developing the incentive regime. Some of the dimensions for the Commission to consider are:
  - Whether the incentives should be uni or bi-directional.
  - Whether the incentives should be applied to customers as a group (network wide), individually or both.
  - Whether the incentives should be linked to an EDB's revenue.
  - The level of the incentive rate. Incentives need to encourage efficient behaviour and not inefficient outcomes.
  - The alignment of the incentives with the value associated with different quality outcomes (interruptions compared with customer service).
  - The total value of the incentives – through establishing caps and collars.
- Whilst the report presents a number of options and recommendations for further consideration by the Commission, it is important that any new arrangements, prior to implementation, are rigorously stress tested from the perspective of: a) the costs and benefits; b) data availability; and c) the incentives that any changes create (both positive and negative).
- The importance of Information Disclosure (ID) as a mechanism to operate alongside quality path measures and targets is noted. When considering the potential for extending the range of "quality measures" (especially over the longer term) it is important to consider whether these measures best sit as part of the quality path itself or as part of an extended information disclosure. The report makes several recommendations in this regard.
- Improvements should be targeted at delivering achievable refinements that provide the most effective value to consumers in the shorter term while providing a pathway to a

[5] System Average Interruption Duration Index
[6] System Average Interruptions Frequency Index

longer term higher value framework. With twenty nine EDBs and a small population base, resources are significantly limited when compared to international counterparts. Therefore improvements should be targeted on areas which yield the highest value first. The Working Group suggests that this would primarily consist of implementing a revenue linked incentive scheme, the weighting of planned outages relative to unplanned and simplifying the data normalisation approach around MED definitions.

- Sufficient time should be allowed for all EDBs to develop data sets suitable for establishing new benchmarks / measures relevant within the New Zealand context. This would include the further development of disaggregated interruption measures and development of customer service metrics. This approach would also allow sufficient opportunity to review and develop appropriate definitions for new measures.

Suggestions for quality under a DPP in RCP2 (2015 to 2020)

The following are the Working Groups' recommendations for quality under a DPP in RCP2:

- For practical reasons reporting in RCP2 should continue to be based on network averages.
- SAIDI and SAIFI should continue to include both planned and unplanned interruptions but to reduce the current perverse incentive a weighting should be introduced for planned outages that recognises the lower impact that planned outages have on consumers (predicated on sufficient notice period).
- Targets could be based on performance over a fixed historical period or based on a rolling historical period. For simplicity and consistency with the "no deterioration" intent, a fixed "historical" period should be retained for establishing performance limits. This creates certainty for both EDBs and consumers. However, the case for maintaining the five year average period (or moving to an alternative duration) should also be tested further. In particular serious consideration should be made to utilising data from a longer timeframe, such as 10 years or more, to provide more representative data set.
- Issues with normalisation around SAIDI data impact some EDBs more than others – ie. normalisation is less effective for small underground networks. The drivers for change are influenced by whether or not the framework transitions from a pass / fail to an incentive based regime. As a minimum consideration should be given to include only non-zero days, and exclude and /or adjust the event day criteria. It is recommended that the Commission review the original reason for specifying the boundary and MED arrangements as they currently stand.
- An alternative to MEDs is to define a boundary value based on a multiple of the average number of daily interruptions experienced in each network. This simplifies the definition and is equivalent to using MEDs.
- One significant change to the current quality regime which could be implemented for RCP2 is a shift away from a blunt pass / fail regime to one based on incentives (i.e. revenue pain / gain) established around a target cap and collar for SAIDI and /or SAIFI. Whilst the majority of Working Group members support such a move this is an area which would require wider consultation by the Commission and consideration of the possible perverse incentives which could arise especially during the transition period (i.e. setting targets

based on historical averages potentially rewards EDBs that have not made quality improvements in the past). In any event phasing the incentive rate from an initial weak incentive during RCP2 is recommended (ie establish the framework first then develop the incentive).

Suggestions for quality under a DPP over the longer term - (post 2020)

The following are the Working Groups' suggestions for further consideration under the DPP over the long term:

- The Working Group identified that disaggregating the current interruptions measures and / or extending the measures to include new metrics could provide a more meaningful picture of overall network performance but that this should be a longer term objective (for RCP3).
- By way of example any of the methods for reporting on interruptions can be disaggregated to a more granular level of detail in order to better measure the distinction in service received by customers of different classes or location and if necessary to support the development of a composite basket of measures that may reflect important distinctions in the services delivered.
- Options include reporting interruptions by:
  - Planned or unplanned;
  - Voltage level;
  - Cause of the interruption (human error, lightening etc...);
  - Location impacted (CBD, Urban, Rural etc.);
  - Network type (underground, overhead);
  - Network area (averaged across GXPs that supply the same interconnected network);
  - Company (as per the current regime);
  - Interruptions per x kilometres;
  - Duration (grouped into bands e.g. greater than or less than x hours);
  - Customer density (grouped into bands of interruptions that impacted on a network with x customers per y km);
  - Customers impacted (commercial, residential, industrial);
  - Customer interruption duration curve or by customer percentile; and
  - Feeder (ranking, by worst served, or by type).
- Quality reporting could also be extended to include broader customer service aspects such as:
  - Providing information on reasons for and the likely duration and the extent of a power cut;
  - Processing applications for new connections; and

  - Sufficient notice of planned shutdowns.

- It is noted that in the United Kingdom (UK) and Australia such "customer service" measures are included, however, currently New Zealand does not have any customer service related measures under the DPP regime.
- In terms of power quality, there are a number of options as to how this could be measured however, as in other jurisdictions there are statutory requirements to maintain power quality within specific bounds. Therefore, power quality measures are typically not incorporated within quality incentive regimes in anything more than a reporting mechanism. Power quality is already subject to reporting within the Model Use of System Agreement (MUoSA) and comes under EDBs obligations under the Consumer Guarantees Act.
- It is important to highlight the following points:
  - The disaggregation of measures and the introduction of new measures is not costless – there must be a clearly defined benefits case prior to introducing new requirements;
  - Extended reporting around disaggregated measures does not necessarily need to form part of the quality path – instead additional reporting could be phased into information disclosure; and
  - There are practical implementation issues which need to be considered. Not least, the availability of data in a consistent format across all EDBs needs to be assessed.

The tables below summarise the analysis undertaken and the recommendations of the Working Group.

Summary of recommendations

Ref	Measure / Option	Value to customer (Current)	Data Availability	Incentive for timely investment	Ease of implementation	DPP Reset (RCP2)	RCP3	IDD
1.3	SAIDI	✓✓✓	✓✓✓	✓✓✓	✓✓✓	Yes	Yes	
1.4	SAIFI	✓✓✓	✓✓✓	✓✓✓	✓✓✓	Yes	Yes	
2.1	Unplanned outages	✓✓✓	✓✓✓	✓✓✓	✓✓✓	Yes	Yes	
2.2	Planned outages	✓✓✓	✓✓✓	✓✓✓	✓✓✓	Yes (Weighted)		
2.3	Based on company averages	✓✓	✓✓✓	✓✓	✓✓✓	Yes		
2.4	Identified by voltage level	✓	✓✓✓	✓	✓✓✓			Yes
4.1	Limits based on fixed historical data	✓✓	✓✓✓	✓✓✓	✓✓✓	Yes	Yes	
4.4	Allowance for natural variation	✓✓✓	✓✓✓	✓✓✓	✓✓✓	Yes	Yes	
6.1	Major event days	✓✓✓ (with proposed adjustments	✓✓✓	✓✓✓ (with proposed adjustments)	✓✓✓	Yes (with proposed	Yes (with proposed	

Ref	Measure / Option	Value to customer (Current)	Data Availability	Incentive for timely investment	Ease of implementation	DPP Reset (RCP2)	RCP3	IDD
						adjustments)	adjustments)	
7.2	Revenue linked incentives	✓✓✓	✓✓✓	✓✓✓	✓✓ incentive rates to be developed	Yes	Yes	

Potential development initiatives

Ref	Measure / Option	Value to customer (Current)	Data Availability	Incentive for timely investment	Ease of implementation	DPP Reset (RCP2)	RCP3	IDD
1.8	CAIDI	✓✓✓	✓✓✓	✓	✓✓✓			Possible RCP2
1.9	Energy not supplied	✓✓✓	×	✓✓	×		Possible	Possible RCP3+
1.10	Capacity availability	✓	×	Unknown	×			Possible during RCP3+
1.11	Expected number and duration of outages	✓	×	Unknown	×			Possible during RCP3+
2.5	Identified by customer location	✓✓✓	✓	✓✓✓	✓		Possible	Possible (during RCP2)
2.7	Worst served customers	✓✓✓	✓	✓✓✓	✓			Possible (RCP3)
3.1	Customer satisfaction	✓✓✓	✓	✓✓✓	✓		Possible	
3.3	Quality of information provided during an outage	✓✓✓	×	✓✓✓	✓		Possible	
3.4	Processing of new connection applications	✓✓✓	✓	✓✓✓	✓		Possible	
3.5	Timely notification of planned outages	✓✓✓	✓✓✓	✓✓✓	✓✓		Possible	
4.3	Forward looking benchmarks	✓✓✓	✓	✓✓✓	✓			Possible at some point
5.1	Established by the EDB customer surveys	✓✓✓	×	TBD	TBD		Possible	Possible (during RCP2)

CONTENTS

GLOSSARY OF TERMS

AER	Australian Energy Regulator (Australia)
BMCS	Broad Measure of Customer Satisfaction
CAIDI	Customer Average Interruption Duration Index
CAIFI	Customer Average Interruption Frequency Index
Commission	Commerce Commission of New Zealand
CI	The Number of Customers Interrupted per 100 Customers
CML	The Number of Customer Minutes Lost per Customer
CENS	Cost of Energy Not Supplied
CPP	Customised Price-quality Path
DNOs	Distribution Networks Operators
DNSPs	Distribution Network Service Providers
DPCR4	Electricity Distribution Price Control Review 4 in the UK
DPP	Default Price-quality Path
EA	Electricity Authority
ENA	Electricity Network Association
EDBs	Electricity Distribution Businesses
ESC	Essential Services Commission (Australia)
GS	Guaranteed Standards
GSLs	Guaranteed Service Levels
GPS	Guaranteed Performance Standards
ID	Information Disclosure
IDD	Information Disclosure Determination
IEEE	Institute of Electrical and Electronics Engineers
IIS	Interruption Incentive Scheme
MAIFI	Momentary Average Interruption Frequency Index
MED	Major Event Day
MUoSA	Model Use of System Agreement

NEM	National Electricity Market
NER	National Electricity Rules
NEV	Norwegian Water Resources and Energy Directorate
Ofgem	Office of Gas and Electricity Markets
Part 4	Regulation under Part 4 of the Commerce Act 1986
QoSI	Quality of Service and Incentives
RCP	Regulatory Control Period
RCP2	Regulatory Control Period 1 April 2015 to 31 March 2020.
RCP3	Regulatory Control Period 1 April 2020 to 31 March 2025 (expected)
RIIO	Revenue= Incentives + Innovation + Outputs
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
STPIS	Service Target Performance Incentive Scheme
The Act	The Commerce Act 1986
Working Group	Quality of Service and Incentives Working Group
WSCF	Worst Served Customer Fund
WTP	Consumer's Willingness to Pay

1. INTRODUCTION

Electricity has grown to be an indispensable part of modern social and economic life. As the utilisation of electricity has grown so has society's expectation for the quality of supply. Over the last thirty years or so there have been significant changes in both the structure and the regulation of the electricity industry as governments and businesses alike strive to discover more effective, efficient and innovative means to achieve higher quality outcomes for consumers at the lowest cost. This endeavour to deliver more services at the lowest possible long term cost is fundamental and brings to the forefront questions such as, what is the right cost; what is the right level of service; and what is the trade-off between the cost to consumers and the service delivered?

The trade-off between cost and service (known as "quality" within the regulatory context) is important to understand and this trade-off is recognised by businesses and regulators globally. The balance between cost and service is one of the key attributes of managing an electricity network. It is always possible to achieve higher levels of reliability if sufficient investment is undertaken. As noted by the Brattle Group in 2012, "In designing and maintaining reliability, planners focus on ensuring that the right mix of capital investment, and operations and maintenance (O & M) practices produce the desired levels of security and reliability."[7] In the past governments determined the appropriate trade-off for consumers. However, now more than ever consumers have the opportunity to provide input directly into the decision making process and to express the level of reliability they desire to receive at a price they are willing to pay. In recognition of this, an increasing number of jurisdictions globally have implemented or are implementing incentive based regulation to raise service quality and reliability to more effectively, from both a consumer and business perspective, establish the link between investment, reliability and customer expectations.

With the Commission undertaking a review of the quality regime we operate under in New Zealand during 2014, there is an opportunity to ensure that the regulatory regime is developed in a way that better reflects the outcomes sought by consumers and at the same time is practical and implementable over the longer timeframe.

The purpose of this paper is to discuss the aspects of quality that matter to consumers, the technical options for measuring the level of quality delivered by network businesses in New Zealand and the implications for the regulatory regime going forward. This paper is the output from the ENAs' QoSI Working Group. The ENA Board established the Working Group in agreement with the Commission to review possible refinements to the current network performance metrics used for price-quality regulation. The Working Group is made up of representatives from EDBs[8] operating under the auspices of the ENA, is chaired by Dr Richard Fletcher, General Manager, Regulation and Government Relations at Powerco with secretariat services provided by Partna Consulting Group Ltd. Representatives from the Commission and the EA attend Working Group meetings in the capacity of observers.

[7] The Brattle Group Ltd, "Approaches to setting electric distribution reliability standards and outcomes", January 2012, pg. 21

[8] The EDB Technical Group members are Sara Carter (Alpine), Derek Caudwell (Horizon), Karen Frew (Powerco), Keith Gilby (WELL), Ling Hauzhuo (WEL), Joshua Lloyd (Unison), Ryno Verster (Vector) and Lynne Taylor (PWC – representing Eastland Energy, The Lines Company and PowerNet)

In summary this report covers:

a. What is quality and what does it mean for consumers?
b. What should be considered when measuring quality performance?
c. The technical options available for measuring quality and the quality path
d. Implementation considerations within the longer term context
e. Recommendations for the 2014 Commerce Commission DPP reset process

Each of these is discussed in the sections below.

2. WHAT IS QUALITY?

The term "quality" is used within the regulatory context to describe the level of service provided by EDBs to their customers. Given the primary role of a distribution network is to transport electricity from the bulk supply points to local consumers, the principal service provided by EDBs is one of transporting electricity. However, quality goes far beyond the simple function of transportation. Quality typically covers such aspects as the differentiated levels of service provided in different locations, how a company interacts with its customers on a day to day basis, the time taken to respond to faults in network equipment and the delivery of information during supply interruptions, to name a few. All such aspects are components of the overall quality of supply being provided. In general terms there are four dimensions to the quality provided by EDBs:

- The transport service delivered by the distribution network as currently exists today. With high levels of continuous supply provided by modern networks, quality is typically thought of in terms of the number of supply interruptions experienced by customers rather than the amount of time supply is continuously provided.
- How this service may change over time. This is a function of asset management processes, systems and the level of investment in both the network and people.
- The service provided by EDB staff and contractors as they interact with customers and local communities.
- The information provided by EDBs to their customers and feedback sought by EDBs' from their customers on performance.

In an ideal world each customer would receive exactly the level of service they are willing to pay for, both today and into the future, no more no less. However, an individually differentiated service is not possible as the physical characteristics of electricity networks mean that:

- The service received by customers connected to the same part of each network is highly correlated. This means that if an investment is made to increase the service level, all customers connected to the same piece of the network benefit. The converse is also true.
- The future performance of the network is a function of the network that currently exists. Networks consist of long life assets and as such the future performance is based on the mix between the current network and future investment. This means that the service is not immediately scalable to varying customer requirements from year to year. Rather asset management practices and investment in additional assets will all impact on the service level provided over time.
- Network augmentation typically requires lumpy investments. In other words the investment required for an increase in service often requires step changes in consumer prices. However, often smaller incremental improvements in quality can be achieved through incremental investments in new technology, although this is situational specific and dependant on the specific network involved.

As such, for all but the largest electricity consumers who directly fund the assets used to supply their operations, a cost quality trade-off must be made for larger groups or communities of consumers. These attributes are further discussed in Section 3.3.

However, irrespective of the physical characteristics of the network it is first necessary to understand what level of service consumers wish to receive over the long term. The regulated quality regime itself can then be targeted to ensure that these long term quality levels sought by consumers are met. By incentivising EDBs to efficiently deliver these quality levels within the context of the actual networks they operate, the regime can support delivery of value to consumers over the long term. Hence, the fundamental core elements to an effective regime include:

- A clear identification and description of the service characteristics that consumers value the most;
- The cost quality trade-off sought by consumers i.e. what level of service do customers value both now and going forward;
- The means to measure the aspects of quality that are important to consumers;
- The benchmark against which performance is measured (the quality path);
- The normalisation of data and identification of exclusions of extreme events that are outside the control of EDBs so as to enable the identification of the underlying longer term trends in performance;
- Incentives that align with the quality cost trade-off; and
- The disclosure of information.

The structure of the core elements in a quality regime are discussed and expanded upon further in Section 2.4. However, as noted above, it all starts by identifying what is important to consumers. Understanding the regulatory context within New Zealand is also important and it is useful to consider what jurisdictions internationally do to address these types of issues.

2.1 CUSTOMER VALUE

The starting point for any service quality regime, and indeed any market in which a supplier provides goods or services, is to understand the wants and needs of the consumers being supplied. In this case the customers are those consumers connected to an EDBs' network.

To support an understanding of what consumers want and need, many EDBs have undertaken customer surveys on the various aspects of the service they provide to their customers. The Working Group has taken the results from several of these surveys combined with the collective experience of Working Group members and developed a list of key aspects of the quality regime valued by consumers. All of the EDB surveys considered by the Working Group clearly illustrate that there are a few key attributes that are more important than others. These are:

1. Duration of interruptions;
2. The number of interruptions;
3. Providing high quality power supply;
4. The time it takes to respond to a power cut;
5. The time taken to answer the telephone;

6. Providing information on reasons for and the likely duration and the extent of a power cut;
7. Processing applications for new connections; and
8. Sufficient notice of planned shutdowns.

It is worth noting that there are some differences in the relative importance of these attributes between commercial and residential customers, with commercial customers placing a higher importance on the duration and the number of interruptions than residential customers. While the results from the surveys appear to be consistent, the constraints on timeframes for the Working Group were such that the Working Group was not able to verify this or engage in its own independent research. As such we have recommended that a useful additional work programme should be undertaken to determine if these attributes are those that customers value across a broader spectrum of New Zealand consumers. However it is clear from the research into international jurisdictions that the nine key attributes list are commonly held as the most important by consumers worldwide.

For the purpose of describing customer value preferences within a regulatory quality regime, the nine aspects of quality can be categorised into three broad areas:

- The reliability and resilience of the network. Reliability and resilience are general descriptors for the primary drivers of interruptions within a network (Items 1 to 3 above).
- Customer service. This covers the qualitative aspects of service provided by EDBs (Items 5 to 8 above).
- Power quality (Item 3 above).

The technical options associated with each of these areas are discussed in more detail in Section 4. It is worthwhile to note that of equal importance is the need to understand whether customers are satisfied with the current level of service provided at the cost currently sought, seek a better standard of service and whether they are willing to pay the corresponding cost, or whether they are happy to pay less for a lower standard. In practice the answer to these questions is dependent on the specific circumstances for each individual or group of customers. As such the specific level of service provided by an EDB is not covered in this paper, except for discussing a generalised approach to establishing performance targets within the context of the quality regulatory regime in New Zealand.

2.2 OTHER STAKEHOLDERS OF THE QUALITY REGIME

In addition to consumers there are a number of stakeholders to the regulatory quality regime. These can be grouped into four categories:

- The Commission, whose role is governed by the Commerce Act 1986 (the Act). The Commission is required to ensure that industry regulation is aimed at achieving the purpose of the Act and is directed towards the long term benefit of consumers.
- The communities that EDBs operate within. This includes ensuring that equipment is safe, meets appropriate environmental standards and that information about the service that EDBs provide is available and assessable to the public.

- The wider New Zealand economy. Electricity plays a significant role in the economy and EDBs are a key component to its success.
- The EDB staff and contractors. The regulatory quality regime will impact on the operation of the companies and consequently the roles and responsibilities of staff and contractors.

Each of these stakeholder groups has their own needs from the quality regime. In their 2012 Information Disclosure Final Reasons Paper[9] the Commission list "interested persons" as being:

- Regulated suppliers;
- Consumers and consumer groups;
- Electricity and gas retailers, electricity generators, and their representative groups;
- Central government and regional authorities;
- Other regulatory agencies, such as the Electricity Authority (EA) and the Gas Industry Company (GIC);
- Any other stakeholder of the regulated supplier, including investors and their advisors (such as equity analysts and other professional advisors), and owners of regulated suppliers; and
- The Commission.

This paper only addresses the needs of the wider stakeholder group to the extent that they impact on how best to measure and determine the quality performance sought by consumers and the impact of incentives on delivery by EDBs.

2.3 THE REGULATORY CONTEXT FOR QUALITY IN NEW ZEALAND

This paper is written within the context of the New Zealand EDB regulatory framework. As such it is useful to briefly describe the implications of this on the regulated quality regime discussed.

EDBs are regulated by the Commission under Part 4 of the Act. The overall purpose of Part 4, as set out in section 52, is "*to promote the long-term benefit of consumers … by promoting outcomes that are consistent with outcomes produced in competitive markets such that suppliers of regulated goods or services:*

a. have incentives to innovate and to invest, including in replacement, upgraded, and new assets;

b. have incentives to improve efficiency and provide services at a quality that reflects consumer demands

c. share with consumers the benefits of efficiency gains in the supply of the regulated goods or services, including through lower prices and

d. are limited in their ability to extract excessive profits."[10]

[9] Information Disclosure for Electricity Distribution Businesses and Gas Pipeline Businesses: Final Reasons Paper; Dated 1 October 2012; p.17

[10] The Commerce Commission, "Input Methodologies (Electricity Distribution and Gas Pipeline Services): Reasons Paper", December 2010, p. ii and iii

Under Part 4, EDBs[11] are subject to price quality regulation. Price quality regulation is designed to provide EDBs with incentives to innovate, invest and improve efficiency without making 'excessive profits' while ensuring that service and quality demanded by consumers are met. The price component either restricts the amount of revenue an EDB can earn, or sets the maximum average price it can charge. In setting the price-quality path the Commission's objective is to provide EDBs with the opportunity to earn above normal returns, as an incentive for improved efficiency and innovation. Associated with the price is a regulated quality standard that is expected to be delivered by an EDB. This is currently established utilising interruption based measures, SAIDI and SAIFI. Part 4 emphasises the importance of incentives on EDBs to innovate, invest, improve efficiency and provide services at a quality that reflects consumers' demand.

There are four types of price-quality regulation in New Zealand. These are:-

1. Default Price-quality Path (DPP).[12]

All EDBs that are subject to price-quality regulation[13] are automatically subject to a DPP. DPPs are an industry-wide approach, applying general price and quality measures that are applicable to a broad spectrum of EDBs. Currently the DPP is premised on the fact that there is no material deterioration of quality standards. There are a number of components that make up a DPP:

(i) ***The starting price.*** This is the maximum price/revenue that an EDB is allowed to charge and this is set at the beginning of the regulatory period.

(ii) ***The annual rate of change.*** This is the annual rate at which all EDBs starting prices can increase. The Commission currently uses CPI-X to calculate this. As such prices are restricted from increasing each year by more than the rate of inflation after adjusting for expected industry wide productivity improvements.

(iii) ***Quality standards.*** These are the minimum service quality standards that an EDB must deliver. These standards are currently based on historic averages measured by SAIDI and SAIFI.

The Commission is in the process of reviewing the regulatory settings utilised under the DPP framework. Accordingly the discussion in this report is focused on the general applicability of the measures and core components of quality for application under a DPP regime.

2. Customised Price-quality Path (CPP)[14]*.*

Should a DPP not meet the needs of a particular EDB due to business-specific circumstances, the EDB can apply to the Commission for a CPP. There are in-depth rules and process requirements and evaluation criteria that need to be met when applying for a CPP. An EDB's application for a CPP must include:-

(i) The reasons for the proposed CPP;

[11] Except those that are exempt due to the consumer criteria under s54D of the Act
[12] http://www.comcom.govt.nz/regulated-industries/electricity/electricity-default-price-quality-path/
[13] Not all EDBs are subject to price quality regulation. Currently 12 out of 29 EDBs are exempt. To qualify as an exempt EDB specific ownership and other conditions must be met.
[14] http://www.comcom.govt.nz/regulated-industries/electricity/cpp/

(ii) The duration of the proposed CPP. This can range from three to five years;

(iii) Financial information such as forecast capital and operational expenditure;

(iv) An audit report and directors' certification confirming the information in the proposal is correct;

(v) An independent expert's review confirming the contents and the reasonableness of the assumptions and methodologies used;

(vi) Evidence of consultation with consumers on the proposed changes.

Once the Commission accepts that it will consider the proposal, it will consult with stakeholders and evaluate the proposal. The Commission can either agree with the EDB's proposal or it can set a price-quality path that differs from the proposal. The Commission's decision can be appealed by the EDB and stakeholders.

3. A quality only CPP

An EDB may submit a proposal for a variation to the quality standards under a DPP. This proposal is known as a quality only CPP. A proposal for a quality standard variation is intended by the Commission to be a cost effective mechanism that recognises that not all EDBs may seek to increase their prices.

4. Information Disclosure

Under Part 4 of the Act, all EDBs (including consumer-owned EDBs) are subject to IDD requirements. The purpose of ID is to ensure sufficient information is readily available to interested parties to assess whether the purpose of Part 4 is being met and to understand whether price-quality regulation is being effective.

In summary, the information that EDBs are currently required to disclose are:

- How the network is being managed, including forward looking information on planned investment, and information on asset management processes;
- Operational and capital expenditure on different activities, both historic and forecast;
- Quality outcomes (eg reliability of electricity distribution network);
- Prices and revenues, including how prices are set, what the prices are, and revenues achieved; and
- Historical financial performance, in particular ROI and the key determinants of ROI.

The quantitative information is to be disclosed in a standardised form based on standardised spreadsheet templates, so that it is comparable over time and across EDBs.

2.4 INTERNATIONAL PERSPECTIVES ON QUALITY

There are a range of regulatory mechanisms utilised by regulators internationally. However, there are some commonalities across most regimes. Most jurisdictions consider the impact of interruptions on consumers along with measures associated with consumer satisfaction. Over time many jurisdictions have moved towards financial incentive schemes which provide increased revenue if targets are exceeded and/or penalties in the form of lost revenue if the performance

targets are not met.[15] SAIDI and SAIFI are the standard reliability measures used by numerous jurisdictions, (e.g. Australia, Italy, Norway, Canada, in some US states, to name a few) with major events such as storms excluded from normalised data sets. Reliability reporting is also a common feature. Several jurisdictions also have specific rules or guidelines regarding worst-served customers.

The following is a brief summary of the regimes utilised in Australia, UK and Norway. More detailed information on Australia and the UK is set out in Appendix B.

AUSTRALIA

The electricity industry in Australia has undergone a range of significant reforms over the last twenty years, commencing in the early 1990s with the breakup of previously wholly state-owned vertically integrated electricity monopolies. This resulted in the formation of competing generation and retailing entities, and regulated transmission and distribution companies.

The first regulatory price control for distribution companies was for the period 2001-2006. This consisted of a simple incentive based scheme. Over time the regime has evolved and in accordance with statutory requirements, the Australian Energy Regulator in 2009 established a Service Target Incentive Scheme (STPIS), creating a link between quality and revenue for network operators, based on customers' willingness to pay (WTP). The five components of the STPIS is reliability of supply, quality of supply, customer service, guaranteed service levels, and information and reporting.[16] The financial incentives are symmetrical. The "at risk" revenue is capped at 5% however a network operator can propose to the AER a different revenue cap. It is noted that not all States have implemented the STPIS scheme and as such the specific arrangements within each state can vary. The STPIS was adopted in Victoria in 2011. ACT and NSW will operate under the STPIS from 2014.

UK

The UK's regulatory framework has evolved over time from a RPI-X regime to a revenue linked incentive regime. There are fourteen separately licenced distribution network systems which are owned by six Distribution Network Operator (DNO) companies. The licence includes the price control contract that stipulates what DNOs are expected to deliver and constraints on the revenue that can be collected from customers. DNOs are regulated by the Office of Gas and Electricity Markets (Ofegm). Since privatisation in 1989 the network industry has undergone five rounds of price control reviews, with the first regulatory period being 1990-1995. Each regulatory price control period has been for a period of five years, however from 2015 this will increase to eight years.

Under the first two regulatory periods, DNOs operated under a revenue cap and on the third regulatory period quality of supply incentives were introduced. These incentives covered three main areas, namely the number of interruptions to supply; the duration of interruptions to supply and the quality of telephone response. Under this, DNOs were rewarded or penalised by up to 3% of revenue, depending on performance relative to the targets. A mechanism to account for exceptional events such as severe weather and third party damage was implemented so as to ensure that DNOs were not unfairly rewarded or penalised due to measurement issues.

[15] The increases or decreases in revenue are funded directly by consumers through pricing.
[16] Australian Energy Regulator, "Electricity Distribution Network Service Providers: Service Target Performance Incentive Scheme," November 2009.

Within the current regulatory period, Ofgem has four main structures in place to incentivise DNOs' levels of reliability. These are the Interruption Incentive Scheme, Guaranteed Standards, the Worst Served Customer Fund and the Broad Measure of Customer Satisfaction measure.

The UK is entering its sixth price review for the period 2015-2023 and a new regulatory framework entitled RIIO[17] has been introduced. RIIO places a strong emphasis on stakeholder engagement. DNOs propose their own outputs under six categories: safety, reliability, environment, connections, customer satisfaction and social obligations. A 'fast-tracked' mechanism was introduced which allows a DNO to settle their price control early.[18]

The measures used for quantifying reliability of supply are Customer Interruptions[19] per 100 customers (CI) and Customer Minutes Lost[20] per customer (CML). Exceptional events are excluded from the normalised data sets. Outages of three minutes or less are not included in the incentive scheme; however DNOs do need to report them. CI and CML targets distinguish between unplanned and planned outages. These are then combined to produce a single CI target and a single CML target. Planned outages have a weighting of 50%.[21]

Since quality of supply incentives were introduced in the third regulatory period customers have experienced a reduction of 30% in CIs and 32% in CMLs between 2001 and 2012.[22]

Norway

The Norwegian electricity market was opened up for competition in 1991 with the introduction of the Energy Act 1991. There are 127 network distribution companies in Norway[23] that service a population of a little over 5 million people. The electricity market is regulated by the Norwegian Water Resources and Energy Directorate (NVE). When distribution companies were first regulated, the NEV employed the traditional rate of return approach. Reporting of interruptions greater than three minutes became mandatory in 1995. From 1997, distribution companies were regulated according to a revenue cap model and a five year regulatory period was introduced. Separate quality of supply regulation was introduced in 2005, containing minimum requirements regarding continuity of supply, voltage quality and customer complaints. In 2007, the five year regulation period was changed to a system with annual determination of revenue caps for each company based on a "yardstick" formula. The rationale for the change was that incentives for cost reductions are weakened when a new regulatory period is approaching. [24]

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[17] RIIO stands for Revenue= Incentives + Innovation + Outputs

[18] On 21 November 2013 Ofgem announced that only one DNO was eligible to be fast-tracked, for the regulatory period 2015-2023.

[19] Customer Interruptions are equivalent to SAIFI x 100

[20] Customer Minutes Lost are equivalent to SAIDI

[21] The Brattle Group Ltd, "Approaches to setting electric distribution reliability standards and outcomes", January 2012, p. 62-61.

[22] Strategy consultation for the RIIO-ED1 electricity distribution price control: Reliability and Safety Supplementary annex to RIIO-ED1 overview paper, 28 September 2012, p. 17.

[23] Bjorndal, E., Bjorndal, M. and Camanho, A, "Weight Restriction in the DEA Benchmarking Model for Norwegian Electricity Distribution Companies – Size and Structural Variables."

[24] Migueis, V.L., Camanho, A.S., Bjorndal, E., and Bjorndal, M. (2011)"Productivity change and innovation in Norwegian electricity distribution companies." *Journal of the Operational Research Society,*(2011) 1-9 p.7.

Revenue incentives are based on the Cost of Energy Not Supplied (CENS). Within the annual revenue cap 40% of the network companies actual costs are passed on to customers, with the remaining 60% based on cost norm with benchmarking analysis used to describe a companies' cost efficiency. Should a company be defined as efficient due to the benchmarking, 100% of the costs are passed on to customers. The revenue cap is based on the previous two years of data. CENS comprises both planned and unplanned interruptions and applies to six customer categories. These categories are industry, large industry, commercial, agriculture, public and residential. Customer interruption costs are determined through national surveys for each customer category. There is a direct compensation scheme for customers who face outages greater than 12 hours in duration. The objective of the scheme is to incentivise network companies to restore power as quickly as possible.

Summary

The following table is a summary of the international regulatory quality regimes described above.

Characteristic	New Zealand	Australia (STPIS)	UK (Under RIIO)	Norway
Reliability Measures	SAIDI and SAIFI (Planned + Unplanned, > 1min).	SAIDI, SAIFI, CAIDI, MAIFI (unplanned only, > 1min).	CML and CI (weighted 50% planned + unplanned, > 3min).	Energy Not Supplied (Planned + Unplanned, >3min).
Customer service measures	None.	Measures include telephone answering, street light repair, new connections, response to enquiries.	Measures in 5 additional areas: customer satisfaction, safety, environment, connections and social.	Customer complaints, customer satisfaction.
Performance Limits	Fixed for RCP, based on 5 years of historical data, 1 std deviation.	Based on rolling 5years of data. No deterioration over RCP.	Unplanned fixed for RCP (based on previous 5 years of data), planned based on 3 years rolling data.	Yes.
Normalisation	MEDs – 2.5 beta method. Boundary value included post exceptional event.	MEDs, events that exceed boundary value excluded.	Exceptional events excluded (>8x average daily variation, one off exceptional events).	Yes.
Incentive scheme	Pass / Fail – 2 out of 3 years.	Overall capped at 5%. Note jurisdictional differences. Banking allowed.	Targeted revenue incentives on reliability and customer service for each DNO.	Revenue incentive.
GSL	Not regulated, included in MUoSA.	Regulated GSL (The STPIS GSL scheme is not currently applied in any state).	Regulated GSL. Categories include restoration time, voltage complaints, estimates for new connection costs, making and keeping	For outages >12 hours.

Characteristic	New Zealand	Australia (STPIS)	UK (Under RIIO)	Norway
			appointments.	
Information disclosure	Yes – AMP, network performance information.	Required to report annually.	High quality disclosures required in regulatory submissions. Annual reporting of DNO performance is required.	All outages reported once a year, data categorised by voltage, planned or unplanned and end user group (36 groups are defined).

There are clearly more variation in regulated quality regimes than those described here, but the descriptions of international jurisdictions above provide a sample of the types of instruments employed.

2.5 CORE COMPONENTS OF THE QUALITY REGIME

In order to describe the quality regime within New Zealand the Working Group has defined the framework as consisting of eight core components. These are:

a. Consumer quality needs. Delivering value to consumers is the reason networks exist. As such, consumers' requirements for service quality determine the overall performance requirements for network operations and development.

b. The measures utilised to indicate quality performance over time. The measures should directly reflect the aspects of quality that customers value, be practical to measure and describe the aspects of quality that are within an EDB's ability to control.

c. A selected subset of measures are utilised within the regulatory quality regime. Not all measures are appropriate to include within a regulatory regime that incentivises performance. In many cases incentivising performance on a few key measures in conjunction with reporting on a suite of other customer related measures is the most effective and efficient mechanism.

d. The appropriate analytical depth (complexity) and qualitative diversity (categories of measures e.g. customer service etc) of the measures needs to be determined. This applies to both measures that are within the regulatory quality regime and those that are simply reported on under ID. A second, but equally important dimension is whether the measures are forward looking or historical and based on inputs or outputs delivered.

e. The performance limit against which the measures included in the regulatory quality regime are assessed. This covers two aspects; how performance limits are determined (the calculation) and what data is used to set the threshold.

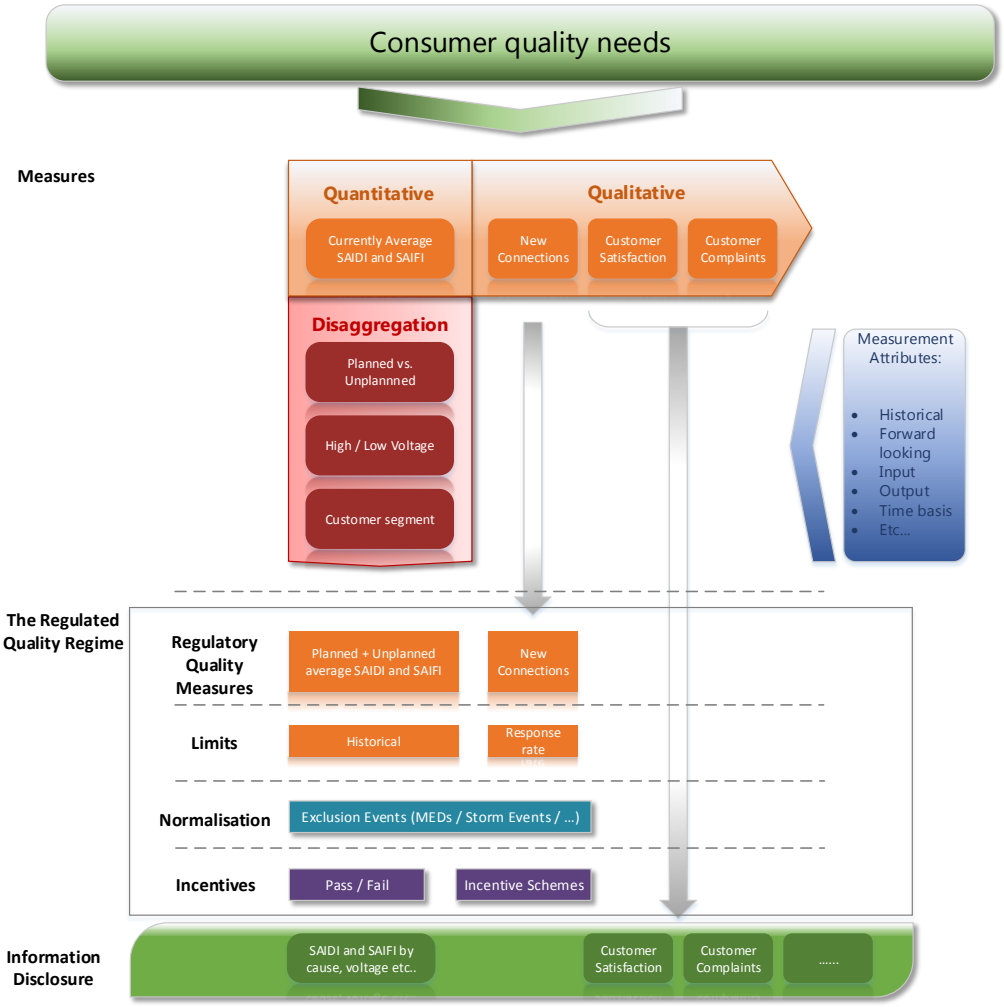
f. A process for normalising the data to establish the long term or underlying trends. In order to establish targets extreme events need to be removed in order to determine what the underlying performance should be. If they are not removed, or appropriately adjusted for, the volatility caused by one-off and extreme events from year to year are likely to render the measurement and the performance redundant. As such a method for normalising the data needs to be established.

g. The incentives created for companies to either meet or outperform the performance limit for each measure. Long term value for consumers is created by companies finding more efficient mechanisms to meet or improve performance and innovate over time. Hence the incentives created are critical to the effective functioning of a quality regime.

h. As discussed previously, there are circumstances where it is useful to disclose information rather than have it form part of the quality regime itself. Already a substantial amount of information is published by EDBs and as such any quality regime should not duplicate the information that is already available.

These eight components of the quality regime are illustrated in the following diagram which shows how the measures, regulatory measures, limits, normalisation, incentives and information disclosure integrate into a single cohesive framework. It is important to recognise that the quality regime works as an integrated package. Taking out individual components may lead to perverse outcomes.

FIGURE 1 - CORE COMPONENTS OF THE QUALITY REGIME[25]



[25] The examples used in Figure 1 are illustrative only.

3. MEASURING QUALITY

There are a number of key attributes that should be explored when measuring quality. These are:

- The alignment between the measures and the delivery of consumer value. The stronger the alignment between the measure and the aspect of quality that consumers value the better. In cases where it is not possible to directly measure the quality aspect itself, either a basket of measures or a composite measure may be more reflective than a single indicator.
- Whether the performance measure and the expected quality path should be forward looking (i.e. based on expected future performance), or based on what was delivered historically or some combination of both forward looking and historical performance.
- Whether the performance measures should be input related (focused on resources utilised) or output related (focused on the service delivered) or both.
- The implications of the physical electricity network and where best to measure the performance (location or voltage level). The physical network places certain limitations on delivering and measuring value.
- The changing nature of the electricity industry as new technology emerges and is implemented over the next decade.
- Timeframes over which the measurement is considered. This concerns both the measurement itself and the timeframe over which the target level of performance is assessed. Network development and asset management is a long term business. As such some aspects of quality are better considered over multiple years.
- The integration of the quality framework as a whole. There needs to be consistency between what is measured, how the targets are established and what incentives are placed on achieving those targets. If the overall framework is not internally consistent the potential for perverse outcomes for both EDBs and consumers is high. In other words cherry picking components without ensuring internal consistency is risky for all stakeholders.
- Information availability. The measurement and inclusion of measures within a regulatory regime requires data to be available in which to assess performance and set benchmarks. If the data is unavailable then sufficient time needs to be allowed to gather the data and establish appropriate performance requirements.

These attributes are explored further in the sections below.

3.1 ALIGNMENT OF THE MEASURES TO CONSUMER VALUE

Aligning organisational attributes with customer value is a core proposition for any company strategy. Much has been written about such an alignment and indeed whole frameworks are based on the proposition (e.g. the balance scorecard). The same principles apply in the regulatory environment. As an EDB's performance is assessed against regulated quality measures and they are incentivised to perform in relation to those measures, it is imperative that the measures themselves closely reflect what customer's value. This is a key criterion when considering the suitability of the measures being adopted in the regulatory quality and ID regimes.

3.2 THE TEMPORAL BASIS FOR MEASUREMENT

The two temporal perspectives on measuring quality are:

- Whether performance should be assessed against historical delivery (how the EDB has performed in the recent past) or should it be forward looking (how will the EDB perform in the future);
- Should the performance be based on inputs utilised to drive outcomes (measuring the resources that are needed to deliver specific outcomes) or on the outcome themselves (the service that was, or is expected to be, delivered).

Typically these perspectives are combined. For example measuring supply interruptions over the last year is an historical measure focused on outcomes delivered to customers. Whereas the reporting of health indices is an input related measure that can be utilised to make forward looking predictions on level of service that will be delivered at some time in the future.

Measures do not have to be restricted to the historical + output and forward looking + input combinations. For example, the expected future performance of the network could simply be reported directly. However, to do this within a regulatory context the basis for the predictive analysis and assumptions would need to be determined and clearly set out well in advance. Hence, while forward looking output measures may be ideal in terms of understanding how quality will likely change over time it is also complex and subject to a number of unknowns. As such forward looking output measures are likely to be better suited to risk based performance frameworks rather than performance benchmarking more akin to the quality regimes employed globally.

As noted previously in Section 2.3 the current DPP regime in New Zealand is predicated on there being no material deterioration of quality performance while an EDB remains within the financial parameters provided for by the Commission. As such within the context of the DPP regime use of historical output performance is entirely appropriate and should be reflective of the performance level achieved going forward. This is not to say that forward looking measures would not be appropriate. There may be significant value to be gained in exploring the opportunities for such measures going forward.

3.3 NETWORK CHARACTERISTICS, TIMEFRAMES AND QUALITY

Electricity distribution network quality performance is a product of an amalgamation of factors. Quality outcomes are inherent in the network topology, past and present investment decisions, past and present operating and maintenance practices and factors external to the network itself. Changes to network assets typically involve large capital works that once implemented last many years. Accordingly, customers' demands for quality are not always able to be met, particularly in the short term. Conversely some customers may be receiving a level of quality above what they require, due to their connection location on the network.

When considering network reliability performance, outages may be either planned or unplanned. Planned outages (which are viewed as being less disruptive to consumers) are required to commission new assets or undertake operational or maintenance tasks efficiently and safely. Unplanned interruptions may be caused by a range of factors including equipment failure, poor

weather (lightning, snow or wind storms), external interference (car v pole, bird strikes), human error or environmental factors such as earthquakes, floods or slips. As such, reliability performance reflects the frequency and duration of interruptions and some consumers will experience more or longer interruptions than others.

However, as each distribution network supplies a large number of consumers, and consumers are supplied from shared or common assets, it is difficult to provide different levels of quality to individual consumers (other than those with dedicated assets). That said those customers who are on the same network topology and subject to similar external influences should expect a similar level of quality from the network. Accordingly, the difference in the number and duration of outages experienced by customers is driven by the differences in the network design and construction in different parts of the network. By way of example, rural customers supplied from long rural lines will generally experience more interruptions than those within a CBD. Long lines are many times more exposed to hazards such as trees, wind, flooding and other hazards than underground networks that supply town centres.

These physical network characteristics have the following implications for how quality is measured:

- Data utilised for benchmarking performance limits needs to be based on multiple years;
- Different network topology will result in different quality outcomes. i.e. network averages are not necessarily good indicators of the service received by customers;
- A certain level of resilience to extreme and unforeseen events is inherent in network design. Consequently when the impact of an extreme event is larger than the inbuilt level of reliability and resilience it will result in significant interruptions for consumers. Time taken to restore power will depend on the operational response of EDBs and the strategic processes in place to manage such events;
- The higher the voltage at which a fault or event occurs, the bigger the impact. However, higher voltage parts of a network typically have more redundancy and higher resilience to events. As such events that impact on sub-transmission and zone substation elements are infrequent (but large when they do occur) whereas the majority of interruptions faced by consumers result from the 11kV feeder and low voltage (LV) networks; and
- Larger industrial and commercial customers have their own dedicated assets and make their own decisions regarding the price quality trade-off they receive. Consequently, the discussion in this paper is primarily relevant to the service provided to mass market consumers i.e. residential, industrial and commercial customers. These are the majority of customers an EDB supplies.

These are some of the physical characteristics that need to be accounted for when measuring quality. However, despite the longevity of network assets, the impression should not be taken from these attributes that the supply of electricity to consumers is not changing. Like any industry electricity supply networks are facing significant changes due to the deployment of new technology and approaches to business. Such innovations are core to continuing to provide consumers with increasing value over time.

3.4 THE CHANGING NATURE OF NETWORKS AND ELECTRICITY SUPPLY

Existing quality measures reflect the performance of networks and the levels of service provided based on conventional network and asset configurations and service models developed over an extended period. More recently however, increasing evidence is emerging of major changes to the energy delivery environment, customer expectations and electricity technology on both the customer and network side. In time, it is likely that these changes could materially alter the way in which electricity provision is required and quality has to be measured. Factors that could contribute to this change include:

- Localised generation. Increasingly customers have the ability to generate some or all of their required electricity, often exporting excess capacity. This situation could be further magnified with an ability to store energy for use during peak demand times. This may imply that consumers would only take intermittent network supply, making conventional reliability measures (based on frequency and duration of interruptions on a constant supply base) irrelevant. Furthermore, quality of service measures would have to be expanded to include consideration of the ability of a distribution network to allow energy to be exported from customer premises.
- Customer preference. Related to the above, based on factors such as energy pricing signals, energy storage capability and the ability to self-generate, customers may in future decide to voluntarily disconnect from the electricity grid from time to time. Conventional quality measures were not designed to reflect such situations.
- Islanding. Clusters of consumers may become largely self-sufficient in energy provision and therefore operate their electricity distribution networks in "islands", not usually connected to the grid. Only during specific times may grid connections still be required. Again, conventional quality of supply measures were not designed to reflect such instances.
- Variety of energy sources making up overall supply. At present, energy-flow to customers is one-directional with full customer demand supplied from (generally) large generators through transmission and distribution networks. In future, customers' electricity requirements may be met through a variety of means, including conventional distribution supplies, localised generation, stored energy, demand-side control measures and energy substitution measures. This is likely to have far-reaching implications on how networks are designed and the manner in which security standards and reliability of supply is measured. It is likely that future service standards would be better stated in terms of the overall availability of supply that reflects the various sources contributing to this (measured as a probability of having some form of electricity supply or alternative measure available). Conventional measures, such as network SAIDI and SAIFI, worst-performing feeders, etc. could become meaningless in such an environment.

The impact of these factors on New Zealand networks is minimal at present, and it is therefore not proposed that these be reflected in this document. However, it is worth considering the flexibility of the quality regime to account for these types of changes going forward as the situation could change markedly over the next five to ten years. It is therefore recommended that the changing energy environment trends, and customers' and EDBs' response to this, are monitored over the next regulatory period. If the impact is material, this should be considered for the quality of supply measures for the RCP3 reset, beginning 2020.

3.5 AVAILABILITY OF INFORMATION

The availability of information is a significant and important determinant when reviewing the quality regime and has direct implications on the implementation of any changes. Information availability that could support the measurement of quality was considered by the Working Group. To determine the status of information availability the Working Group surveyed a sample of EDBs (13 out of the 29). The Survey was based around the data availability that would support ten aspects of quality. The ten aspects related to the information required to determine EBD performance on the highest valued aspects of consumer quality preferences. They were:

- The level of disaggregation that interruption data is recorded at;
- The methods of communication during and post outages;
- The methods utilised for communication of planned outages;
- The measurement of power quality;
- How companies measure HILP resilience;
- The extent to which information on worst served customers is gathered and utilised in business processes;
- How the response time to interruptions is measured; and
- The extent that guaranteed service levels are utilised on a voluntary basis.

The following are the highlights from the responses provided by EDBs to the quality information survey:

a. All respondents separate out planned and unplanned outages when recording the number and duration of interruptions. All report SAIFI and SAIDI and most use CAIDI and faults per 100km (faults per 100km is now required to be reported under ID). Twelve EDBs out of the thirteen capture data down to feeder level.
b. For communications all EDBs surveyed utilise call centres in one form or another. Most EDBs use radio and mail drops where necessary for notification of planned outages.
c. A majority of EDBs use the complaint process as part of the business processes for all three of the communication related measures.
d. Power quality at LV level is not proactively measured, with a majority appearing to rely on a complaint process or inbound call centre process to highlight where LV power quality issues occur.
e. HILP resilience, information on worst served customers and visible response to extreme events are not consistently treated by all EDBs. The companies surveyed appear to have different processes and approaches to these topics.
f. Half the respondents have a Service Guarantee of some form in place.
g. There are no stand-out future developments for data capture, except smart meters were noted by a number of companies as a means of capturing outage information in the future. However, as the business processes around the access to, and use of, smart meter data evolves, smart meters are likely to have a much larger impact on quality measurement than they do currently.

Based on these findings it is clear that the data required to support existing measures is in place and in good order. In addition, any measure that utilises interruption data down to the HV feeder level could generally be supported in a relatively short timeframe. However, should additional measures be needed, either interruption based or customer service based then time will be required to determine the appropriate definitions, develop consistent surveying methods where required, and gather a base set of data from which performance targets could be established. The requirement for such a time interval has implications for the timing of any implementation of additional or new quality measures. These implications are discussed further in Section 5.

4. TECHNICAL OPTIONS FOR QUALITY

This section describes the technical options that exist for each component of the quality regime described in Section 2.5. The components covered are:

- The measures that could be utilised within a regulatory quality regime;
- Performance limits;
- Normalisation and exclusions; and
- The incentive regime.

The description for each component is laid out in the following structure:

1. Opening discussion on the component;
2. List of technical options for the component;
3. Implications for the regulatory quality regime; and
4. A summary of the Working Group's conclusions.

Implementation issues are addressed in Section 5. A summary table is included at the conclusion of each section illustrating the Working Groups' conclusions. Each option has been given a high level rating, ranging from × to ✓✓✓. The purpose of the rating is simply to indicate the current status or perception of the Working Group in relation to the item.

It is also important to note the interaction between the components. In many cases the outcome of the discussion on one component is dependent on the other. By way of example, the incentive regime utilised must be consistent with the mechanism used for setting performance limits and normalisation. Accordingly the regulatory quality regime must be thought of as a package and in order to develop the right incentives for EDBs then the regime adopted must be internally consistent.

4.1 THE MEASURES

The purpose of measuring quality is to objectively determine the performance of an EDB in its delivery of services to customers. Therefore, as discussed in Sections 2 and 3, the measures should align as closely as possible to and reflect the aspects of quality that consumers value.

Section 2.1 described the highest valued aspects of the service provided to consumers. These fall into three broad categories:

- Reliability and resilience - quantitative measures utilised to reflect the level and duration of interruptions experienced by customers.
- Customer service - the qualitative aspects of the service provided by EDBs.
- Power quality - quantitative measures that demonstrate power quality falls within statutory limits.

The technical options for each of these categories are discussed below.

4.1.1 RELIABILITY AND RESILIENCE

The three aspects of reliability and resilience most highly valued by consumers (as discussed in Section 2.1) relate to:

1. The duration of interruptions;
2. The number of interruptions; and
3. The time it takes to respond to a power cut.

Traditionally, interruption measures tend to be based on historical outcomes. Forward looking indicators of reliability and resilience primarily are reported through ID and describe the current condition of assets and asset management practices, i.e. they are input related. This is generally the approach taken internationally.

To date the Working Group is unaware of any measures that relate directly to resilience. However, the concept of resilience is primarily related to the time taken to restore supply following extreme events. As such, output measures for resilience could be developed.

The options for interruption based performance measures are set out below in Table 1 below.

TABLE 1 - INTERRUPTION MEASURES

Ref	Measure	Discussion
1.1; 1.2	Number and duration of interruptions for each customer	The number and duration of interruptions for each customer could be reported as a duration curve i.e. ranked highest to lowest. This would require some translation of interruptions recorded by EDBs at 11kV feeder level to specific customers. The advantage of reporting interruptions in this manner is that it gives an indication of the range of service levels provided to customers. In addition a duration curve could be utilised to report on worst served customers.
1.3; 1.4	SAIDI and SAIFI	SAIDI and SAIFI are currently used in New Zealand, Australia and numerous other regulated quality regimes. They report the average duration and number of interruptions per EDB customer. There are no apparent disadvantages to the continued use of SAIDI and SAIFI. Further disaggregation of SAIDI and SAIFI by network level, by location etc. could be utilised to further report on the service levels delivered (refer to Table 3). The benefits of continuing to use SAIDI and SAIFI include: • existing data sets and historical benchmarks are available • business processes already exist to collect and store data to an appropriate level of accuracy. Interruptions less than 1 minute are not included in the measures. Of note is that in New Zealand interruptions are not measured on the LV network. This differs from international jurisdictions where measurement of LV interruptions is required. The principle reason for the exclusion of LV interruptions in New Zealand is that in many instances we do not currently have the technology in place to do so. However, with the increased penetration of smart meters it will at some point be possible to incorporate

Ref	Measure	Discussion
		LV interruptions. Accordingly the appropriateness of including LV interruptions is a potential area for further development and the benefits may be beneficial.
1.5, 1.6	CML and CI	CML and CI are utilised in the UK. CML is essentially the same as SAIDI and CI is SAIFI multiplied by 100. The primary difference is that the UK only reports interruptions of duration greater than three minutes. Allowing three minutes provides sufficient time for automated switching schemes to operate which means that incentives for investment are more aligned with technology capability – i.e. results in a reduced need for high speed communications and switching gear relative to a one minute threshold, resulting in lower costs to consumers. There is however, the corresponding reduction in the expected level of service.
1.7	MAIFI[26]	EDBs in Australia also report on MAIFI. This is a measure of the number of momentary interruptions (of duration less than one minute) faced by customers. While in general interruptions of less than a minute are less of an inconvenience, even momentary interruptions can be disruptive, particularly to commercial and industrial customers. As such reporting on MAIFI can assist in demonstrating the level of service performance of EDBs.
1.8	CAIDI[27]	CAIDI is SAIDI divided by SAIFI and represents the weighted average outage duration for customers that experienced an interruption within the reporting period. As such CAIDI can be reported using current data sets. However, if interruptions of SAIDI and SAIFI are reported then reporting CAIDI has little additional value.
1.9	Energy not supplied	An alternative to reporting on the duration of interruptions is to report the amount of energy not supplied due to an outage. Adoption of this measure allows for a value metric to be placed on the impact of an outage. The disadvantage of reporting on energy not supplied is that an assumption needs to be made on the profile of energy use had the interruption not occurred. This could be modelled either at an individual customer or bulk supply level (such as at a zone substation) or assumed to be constant based on the measured consumption prior to the event. The primary issue at present is that measurement of consumption at an individual consumer level is only being made possible through the deployment of smart meters. This will take time for sufficient penetration and for the information to be available for EDB performance reporting purposes. Given the ownership of meters, access to metering data is also a potential issue for EDBs.
1.10	Availability of capacity	As discussed in Section 3.4, in the future it may be more appropriate to report on the percentage of the capacity available and the duration of its availability. However, further work should be done to understand the benefits and challenges for measuring customer service levels in this way.

[26] Momentary Average Interruption Frequency Index
[27] Customer Average Interruption Duration Index

Ref	Measure	Discussion
1.11	Expected number and duration of outages over the next [3] years	This is a forward looking measure based on the likely probability of the number and duration of outages on a network. The measure has potential interest for consumers if it can be benchmarked across different networks and locations on a consistent basis. However, it does not report on the actual service delivered. Further work on such a forward looking measure would be necessary before it could be considered for inclusion in the regulated quality regime.

Of the eleven interruption measures the only realistic option is for SAIDI and SAIFI to be included within the next DPP reset. This is simply due to the time required to develop data sets and appropriate reporting mechanisms for the other measures. However, the Working Group considers that further work could be completed on the last three measures as they are likely to be highly valuable going forward. Of the two current measures the Working Group considers that SAIDI captures more information that SAIFI. Accordingly, if the Commission was considering simplifying the current regime then it should consider only including SAIDI in the regulated quality regime. Table 2 below is a summary of the conclusions from the Working Group on the suitability of interruption measures for inclusion within the regulated quality regime.

TABLE 2 - ASSESSMENT OF INTERRUPTION MEASURES

Ref	Measure	Value to customer (Current)	Data Availability	Incentive for timely investment	Ease of implementation	DPP Reset (RCP2)	RCP3+	IDD
1.1	Number of outages	✓✓✓	✓✓✓	✓	✓✓			Possible RCP2
1.2	Duration of outages	✓✓✓	✓✓✓	✓	✓✓			Possible RCP2
1.3	SAIDI	✓✓✓	✓✓✓	✓✓✓	✓✓✓	Yes	Yes	
1.4	SAIFI	✓✓✓	✓✓✓	✓✓✓	✓✓✓	Yes	Yes	
1.5	CML	✓✓✓	✓✓✓	✓✓✓	✓✓			
1.6	CI	✓✓✓	✓✓✓	✓✓✓	✓✓			
1.7	MAIFI	✓✓✓	✓	✓	✓			
1.8	CAIDI	✓✓✓	✓✓✓	✓	✓✓✓			Possible RCP2
1.9	Energy not supplied	✓✓✓	×	✓✓	×		Possible	Possible RCP3+
1.10	Capacity availability	✓	×	Unknown	×			Possible during RCP3+
1.11	Expected number and duration of outages	✓	×	Unknown	×			Possible during RCP3+

Key: Yes – proposed for the DPP reset, Possible/Yes – reviewed or under development during RCP2, implementation in RCP3 or beyond.

OPTIONS FOR DISAGGREGATING INTERRUPTION MEASURES

Any of the methods for reporting on interruptions can be disaggregated and reported according to an accompanying meta characteristic. The purpose of reporting interruption measures at a more disaggregated level of detail is to better measure the distinction in service received by customers of different classes or location and if necessary to support the development of a composite basket of measures that may reflect important distinctions in the services delivered. Options include reporting interruptions by:

- Planned or unplanned;
- Voltage level;
- Cause of the interruption (human error, lightening etc..);
- Location impacted (CBD, Urban, Rural etc.);
- Network type (Underground, overhead);
- Network area or sub network[28] (averaged across GXPs that supply the same interconnected network);
- Company (as per the current regime);
- Interruptions per x kilometres;
- Duration (grouped into bands e.g. greater than or less than x hours);
- Customer density (grouped into bands of interruptions that impacted a networks with x customers per y km);
- Customer class (commercial, residential, industrial);
- Customer interruption duration curve or by customer percentile; and/or
- Feeder (by ranking, or by worst served, or by type);

For the purposes of aligning EDB performance with the value received by consumers these reporting metrics are typically combined within regulatory structures. The most common metrics utilised for reporting internationally are set out below.

In regard to aligning the measures with consumer value, it is generally accepted that previously notified planned interruptions are of lower concern for consumers than unplanned interruptions. Surveys indicate that notice prior to planned shutdowns is important. Anecdotal evidence also suggests that there is a substantial difference between the expectations of CBD, urban based consumers and rural or deep rural consumers. As such it would suggest that a regime around these parameters is more likely to align with consumer values than other options described.

TABLE 3 - DISSAGGREGATION OPTIONS FOR INTERRUPTION REPORTING

Ref	Measure	Discussion
2.1	Unplanned outages	Reporting unplanned interruptions is a base requirement for measuring quality performance. Internationally the Australian STPIS regime is based on unplanned outages only. All jurisdictions reviewed have unplanned interruptions within their regulated quality regime.
2.2	Planned outages	Reporting on planned outages are included in most quality regimes. The key aspect for the regulatory regime is whether planned outages are

[28] Reliability is currently reported by sub-network for ID purposes.

Ref	Measure	Discussion
		equally weighted or have a lower weighting than unplanned outages. Currently in New Zealand planned outages are equally weighted which can result in incentivising the perverse behaviour of delaying or reducing essential maintenance and refurbishment work. The UK have recognised this and reduced the impact of planned interruptions to 50% of unplanned. Planned outages are typically notified prior to the event and consequently the impact on consumers can be managed more effectively.
2.3	Based on company averages	The current quality regime is based on the normalised five year average SAIDI and SAIFI for each EDB. While the average is useful as a high level measure and reflects the service provided to the "average" customer, it doesn't recognise the diversity within networks around New Zealand.
2.4	Identified by voltage level	Reporting interruptions by voltage level recognises the different impacts that interruptions have at each level in the network. Interruptions at higher voltages (such as at 110kV or 66kV) typically impact on a larger number of customers than interruptions at lower voltages. However, while reporting on voltage level is a useful indicator of network related performance, it does not directly align with the service level provided to customers. Currently in New Zealand reporting SAIDI and SAIFI by network voltage level is required under the ID regime. Note, this does not include LV interruptions.
2.5	Identified by customer location	In many jurisdictions, interruption measures are reported separately by customer location. Typical classifications are CBD, Urban, Rural and Deep Rural. The advantage of reporting by customer location is that it more accurately reflects the performance of networks as observed by consumers and at the same time acknowledges, albeit at a high level, the difference in network topologies. However, if reporting by customer location was adopted in New Zealand it will take some time to establish suitable definitions for the customer zones and establish appropriate data sets.
2.6	Worst performing feeders	Reporting the number and duration of interruptions on a network's worst performing feeders is possible. This is a proxy for reporting on the worst served customers in a network. It is likely however that identifying worst performing feeders will likely just identify the longest, oldest and/or the most remote feeders within each network.
2.7	Worst served customers	Reporting on worst served customers is included in many jurisdictions. However, care should be taken if incentives are to be placed on worst served customers as the level of service received may simply be an outcome of the price-quality trade-off made. However, there is some value to reporting on worst served customers and highlighting the distribution of service levels delivered.
2.8	Reporting on restoration time	Reporting on the restoration time for interruptions is currently required under ID. Reporting is binned into two categories, those restored within three hours and those longer than three hours. This could be included within a quality regime, but would be more suited to be included under a customer service standard. Internationally restoration tends to be

Ref	Measure	Discussion
		incorporated into Guaranteed Service Standards or equivalent rather than the incentive regime for interruptions. An equivalent Guaranteed Service Standard is currently included within the MUoSA. The establishment of incentives around SAIDI and SAIFI inherently encourage increased response and faster restoration times for interruptions.

The following table summarises the Working Groups consideration of the disaggregation of interruption measures. Overall we consider that inclusion of unplanned and the weighting of planned outages is likely to lead to the best results. Reporting by customer location is likely to have benefit over the longer term as it recognises the key differences in customers' price quality trade-off being made. In the longer term there is also a place for reporting on worst served customers. Reporting on both the customer location and worst served customer will take some time to establish definitions and data sets to ensure that reporting can be consistently applied across all EDBs.

TABLE 4 - ASSESSMENT OF DISSAGREGATED INTERRUPTION MEASURES

Ref	Measure	Value to customer	Data availability	Incentive for timely investment	Ease of implementation	DPP Reset (RCP2)	RCP3	IDD
2.1	Unplanned outages	✓✓✓	✓✓✓	✓✓✓	✓✓✓	Yes	Yes	
2.2	Planned outages	✓✓✓	✓✓✓	✓✓✓	✓✓✓	Yes (Weighted)	Yes (Weighted)	
2.3	Based on company averages	✓✓	✓✓✓	✓✓	✓✓✓	Yes		
2.4	Identified by voltage level	✓	✓✓✓	✓	✓✓✓			Yes
2.5	Identified by customer location	✓✓✓	✓	✓✓✓	✓		Possible	Possible (during RCP2)
2.6	Worst performing feeders	✓	✓✓✓	✓✓✓	✓✓✓			
2.7	Worst served customers	✓✓✓	✓	✓✓✓	✓			Possible (RCP3+)
2.8	Restoration time for interruptions	✓✓	✓✓✓	✓	✓✓✓			

Key: Yes – proposed for the DPP reset, Possible/Yes – reviewed or under development during RCP2, implementation in RCP3 or beyond.

4.1.2 CUSTOMER SERVICE MEASURES

As described in Section 2.1, the customer service aspects to the services provided by EDBs relate to such aspects as:

- The time taken to answer the telephone;
- Providing information on reasons for and the likely duration and the extent of a power cut;
- Processing applications for new connections; and
- Sufficient notice of planned shutdowns.

In the general sense customer service relates to the more qualitative interactions between an EDB and their customers. There are a number of options for reporting on customer service and there is a long list of possible customer service related measures that could be utilised. Accordingly only the most relevant measures are noted below. However, please note that the list is not exhaustive and as such other measures not listed here may in the long run be more beneficial. Internationally, almost all quality regimes incorporate some form of customer service related reporting. Development of customer service measures has been identified by the Working Group as an area that would benefit from further consideration.

Typical customer service measures utilised internationally are described in Table 5 below.

TABLE 5 - CUSTOMER SERVICE MEASURES

Ref	Measure	Discussion
3.1	Customer satisfaction	Customer satisfaction is a broad measure of an EDBs' performance on customer service related aspects. It can cover such characteristics as answering of queries, responsiveness to unplanned interruptions, notification of planned outages, quality of supply, new connections, and quality of staff interactions. Customer satisfaction would be measured through surveys. The questions and structure of the survey would need to be standardised across EDBs and should be developed jointly by the ENA and the Commission.
3.2	Time taken to answer the telephone	This measure is less relevant in New Zealand than internationally due to the mix of arrangements between EDBs and retailers. While, it is still relevant for consumers, if such a measure was included within a reporting regime the specification of reporting would need to be developed.
3.3	Quality of information provided during an outage	This measures the ability of the EDB to communicate the cause and provide information on an interruption during or post an event. Consumers place high value on this as it assists with managing the impact of an outage. The appropriate survey questions would need to be established.
3.4	Processing of new connection applications	This would measure the responsiveness of an EDB to applications for new connections. For example the measure could report the percentage of applications responded to in x days. Councils in New Zealand have a similar obligation (albeit a statutory obligation) to respond to a property information request within 10 days.
3.5	Timely notification of planned outages	This could measure the percentage of planned outages notified within specific time periods i.e. all effected consumers notified for 95% of outages two or more days in advance of a planned outage.
3.6	Number of complaints and complaint resolution time	This measures the number of complaints made by consumers and the timeliness of resolution. Currently the only official reporting of complaints is done through the office of the Electricity and Gas Complaints Commissioner.

Ref	Measure	Discussion
3.7	Control period for hot water	Having access to hot water is fundamental to the modern life style. This measure could consist of reporting on the number and duration of hot water control events.
3.8	Street light repairs	Street light repairs are utilised within customer service measures internationally. Street lights are an important contributor to public safety and accordingly the response for repair to faulty streetlights within specified time periods is typically required. However, within New Zealand there are a wide variety of streetlight ownership and commercial structures surrounding its maintenance and operation. As such it would not be appropriate to include streetlight repairs within the regulatory framework for EDBs. In many cases EBDs do not provide a street lighting service.
3.9	Information requests	Similar to the information provision during or post an outage, it is possible to report on the response time for general provision of information. Typically this type of measure will report on the timeframes for communicating an acknowledgement of the request.

When considering customer service related measures, it is important to account for the interpose relationship most New Zealand EDBs have with consumers through the retailers that operate across each network. This means that in some instances reporting on agreed standards between EDBs and retailers is likely to be more appropriate than inclusion of a measure within a regulated quality regime. It is also important to recognise that many customer service aspects are also included within the commercial arrangements between EDBs and the retailer. The MUoSA developed by the EA contains many of these. By way of example the MUoSA includes provisions relating to:

- Restoration of unplanned service interruptions;
- Reporting on load management services;
- Reporting timeframes on identified power quality events;
- Communications on unplanned interruptions;
- Notification of planned outages; and
- Timeframes around information requests.

Many of the MUoSA provisions also have an associated guaranteed service payment which, where relevant, must be passed on to the consumer by the retailer.

Nonetheless there are a number of customer service measures that could be included within a regulated quality regime and as noted above is an area where further consideration is recommended. The Working Groups assessment is summarised in Table 6.

TABLE 6 - ASSESMENT OF CUSTOMER SERVICE MEASURES

Ref	Measure	Value to customer	Data Availability	Incentive for timely investment	Ease of implementation	DPP Reset (RCP2)	RCP3	IDD
3.1	Customer satisfaction	✓✓✓	✓	✓✓✓	✓		Possible	
3.2	Time taken to answer the telephone	✓✓✓	Mixed[29]	✓	✓			
3.3	Quality of information provided during an outage	✓✓✓	×	✓✓✓	✓		Possible	
3.4	Processing of new connection applications	✓✓✓	✓	✓✓✓	✓		Possible	
3.5	Timely notification of planned outages	✓✓✓	✓✓✓	✓✓✓	✓✓		Possible	
3.6	Number of complaints and complaint resolution time	✓✓✓	✓✓	✓✓✓	✓✓✓			Alternative reporting mechanism
3.7	Control period for hot water	✓✓	✓✓✓	✓✓	✓✓✓			
3.8	Street light repairs	✓✓✓	×	×	×			
3.9	Information requests	✓✓	✓	✓✓	✓✓✓			

Key: Yes – proposed for the DPP reset, Possible/Yes – reviewed or under development during RCP2, implementation (if appropriate) in RCP3 or beyond.

4.1.3 POWER QUALITY MEASURES

There are a number of options for measures that could report on Power Quality. However, as in other jurisdictions there are statutory requirements to maintain power quality within specific bounds and therefore are typically not incorporated within the quality regime in anything more than a reporting mechanism. Power quality is already subject to reporting within the MUoSA and comes under EDBs' obligations under the Consumer Guarantees Act. Consequently the Working Group has not at this stage considered Power quality measures any further.

[29] Depending on whether call centre is outsourced to a retailer.

4.2 OPTIONS FOR ESTABLISHING THE QUALITY PATH

The quality path determines the overall level of performance being sought by consumers from an EDB, consistent with the Part 4 Purpose Statement. The critical elements to consider when establishing the level of performance include:

- The manner in which the performance benchmark is being utilised i.e. is it for reporting purposes only, or to determine a hurdle over which an EDB must perform, or a level around which financial incentives could apply;
- The time period over which information must be gathered to establish an appropriate performance benchmark or limit.
- The timeframe over which the performance limits apply; and
- Whether historical performance is representative of what consumers are seeking or should the levels be forward looking.

The options for establishing the performance limits for interruption measures and customer service measures are discussed below.

4.2.1 ESTABLISHING THE QUALITY PATH FOR INTERRUPTION MEASURES

While the specific details differ somewhat in each jurisdiction, there are two basic methods utilised globally for establishing interruption performance limits. These are:

- Targets based on performance over a fixed historical period; and
- Targets based on a rolling historical period.

As far as the Working Group is aware there are no forward looking mechanisms for establishing performance targets that don't take account of historical data. For example in both the UK and Australia some of the performance benchmarks are based on historical data and altered to account for an EDBs' asset management and expenditure plans. However, in the context of a DPP regulatory regime bespoke adjustments to the targets cannot be determined. Instead any forward looking measure would require development of a standardised methodology that could be applied across EDBs.

TABLE 7 - OPTIONS OF ESTABLISHING THE QUALITY PATH FOR INTERRUPTIONS

Ref	Option	Discussion
4.1	Limits based on a fixed period of historical data	Current interruption performance limits are based on interruption data from the five years preceding the end of the previous regulatory period. The advantage of this approach is that the limit is fixed for the current regulatory period and provides certainty as to the required level of performance. The disadvantage is that it incorporates data that arose from a network that will be up to ten years old (at the end of the current RCP) and as such may not reflect the level of performance that could be expected from the network that is being measured. The UK utilise this method for setting targets for unplanned interruptions. There is also a balance between the relevance and the sufficiency of the data to ensure it is representative of the underlying network performance. To this end it may be more appropriate to utilise 10 years of historical data. However, the

Ref	Option	Discussion
		Working Group has not tested where this balance should be struck but recommends that the Commission seriously consider utilising the longer time period. Internationally five years of data, albeit for much larger networks, appears to be the standard period used.
4.2	Limits based on rolling historical data	Australia establishes limits based on a rolling five years' worth of data. The advantage is that it better reflects the current state of the network. The disadvantage of the rolling limit is that it creates uncertainty for asset investment planning and EDB operations over the regulatory control period. There are some key features to this option that can be utilised to ensure the level of performance consumers receive doesn't decline over time. This includes a limitation on the limit degrading over the regulatory period. Use of rolling data also has the potential to introduce volatility in performance targets. Management of the annual volatility is therefore important to ensure EDBs can efficiently plan and operate, which is in the long term interest of consumers. To assist this within a given year Australian DNSPs can bank the performance (i.e. the incentive payments, which can be either negative or positive). Banked incentives must be factored into the following year and performance cannot be banked in consecutive years. The UK utilise a rolling average for establishing a target for planned interruptions only. Under RIIO, DNOs' annual targets for planned interruptions are to be set at the annual average level of planned interruptions and minutes lost over a previous three year period.[30] This three-year average performance rolling target is updated on an annual basis.
4.3	Forward looking benchmarks	The purpose of the forward looking limit is to signal the situation where the future performance is expected to be materially different from that achieved historically. As noted previously this would require significant development.
4.4	Allowance for natural variation	The degree of natural variation needs to be accounted for when determining an appropriate performance limit. Currently performance limits are based on one standard deviation from the historical average and require a failure of an EDB to meet the performance limit two out of three years before an EDB is considered in breach. The proportion of natural variation that is appropriate in the limit is dependent on how the limit is treated. In the current pass/fail regulatory regime sufficient allowance needs to be made so as to avoid false breaches. Under a revenue linked regime a buffer is necessary to ensure that improvements in quality result from actual

[30] Ofgem, "Strategy consultation for the RIIO-ED1 electricity distribution price control: Reliability and Safety Supplementary annex to RIIO-ED1 overview paper", 28 September 2012.

Ref	Option	Discussion
		underlying performance improvements and not simply natural variation. Accordingly, whatever the incentive mechanism selected it is appropriate for some allowance for natural variation. However, the appropriate allowance for variation will be dependent on the incentive regime utilised. At this stage the Working Group has not considered how this may vary between incentive mechanisms.

After considering the options the Working Group concludes that the potential benefit of a limit based on rolling historical data is not significant and is outweighed by the uncertainty and the potential complexity introduced by banking mechanisms. As such the option likely to best meet the long term needs for consumers, and that is consistent with the DPP regime, is to utilise a fixed benchmark for the duration of a regulatory period based on a fixed period of historical performance. The Working Groups conclusions are summarised in Table 8 below.

TABLE 8 - ASSESSMENT OF OPTIONS FOR ESTABLISHING THE INTERRUPT5ION LIMIT

Ref	Option	Value to customer	Data Availability	Incentive for timely investment	Ease of implementation	DPP Reset (RCP2)	RCP3	IDD
4.1	Limits based on fixed historical data	✓✓	✓✓✓	✓✓✓	✓✓✓	Yes	Yes	
4.2	Rolling thresholds	✓✓	✓✓✓	✓✓	✓✓			
4.3	Forward looking benchmarks	✓✓✓	✓	✓✓✓	✓			Possible at some point
4.4	Allowance for natural variation	✓✓✓	✓✓✓	✓✓✓	✓✓✓	Yes	Yes	

Key: Yes – proposed for the DPP reset, Possible/Yes – reviewed or under development during RCP2, implementation in RCP3 or beyond.

4.2.2 ESTABLISHING THE QUALITY PATH FOR CUSTOMER SERVICE MEASURES

Performance limits for customer service is only necessary if customer service is included within the regulated quality regime. In the UK and Australia such measures are included, however, currently New Zealand does not have any customer service related measures under the DPP regime.

There are three options for establishing performance limits for customer service measures, if required:

- Established by EDBs themselves;
- Established by the Commission; or
- Jointly established by the Commission and EDBs.

Irrespective of who establishes the limits the only real option is the use of customer surveys to determine what level of service is sought by customers and the level of service delivered by EDBs. We note that the most appropriate choice of agency depends on the customer service measure in question. Nationally related customer service measures are likely to be better established by the Commission themselves or through close co-ordination between the Commission and the ENA and locally dependant customer service limits by the EDB themselves.

TABLE 9 - OPTIONS FOR ESTABLISHING CUSTOMER SERVICE PERFORMANCE LIMITS

Ref	Option	Discussion
5.1	Established by the EDB through customer survey	This allows for customer service targets to be established by EDBs surveying customers either in each network area or nationally (if national benchmarks were to be established). To ensure consistency between EDBs the form and structure of the survey could be agreed and established in conjunction with the Commerce Commission.
5.2	Established by the Commission	The Commission could establish either national or local performance limits for each measure. These would ideally be established through customer surveys or simply set at an initial value and the incentive regime utilised to determine the appropriate level of performance.

Customer service measures are an area of ongoing development. Consequently the methodology used for establishing the limits will also need to be developed. Hence, neither option should be discarded at this stage. However, the preferred approach to surveying is that EDBs directly survey their customers and understand the customer service requirements. Anecdotally international experience shows that if this can be formed in co-operation with the Regulator, rather than being imposed by the Regulator, better outcomes are likely to result. The following table summarises the Working Group's conclusions. As with the customer service measures themselves, establishing an appropriate target will require sufficient development time. As such the implementation would likely be in RCP3 or beyond.

TABLE 10 - ASSESSMENT OF OPTIONS FOR ESTABLISHING CUSTOMER SERVICE LIMITS

Ref	Option	Value to customer	Data Availability	Incentive for timely investment	Ease of implementation	DPP Reset (RCP2)	RCP3	IDD
5.1	Established by the EDB customer surveys	✓✓✓	×	TBD	TBD		TBD	Possible (during RCP2)
5.2	Established by the Commission customer surveys	✓✓✓	×	TBD	TBD		TBD	Possible

Key: Yes – proposed for the DPP reset, Possible/Yes – reviewed or under development during RCP2, implementation in RCP3 or beyond.

4.3 NORMALISATION OF PERFORMANCE DATA

The purpose of the quality regime is to provide incentives for EDBs to manage quality to a level sought by their customers. However, in reality there is a natural level of variation in the size and number of events on the network that impact on supply. This variation in events from year to year includes what might be considered "normal" variations (as discussed in option 4.4 in table 8 above). It also includes occurrences of extreme events that can have significant impact on consumers within a region. The recent storms in Wellington and Canterbury are examples of such events. While these types of events are important to consider when managing a network, they are not helpful when trying to identify the underlying trend in an EDBs' performance. Accordingly regulatory regimes internationally either remove or, in the case of New Zealand, adjust for the impact of such events from the data sets utilised to measure and establish performance limits so that the underlying performance trend can be determined. There are two methods utilised for determining which events should be excluded from (or adjusted for) to form a normalised data set. These are described in Table 11 below.

TABLE 11 - OPTIONS FOR NORMALISING INTERRUPTION DATA

Ref	Option	Discussion
6.1	Normalisation based on Major Event Days (MEDs)[31]	Currently MEDs are moderated before inclusion in an EDBs' quality performance. For any day (24 hour period) if total SAIDI exceeds the SAIDI boundary value, SAIDI values are replaced by that boundary value. SAIFI values on that day are also replaced if total SAIFI exceeds the SAIFI boundary value. SAIFI MEDs are only moderated if they coincide with a SAIDI MED. MED days are defined utilising the IEEE 2.5 Beta method which establishes the boundary, assuming that daily interruptions represent a lognormal distribution throughout a year. More information on this is presented in Appendix A. In summary, there are several issues with the current treatment and definition of MEDs in New Zealand: • The addition of the existing calculation of the boundary value into the quality performance of an EDB on a MED means that significant quantities of SAIDI and SAIFI are added to annual performance. This can lead to large volatility in the SAIDI and SAIFI reporting for some EDBs. • For a number of networks in New Zealand, a log normal distribution does not accurately represent the profile of interruptions on EDB networks. The common occurrence of zero event days in New Zealand (typically in predominantly underground networks and/or those which are small) also has a well-known and significant effect on the MED boundary. • The MEDs only apply on a SAIDI MED. Therefore if daily SAIFI exceeds the MED, but daily SAIDI does not, the SAIFI values are not normalised. Thus, often extreme SAIFI days remain in the

[31] Refer to Appendix A for a more complete explanation of MED days and the advantages and disadvantages of its application in New Zealand.

Ref	Option	Discussion
		performance measures, without normalisation. • Outages are assigned to the day on which each interruption commences and ends. For example, if an interruption starts on Monday and finishes on Wednesday the total SAIDI minutes over the 36 hours is replaced by the boundary value for each 24 hour period. However, a major event may continue for a number of days, with many individual interruptions. In this instance the total outage impact of the event is spread across more than one day, assuming the interruptions occur over a period of time. Thus prolonged events, with many interruptions which occur over time, may fail to meet the MED boundary on any of the individual days affected by the event, because the impact is spread over time. This can result in a number of consecutively high SAIDI (or SAIFI) days, none of which are eligible for MED normalisation. In Australia should an event exceed the boundary the entire event is excluded from the performance limit.
6.2	Normalisation based on a multiple of average daily interruptions	An alternative to MEDs is to define a boundary value based on a multiple of the average number of daily interruptions experienced in each network. This simplifies the definition and is equivalent to using MEDs. The UK utilises two levels for event days: • The "Severe Weather Exceptional Event Threshold" is set at 8 times the average interruptions on a network within a 24 hour period; and • One-off exceptional events which cause significant disruption to at least 25,000 customers and/or 2 million customer minutes. Like Australia, if an event falls within these definitions it is entirely excluded from the performance of a network. The severe event definition could be tailored to the New Zealand environment. However an appropriate multiplier would need to be determined.

The implications of the normalisation methods for the DPP quality standard are dependent on whether future DPPs move away from the current pass/fail regime. However, to the extent that reliability performance is to be measured and/or monitored in some way, normalisation methods will need to be considered for the DPP reset and potentially more widely for performance reporting through IDs.

We note that the extreme event normalisation approach was originally developed as part of the thresholds regime which predated the DPP. In its 2007 consultation papers on the threshold assessment and investigation process the Commission noted that it wished for the boundary value to be sufficiently rigorous such that it was not overly generous with the number of events that it classified as extreme. It was the Commission's view at the time that a boundary value which promoted more investigations was more appropriate than one which was conservative, under the thresholds regime.

It is appropriate to reconsider this approach for the next DPP reset, particularly now there is some normalised data available for review. In this respect we recommend the following options are considered further:

- Allow all interruptions associated with a major event to be assigned to the day that the event first occurred. This would increase the incidence of MEDs and reduce the incidence of high SAIDI/SAIFI days which fall below the MED boundary. This would better accommodate the impact of extreme events within annual reliability assessments;
- When normalising MEDs, replace daily SAIDI or SAIFI with either the average daily SAIDI/SAIFI (from the reference dataset) or 0. The IEEE methodology recommends that any MEDs identified by the application of the Beta Method are completely removed from the population. This is consistent with the Australian (and equivalent UK) approach; and
- If SAIFI and SAIDI are to be retained as quality path measures, allow MED normalisation of both measures, independent of each other. This will ensure that the treatment of SAIDI and SAIFI are consistent.

Accordingly, the Working Group's conclusion is that MEDs would work appropriately if the proposed amendments are made and is more desirable than switching mechanisms. The advantage of continuing with MEDs is also that the data is available and EDBs and the Commission are already familiar with their use. However, the proposed amendments need to be acknowledged and implemented in order for MEDs to be an effective mechanism for normalising performance data. Of note is that for consistency any changes to treatment of MEDs would need to be reflected in the base performance data sets utilised for setting performance limits.

TABLE 12 - ASSESSMENT OF DATA NORMALISATION OPTIONS

Ref	Option	Value to customer	Data Availability	Incentive for timely investment	Ease of implementation	DPP Reset (RCP2)	RCP3	IDD
6.1	Major event days	✓✓✓ (with proposed adjustments	✓✓✓	✓✓✓ (with proposed adjustments)	✓✓✓	Yes (with proposed adjustments)	Yes (with proposed adjustments)	
6.2	multiple of average daily events	✓✓✓	✓✓✓	TBD	✓✓			

Key: Yes – proposed for the DPP reset, Possible/Yes – reviewed or under development during RCP2, implementation in RCP3 or beyond.

4.4 INCENTIVE BASIS

The basis on which EDB performance is incentivised is a critical aspect of the quality regime. If the incentive mechanism is appropriate and practical the services delivered to consumers will more likely reflect the outcomes sought. If not then there is potential of perverse results. There are also many options for developing the incentive regime. Some of the dimensions to consider are:

- Whether the incentives should be uni or bi-directional;
- Whether the incentives should be applied to customers as a group (network wide), individually or both;
- Whether the incentives should be linked to an EDB's revenue;
- The level of the incentive rate. Efficient behaviour needs to be incentivised so as not encourage inefficient outcomes;
- The alignment of the incentives with the value associated with different quality outcomes (interruptions compared with customer service); and
- The total value of the incentives – through establishing caps and collars.

Many of these dimensions are outside the scope of this report and more appropriately fall within the next stage of the DPP review. However, it is important to recognise the relationship between the incentive regime, the selection of measures, the setting of performance limits and ultimately the delivery of long term value to consumers. To this end we have described three basic options for the incentive mechanism.

TABLE 13 - OPTIONS FOR INCENTIVE MECHANISM

Ref	Option	Discussion
7.1	Pass / Fail regime (Uni-directional, network wide)	The current incentive regime is based on a pass / fail mechanism. EDBs fail if either their SAIDI or SAIFI exceeds the quality standard (after the extreme events are normalised). The disadvantages of the current pass / fail regime are: • The consequence of failure is not clear and currently remains highly uncertain; • It does not incentivise improvements in the quality standard being delivered i.e. it does not reward good performance, it only penalises poor performance; and • It doesn't adequately deal with the natural variation in network events and as such makes the selection of the performance limit more crucial and controversial. Therefore, in an environment where EDBs should strive to continually deliver long term benefits to consumers, a pass / fail regime fails to provide the right incentives. Of note is that both Australia and the UK have moved away from the pass / fail regimes to more incentive based regimes that provide benefits for both consumers and the network companies over the long term.

Ref	Option	Discussion
7.2	Revenue linked incentive rate regime (Bi-directional, network wide)	Internationally a revenue linked incentive rate regime has resulted in more efficient and higher quality outcomes for consumers. This is based on incentives that result in an EDB lowering revenues (facing a penalty) if they fail to meet the target quality outcomes or increasing revenues (gaining a reward) for exceeding the performance limits. Both the penalties and rewards are typically symmetrical and capped. International experience has shown the application of incentive rates have been very successful and have produced positive outcomes for consumers. For example Ofgem note that the UK has experienced a 30% reduction in customer interruptions and 32% reduction in customer minutes lost since the scheme was introduced.[32] Incentives can apply to both interruption measures (SAIDI and SAIFI) and customer service based measures. The incentive rates utilised are important and the appropriate marginal rate for New Zealand would need to be determined. Ideally the marginal cost for non-performance should be higher than the benefit gained from not investing. Likewise the marginal gain should be higher than the efficient cost of investment in order to provide the incentive. Typically the rates are based on the value of improved reliability to the consumer.
7.3	Guaranteed service levels (Uni-directional, individual customer)	Guaranteed Service Levels (GSL) or Guaranteed Performance Standards (GPS) are utilised in some international jurisdictions. While the incentive schemes for interruptions and customer service encourage performance across an EDB's network, GSLs provide payments to specific customers when certain performance criteria are not met. Criteria can include such things as: • Notification of planned outages; • Streetlight repair; and • New connections New Zealand does not currently have a regulated GSL scheme, however a number of EDBs have developed their own voluntary arrangements. GSL provisions are also included within the MUoSA. As such a regulated GSL is not considered necessary at the current time.

The incentive regime provided for within the regulated quality regime is critical to the effective operation of the regulated quality regime and the delivery of value to consumers. Accordingly, on the basis of evidence internationally, the Working Group would strongly encourage the Commission to consider the inclusion of a revenue linked incentive scheme in the DPP reset. In our view this would provide significant benefits to all stakeholders, particularly consumers. In respect of a GSL

[32] Ofgem, "Strategy consultation for the RIIO-ED1 electricity distribution price control Reliability and Safety", 28 September 2012, p.17.

scheme, there appears to be sufficient alternative mechanisms in which a GSL is being implemented such that a regulated GSL scheme within the DPP context is likely to be unnecessary.

TABLE 14 - ASSESSMENT OF INCENTIVE SCHEME OPTIONS

Ref	Option	Value to customer	Data Availability	Incentive for timely investment	Ease of implementation	DPP Reset (RCP2)	RCP3	IDD
7.1	Pass / fail	✓	✓✓✓	✓	✓✓✓	No	No	
7.2	Revenue linked incentives	✓✓✓	✓✓✓	✓✓✓	✓✓ (incentive rates to be developed)	Yes	Yes	
7.3	GSL	✓✓	✓✓✓	✓	✓✓✓			Already implemented within MUoSA

Key: Yes – proposed for the DPP reset, Possible/Yes – reviewed or under development during RCP2, implementation in RCP3 or beyond.

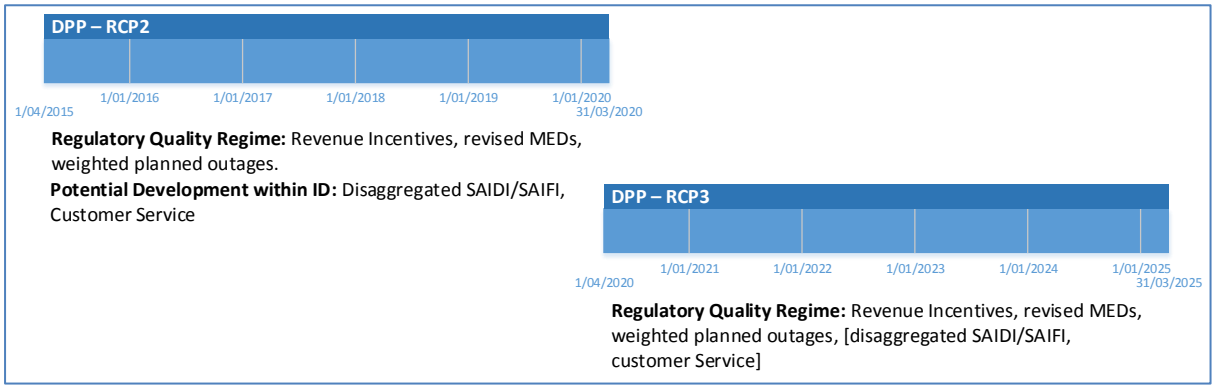
5. IMPLEMENTATION CONSIDERATIONS

Alongside the critical factors that support delivery of value to consumers, it is important to consider the implementation requirements of the regulated quality regime. In particular the implementation dimensions of the time and cost for establishing data sets necessary for determining appropriate performance limits and reporting on the level of services delivered need to be considered. While none of the measures, limits, and incentives described in this paper are extremely complex, any new measures and development initiatives will take time and resource to develop. As such the Working Group recommends that a staged approach be utilised by the Commission when considering the suggestions within this paper. Specifically it is recommended that the Commission should:

- Target improvements that provide the most effective value to consumers in the shorter term while providing a pathway to a longer term higher value framework. With 29 EDBs and a small population base, resources are significantly limited when compared with some of our international counterparts. Therefore improvements should be targeted on those which yield the highest value first. In our view this would primarily consist of implementing a revenue linked incentive scheme, weighting planned outages relative to unplanned and implement an amendment of the MED definitions; and
- Allow sufficient time to develop data sets suitable for establishing new benchmarks relevant within the New Zealand context. This would include the further development of disaggregated interruption measures, development of customer service metrics and consideration of any forward looking measures. Initial inclusion of these measures within ID would facilitate the implementation process prior to inclusion within the regulated quality regime. This approach would also allow sufficient opportunity to review and develop appropriate definitions for new measures

The following diagram illustrates the proposed staged development approach.

FIGURE 2 - PROPOSED IMPLEMENTATION TIMELINE



6. RECOMMENDATIONS FOR THE DPP RESET

The material in this paper has been developed from a combination of work undertaken by EDBs around New Zealand, review of international practices, direct feedback from consumers and stakeholders, feedback from the stakeholder seminar held in November of this year, along with the experience and knowledge of Working Group members. The conclusions reached from this work regarding the regulatory quality regime for the DPP are:

- That SAIDI and SAIFI should be retained as they closely reflect consumer value preferences;
- For practical reasons reporting in RCP2 should continue to be based on network averages; Introduce weighting for planned outages that recognises the lower impact that planned outages have on consumers ;
- Retain a fixed period for establishing performance limits. This creates certainty for both EDBs and consumers (the time period used for establishing the base dataset should be considered);
- Implement amendments for MEDs that reflect international practice and result in a dataset that better reflects underling EDB performance; and
- Introduce revenue incentives rather than continue with the pass / fail regime. This is the single biggest improvement that could be made.

The following table is a summary of the Working Group's conclusions from considering the options available for the quality regime for RCP2.

TABLE 15 - SUMMARY OF RECOMMENDED OPTIONS FOR THE DPP RESET

Ref	Measure / Option	Value to customer (Current)	Data Availability	Incentive for timely investment	Ease of implementation	DPP Reset (RCP2)	RCP3	IDD
1.3	SAIDI	✓✓✓	✓✓✓	✓✓✓	✓✓✓	Yes	Yes	
1.4	SAIFI	✓✓✓	✓✓✓	✓✓✓	✓✓✓	Yes	Yes	
2.1	Unplanned outages	✓✓✓	✓✓✓	✓✓✓	✓✓✓	Yes	Yes	
2.2	Planned outages	✓✓✓	✓✓✓	✓✓✓	✓✓✓	Yes (Weighted)		
2.3	Based on company averages	✓✓	✓✓✓	✓✓	✓✓✓	Yes		
2.4	Identified by voltage level	✓	✓✓✓	✓	✓✓✓			Yes
4.1	Limits based on fixed historical data	✓✓	✓✓✓	✓✓✓	✓✓✓	Yes	Yes	
4.4	Allowance for natural variation	✓✓✓	✓✓✓	✓✓✓	✓✓✓	Yes	Yes	
6.1	Major event days	✓✓✓ (with proposed adjustments	✓✓✓	✓✓✓ (with proposed adjustments)	✓✓✓	Yes (with proposed adjustments)	Yes (with proposed adjustments)	

Ref	Measure / Option	Value to customer (Current)	Data Availability	Incentive for timely investment	Ease of implementation	DPP Reset (RCP2)	RCP3	IDD
7.2	Revenue linked incentives	✓✓✓	✓✓✓	✓✓✓	✓✓ incentive rates to be developed	Yes	Yes	

For RCP3 the Commission could consider a number of development initiatives that may improve the regulated quality regime in aligning with what consumers value. Namely the Commission should consider:

- The disaggregation of interruption measures by customer location;
- The implementation of selected customer service measures; and
- The potential for development of forward looking measures and limits.

The role of ID within the development is also important. As any additional the measures are defined reporting in ID prior to any inclusion within the regulated quality regime would allow the additional aspects to be introduced in a staged manner and provide a means to testing the effectiveness prior to inclusion in an incentive regime. The Working Group would also strongly encourage the Commission to undertake the development of these initiatives in conjunction with the ENA and consumer representatives. The following table summarises specific areas for potential development.

TABLE 16 - SUMMARY OF POSSIBLE LONGER TERM IMPROVEMENT INITIATIVES

Ref	Measure / Option	Value to customer (Current)	Data Availability	Incentive for timely investment	Ease of implementation	DPP Reset (RCP2)	RCP3	IDD
1.8	CAIDI	✓✓✓	✓✓✓	✓	✓✓✓			Possible RCP2
1.9	Energy not supplied	✓✓✓	×	✓✓	×		Possible	Possible RCP3+
1.10	Capacity availability	✓	×	Unknown	×			Possible during RCP3+
1.11	Expected number and duration of outages	✓	×	Unknown	×			Possible during RCP3+
2.5	Identified by customer location	✓✓✓	✓	✓✓✓	✓		Possible	Possible (during RCP2)
2.7	Worst served customers	✓✓✓	✓	✓✓✓	✓			Possible (RCP3)
3.1	Customer satisfaction	✓✓✓	✓	✓✓✓	✓		Possible	
3.3	Quality of information provided during an outage	✓✓✓	×	✓✓✓	✓		Possible	
3.4	Processing of new	✓✓✓	✓	✓✓✓	✓		Possible	

	connection applications							
3.5	Timely notification of planned outages	✓✓✓	✓✓✓	✓✓✓	✓✓		Possible	
4.3	Forward looking benchmarks	✓✓✓	✓	✓✓✓	✓			Possible at some point
5.1	Established by the EDB customer surveys	✓✓✓	×	TBD	TBD		Possible	Possible (during RCP2)

7. APPENDICES

APPENDIX A - MEDS

The intention of the quality standards is to identify material deterioration in the network. In its setting of the initial DPP the Commission recognised that an EDBs' reliability data is susceptible to variation resulting from MEDs, which are largely outside of the EDBs' control. To account for this variability the Commission use the IEEE 2.5 Beta method[33] to derive a measure that mitigates the chance of breaches where no material deterioration in a EDBs underlining reliability performance has occurred.

The IEEE 2.5 Beta Method is based on a EDBs reliability data exhibiting a log-normal distribution from which a boundary value is derived as being 2.5 standard deviations from the mean. Currently where the cumulative effect of an outage exceeds the boundary value the total SAIDI minutes of this event is replaced by the boundary value.

For example, EDB A has a boundary value of 19 SAIDI minutes. A snow storm hits EDB A's network and its consumers experience an outage of 39 SAIDI minutes. The IEEE 2.5 Beta Method allows EDB A to reduce the SAIDI minutes of that event by 20 minutes. The 'normalised' reliability performance for EDB A, for that snow event, is equal to 19 SAIDI minutes.

All things being equal the normalisation of the reliability set will mitigate the inherent variability of an EDBs' reliability data set. However, this is not always the case as it is possible that an EDB can still breach the threshold as a result of extreme events even though these events have been identified as MED's.

For example, EDB A has a target of 100 SAIDI minutes. In the first six months of the regulatory year the EDB has 30 SAIDI minutes of planned outages and 20 SAIDI minutes of unplanned non-MED interruptions. At the mid-year point the EDB is well within its reliability targets. However a snow storm hits in July and it records normalised performance of 19 SAIDI minutes. EDB A then experiences two more extreme weather events in August and September. Both are identified as MEDs and both have a normalised SAIDI of 19 minutes. Even though EDB A has had its reliability data normalised for events outside of its reasonable control it will, even before the end of the regulatory year, exceeded the target by 7 SAIDI minutes.

In Australia to normalise the data set EDBs are allowed to completely remove the MED from the performance data. The equivalent is allowed for in the UK. Take EDB A's MED of 39 SAIDI minutes once again, by removing the SAIDI minutes in its entirety EDB A records zero SAIDI minutes for all MEDs. In the situation of EDB A experiencing multiple events in one year, as given in the example above, all three events would be zero and accordingly EDB A's reliability performance would be 50 SAIDI minutes at the end of September. Arguably this method of normalisation means that EDB A's performance at the end of the period will be assessed on only those events that it has reasonable control over.

[33] Institute of Electrical and Electronics Engineers (IEEE) Power Engineering Society, Guide for Electric Power Distribution Reliability Indices. IEEE std. 1366-2003, 14 May 2003.

APPENDIX B – INTERNATIONAL REGIMES

The following provides a more in-depth summary of the quality regimes utilised in Australia and the UK.

B1. AUSTRALIA

The electricity industry in Australia has undergone a range of significant reforms over the last twenty years, commencing in the early 1990s with the breakup of previously wholly state-owned vertically integrated electricity monopolies. This resulted in the formation of competing generation and retailing entities, and regulated transmission and distribution companies.

Distribution companies are referred to as Distribution Network Service Providers (DNSPs). The first regulatory price review control for DNSPs was for the period 2001-2006. This consisted of a simple incentive scheme. The Australian Energy Regulator (AER) was established in 2005 at which time it took over responsibility of regulating DNSPs. It was not until 2012 that the AER assumed responsibility for the regulatory framework for DNSPs on a national basis. However, Australia is unique as reliability regulation is split between jurisdictional states and their regulators and the AER and there is no 'national reliability framework.'

It is a statutory requirement for the AER to establish and publish a Service Target Performance Incentive Scheme (STIPIS) to encourage DNSPs to maintain or improve service performance where customers are WTP for these improvements. The STPIS creates a link between service quality and revenue. The first STPIS was established in 2009.[34] Not all jurisdictions or DNSPs operate under the STPIS. The jurisdictions that do are Queensland, Tasmania, South Australia and Victoria. The STPIS was adopted in Victoria in 2011. ACT and NSW will operate under the STPIS from 2014. Victoria is the only jurisdiction where all DNSPs have adopted the STPIS targets set by the AER (in addition to their SAIDI and SAIFI targets). The AER monitors compliance of the STPIS. Jurisdictions that do not use the STPIS predominantly use SAIDI and SAIFI standards, with a few jurisdictions that also address system planning.

The STPIS provides incentives for DNSPs to maintain or improve their reliability and customer service. It was designed to balance a DNSP's incentive to reduce their expenditure by reducing reliability with the need to maintain and improve service performance and reliability for their customers. The scheme incentivises the DSNP to make sustained improvements above the target performance set.

Under the STPIS, performance targets are set at the commencement of the regulatory control period and apply for the duration of that period. Targets are based on the rolling average performance over the previous five years. However, targets are adjusted when there are planned investments that have been approved and funded through the price control. A DNSP does not receive financial rewards if their performance reflects the target performance.

[34] Australian Energy Regulator, "Electricity Distribution Network Service Providers: Service Target Performance Incentive Scheme," November 2009.

The at risk revenue is capped at 5% however a DNSP can propose a different revenue cap eg in South Australia it is 3%; 2% for one of Queensland's DNSPs and one Victoria DNSP has a 7% cap. The following is a summary of the STPIS. It consists of five components[35]:

- Reliability of supply
    - Performance targets are based on a rolling average over the past five regulatory years and must not deteriorate within a regulatory period. The incentive rates are established on customers WTP. The network area is divided into network types eg CBD, urban and rural (short and long). The measures used are unplanned SAIDI, unplanned SAIFI and MAIFI. Interruptions of less than one minute are excluded. Also excluded are events that include a) load shedding due to generation shortfall, at the direction of the system operator, or a failure of the shared transmission network b) automatic load shedding and c) events that exceed the MED boundary (established utilising the IEEE 2.5 beta method).
    - A performance revenue incentive is applied to reliability measures. This is discussed further below.
- Quality of supply
    - Currently there are no power quality measures specified for inclusion in the scheme, but the provision is allowed for within the STPIS.
- Customer service
    - The customer service components include a) telephone answering b) streetlight repair c) new connections and d) response to written enquires. There is a 1% cap on the incentive for customer service and a 0.5% cap on any individual customer service factor.
- Guaranteed service levels (GSL)
    - The GSL component encourages improved service for worst-served customers. Failure by DNSPs to meet the standards involves payments to the affected customers. The GSL component in the STPIS is not currently applied in any jurisdiction in Australia, instead individual jurisdictional GSL schemes are applied.
- Information and reporting
    - DNSPs are required to report annually.

A S-Factor incentive scheme is included in the price control formula for the reliability of supply and customer service components. The S-Factor is a financial incentive or penalty for network

[35] Australian Energy Regulator, "Electricity Distribution Network Service Providers: Service Target Performance Incentive Scheme," November 2009.

performance against predetermined service targets. In essence, DNSPs are allowed to increase tariffs (revenue) when actual reliability performance has exceeded the target. Equally however, tariffs will decrease (DNSPs will be penalised) if actual reliability falls below the performance targets. The STPIS S-Factor is symmetrical with penalties and rewards attained at the same rate.

- There is an "s-bank' mechanism where the s-factor can be delayed by one year to smooth the impact on customer prices. Banking is not permitted in successive years, therefore should a decision be made to bank in one year it cannot be utilised in the following year. The rationale is that banking is intended for events that are very rare, and fall outside the exemptions. As an example if a DNSP had a very bad outcome in 2013 and chose to bank the price impact would not be applied till the 2015 calendar year for the s-factor outcomes. The decision to bank is not required until November 2014 when prices are being determined for 2015. This means that the next year is almost fully known at the time the banking decision is made so that if it turned out that 2014 was even worse, then a strategic decision could be taken to bank at an alternative time.

In regard to other aspects of the quality regime, some jurisdictions have specific mechanisms to target worst-performing components of each system. NSW is the only jurisdiction that has formal standards. In Queensland DNSPs are required to identify and describe worst performing feeders in their system management plans.[36]

B2. UK

The electricity industry in the UK was privatised in 1989. There are now fourteen separately licenced distribution network systems which are owned by six Distribution Network Operator (DNO) companies. The licence includes the price control contract that stipulates what DNOs are expected to deliver and constrains the revenue that can be collected from customers. DNOs are regulated by the Office of Gas and Electricity Markets (Ofgem). Since privatisation the network industry has undergone five rounds of price control reviews, with the first regulatory period being 1990-1995 and the industry is now entering its sixth price review beginning 2015.

The incentive regime employed by Ofgem has evolved overtime as it has adapted to lessons learned from implementing the framework over a long period of time. For example, the regulatory control period was set at five years, however from 2015 the period increases to eight years, in order to reduce regulatory burden. Under the first two regulatory periods, DNOs operated under a revenue cap and on the third regulatory period quality of supply incentives were introduced. These incentives covered three main areas, namely the number of interruptions to supply; the duration of interruptions to supply and the quality of telephone response. Under this, DNOs were rewarded or penalised by up to 3% of revenue, depending on performance relative to the targets. Exceptional events such as severe weather and third party damage are excluded so as to ensure that DNOs were not unfairly rewarded or penalised due to measurement issues.

[36] The Brattle Group Ltd, "Approaches to setting electric distribution reliability standards and outcomes", January 2012, p. 41

Within this current regulatory period, Ofgem have four main structures in place to incentivise DNOs levels of reliability.[37] These are:-

- Interruption Incentive Scheme[38] (IIS)
    - This has symmetric annual rewards and penalties depending on each DNO's performance against their targets for the number of customers interrupted per 100 customers (CI[39]) and the number of customer minutes lost.[40] CI and CML are considered separately for each DNO. As such, a DNO could receive a bonus for CI while also paying a penalty for CML. [41]
- Guaranteed Standards[42] (GS)
    - These standards have been set to guarantee a level of service that is reasonable to expect DNOs to deliver in all cases. Failure to meet the standard results in DNO being required to make a payment to the customer. The areas covered are response times, restoration times, estimate of charges for connection, notice of planned interruption, investigation of voltage complaints, and making and keeping appointments. GS rates of payments varying depending whether the customer is domestic or non-domestic customers.
- Worst Served Customer[43] Fund.(WSCF)
    - Ofgem has allocated £42 million to a worst served customer fund. It is provided to fund additional capital for DNOs, on a "use it or lose it" basis, for investment to improve the supply to their worst served customers.
- Broad Measure of Customer Satisfaction" (BMCS).
    - The "broad measure of customer satisfaction" (BMCS) was introduced in April 2012. The BMCS has three components 1) Customer Satisfaction Survey 2)Complaints Metric and 3) Stakeholder Engagement Incentive to incentivise DNOs to listen to customers, respond quickly and effectively to complaints and to engage with stakeholders.[44]

Ofgem directly use the results of WTP studies to set incentive rates and to create the worst served customer fund. The studies have indicated that customers would prefer to be compensated for poor service rather than pay more to receive a more reliable service. Since the introduction of IIS, the GSL

[37] Details of the these are given in Ofgem publication, "Electricity Distribution Price Control Review: Final Proposals – Incentives and Obligations", Ref:145/09, 7 December 2009

[38] https://www.ofgem.gov.uk/electricity/distribution-networks/network-price-controls/quality-service/quality-service-incentives

[39] Customer Interruptions is equal to 100 x SAIFI

[40] Customer Minutes Lost is equivalent to SAIDI.

[41] The Brattle Group Ltd, "Approaches to setting electric distribution reliability standards and outcomes", January 2012, p. 59

[42] https://www.ofgem.gov.uk/licences-codes-and-standards/standards/quality-service-guaranteed-standards

[43] A Worst Served Customer is defined as experiencing on average at least five higher voltage interruptions per year over a three period.

[44]https://www.ofgem.gov.uk/electricity/distribution-networks/network-price-controls/customer-service

and WSCF, customers have experienced a reduction of 30% in CIs and 32% in CMLs between 2001 and 2012. [45]

Adjustments are made to CI and CML for exceptional events. For example severe weather events are measured against a threshold that is equal to eight times the DNO's daily average HV interruption rate for the last ten years.[46] Outages of 3 minutes or less are not included in the incentive scheme, however DNOs do need to report them. CI and CML targets distinguish between unplanned and planned outages and then combines these to produce a single CI target and a single CML target. Pre-arranged outages have a weighting of 50%[47]). Ofgem is currently looking at reporting on interruptions per customer class eg domestic, or non-domestic.

In 2010 Ofgem introduced a new regulatory framework, RIIO for its sixth price review, which is currently underway. RIIO stands for Revenue = Incentives + Innovation + Outputs. The rationale for the design of RIIO[48] is to encourage DNOs to:

- Put stakeholders at the heart of their decision-making process;
- Invest efficiently to ensure continued safe and reliable services;
- Innovate to reduce network costs for current and future consumers; and
- Play a full role in delivering a low carbon economy and wider environmental objectives.

Under RIIO, DNOs submit to Ofgem well-justified business plans detailing how they intend to meet the RIIO framework objectives. The RIIO framework places a strong emphasis on stakeholder engagement. Accordingly, DNOs are required to obtain stakeholder input into their plans and also illustrate how this input has been used to develop the plans.[49] DNOs propose their own outputs. Outputs are to be listed under six categories: Safety, Reliability, Environment, connections, customer satisfaction, and social obligations. Ofgem reviews these plans to ascertain if all or any DNO's business plans are eligible for being 'fast-tracked." Fast-tracking allows a DNO to settle their price control early.[50]

[45] Strategy consultation for the RIIO-ED1 electricity distribution price control: Reliability and Safety Supplementary annex to RIIO-ED1 overview paper, 28 September 2012 ,p. 17 .
[46] Ofgem publication, "Electricity Distribution Price Control Review: Final Proposals – Incentives and Obligations", Ref: 145/09, 7 December 2009.
[47] The Brattle Group Ltd, "Approaches to setting electric distribution reliability standards and outcomes", January 2012, p. 62-61
[48] https://www.ofgem.gov.uk/network-regulation-%E2%80%93-riio-model
[49] https://www.ofgem.gov.uk/ofgem-publications/64003/pricecontrolexplainedmarch13web.pdf
[50] On 21 November 2013 Ofgem announced that only 1 DNO was eligible to be fast-tracked, for the regulatory period 2015-2023.